

MANAGEMENT AND CONTROL

A prospective examination of asthma symptom monitoring: provider, caregiver and pediatric patient influences on peak flow meter use

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Abstract

Objective: This study examined whether provider, caregiver and child communication predicted peak flow meter (PFM) use one month later. **Methods:** Five practices, 35 providers and 296 children with persistent asthma and their caregivers comprised the study sample. Audio-recorded provider–caregiver–child communication during the baseline medical visit captured discussion of the PFM; and child and caregiver baseline interviews after the medical visit collected factors associated with PFM use. Child- and caregiver-reported PFM availability and use, and observed child use of PFM were collected one-month later in the family's home. **Results:** During the medical visit, provider communication about PFM use was infrequent (10% maximum) and child- or caregiver-initiated communication was nearly absent (0%–2%). Despite this, children demonstrated good use of the PFM one month later. Children were significantly more likely to perform at least six PFM steps correctly one month later when there was more communication about PFM during the medical visit. Few other factors predicted availability and use. **Conclusions:** Few providers discussed use of a PFM; observed performance was predicted by having talked about it with the child's provider. Provider communication should be targeted in future interventions to improve asthma management skills.

Keywords

Children, peak flow meters, predictors, provider-patient communication

History

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Introduction

Asthma is a prevalent chronic health condition [1] affecting racially/ethnically diverse children [2], and those of lower socio-economic status [3] more than their counterparts. The health care costs of asthma are significant [4] and the quality of life of those with uncontrolled asthma is poorer than among those who are controlled [5]. Thus, one goal of chronic disease prevention and control research is to identify strategies to promote asthma control.

Good asthma control requires a self-monitoring strategy in order to determine an appropriate course of action. This is consistent with theories which suggest that monitoring progress toward a behavioral goal is essential for the behavior to occur [6–9]. In asthma control, one method for monitoring is by using a peak flow meter (PFM), a device that objectively measures expiratory flow rate which is then grouped into

zones for ease of interpretation by patients and their caregivers. Depending on the person's zone, the patient must make a decision about his/her course of treatment, preferably written into an asthma action plan developed in partnership with a health care provider [10]. Yet, despite current recommendations [11] and evidence that proper use is associated with fewer emergency room visits [12], few children report having been shown how to use a PFM [13] and few youth deemed it important to include in an asthma management intervention for youth [14]. This may explain why both child and adult asthma patients endorse a symptom monitoring approach over use of a PFM, and lends support to evidence that the addition of PFM does not improve asthma control over other symptom monitoring approaches [15–17]. Grad and colleagues [10] concluded that PFM monitoring adds little value to symptom-based management.

Such recommendations may need to be reconsidered for a number of reasons. First, there are no published studies describing whether and how PFM use is promoted in clinical care. Failing to use a PFM may simply reflect a lack of adherence to clinical guidelines by health care providers as

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peak flow monitoring remains one of several recommendations given to pediatricians to promote asthma control in their patients [11]. Second, symptom-monitoring is an important chronic disease management behavior, and research indicates that it is perceived as an important behavior by caregivers, and to lesser extent children, irrespective of type of self-monitoring method promoted [18]. There are few other alternatives that a patient and his/her caregiver can be empowered to perform. It is possible that one reason why patients and their caregivers report less interest in using a PFM to monitor symptoms may be due to not feeling empowered to do so. Finally, there are children who are 'poor perceivers' of asthma symptoms. A 'poor perceiver' is a patient who has trouble detecting either breathlessness or bronchospasm. A more objective assessment of expiratory flow rate using an instrument that could be made accessible to most people could be very beneficial for improving asthma outcomes. For these reasons, determining the extent to which providers, caregivers and children discuss aspects of peak flow monitoring, and whether this communication is associated with future PFM use will provide further evidence reaffirming or suggesting revision of practice guidelines [11].

Equally important to engaging in self-monitoring behaviors is the proper use of self-monitoring devices. Using self-monitoring devices improperly is associated with more hospitalizations and increased health care costs [19], yet proper use is associated with better control. Receiving instruction from a health care provider on how to use a monitoring device is an important predictor of proper use, as is confidence in one's ability to use it. In addition, youth who said they were shown how to use a PFM by their health care providers reported greater confidence in their ability to prevent an asthma episode [13]. Thus, understanding the extent to which provider instruction on how to use a PFM is associated with improved use (here defined as observed number of steps performed correctly), would shed light on where additional provider instruction may be needed to improve the proper use of an important monitoring device.

Present study

In this prospective observational study, we examined the extent to which provider–caregiver–child communication during a baseline medical visit was associated with child- and caregiver-reported PFM use and observed performance one month later. We also examined the extent to which child- and caregiver-reported psychosocial variables predicted reported PFM use and observed performance. Finally, given questions on the clinical value of PFM use, we examined whether child-reported PFM use at baseline predicted several caregiver-reported asthma outcomes including symptoms days and school absences one month later.

Methods

Design

This is a prospective observational study with four data sources:

- (a) audio-recorded medical visits between the child's health care provider (provider), caregivers and children at baseline;

- (b) child- and caregiver-reported availability and use of a PFM collected at the one-month home visit;
- (c) child- and caregiver-reported demographic and psychosocial variables collected at baseline; and
- (d) observations of children's use of a PFM at the one-month home visit.

This was an observational study of usual care and there was no intervention given during the course of the study. All study protocols were approved by the University of North Carolina at Chapel Hill Institutional Review Board.

Setting

Providers, caregivers and children were recruited from five pediatric practices in suburban and rural areas of North Carolina. These practices serve a diverse population with most (50.6%) pediatric patients on state-sponsored health insurance.

Recruitment

Providers were recruited by the Principal Investigator (Dr Sleath), who visited each clinic and explained the study procedures to 43 providers. Forty-one (95.3%) agreed to participate. Provider participation involved completing a brief survey, allowing us to train clinic staff to approach families with information about the study, and having medical visits between the provider and families who agreed to the research protocol audio-recorded. Approximately half of the providers were females (51%), and most were Caucasian (77%). They ranged in age from 30 to 70 years ($M = 44.8$ years; $SD = 9.4$).

Interested families were referred by a clinical staff member to a trained research assistant (RA), who explained the study in detail, administered the eligibility screener to interested families, and if interested and eligible, obtained caregiver consent and child assent. Child eligibility criteria included: (a) age between 8–16 years old, (b) English language dominant, (c) able to read the assent form, (d) had been seen at the clinic at least once before, (e) accompanied by an adult caregiver (parent or legal guardian) who could read and speak English, and (f) diagnosed with asthma [20,21]. Persistent asthma was defined as experiencing asthma-related daytime symptoms more than twice a week, asthma-related night-time symptoms more than twice a month, or receiving 1 or more long-term controller therapies for asthma [20,21].

Of the 377 families approached by the RA, 333 (88%) agreed to participate and of those, 296 (89%) had useable audio-tape data and had been seen by 35 of the 41 study providers. Missing audio-tape data was primarily due to poor quality recordings. The sample was further reduced to 259 families who completed the second visit that occurred in the home. Families with male children were significantly more likely to complete the second visit ($\chi^2 = 8.2$, $p \leq 0.01$) compared with non-completers; no other baseline differences were observed.

Procedures

Details of the baseline medical visit procedures are available elsewhere [22,23]. Briefly, an audio-recorder was turned on by an RA once the family and provider were in the exam room. The audio-recorder was turned off by the provider and

then the family was guided to the RA to complete the remaining baseline protocol including a child interview and a caregiver self-administered survey.

One month later, during a home visit, the RA interviewed the child and gave the caregiver a self-administered survey to complete, capturing among other variables, child- and caregiver-reported availability and use of a PFM. The RA then observed the child demonstrate use of a PFM.

Coding of the medical visit – baseline

Each audio-tape visit was transcribed verbatim and a detailed coding tool was developed to analyze provider–caregiver–child communication about the PFM, specifically whether the provider demonstrated the use of a PFM and whether he/she asked the child to demonstrate the use of a PFM. These two behaviors were selected given that a National Heart Lung and Blood Institute expert panel report [11] emphasized that providers should demonstrate proper asthma device techniques and have the child return the demonstration.

The transcripts were reviewed by two RAs who met biweekly with the investigators to develop and refine the coding rules. RAs coded provider, caregiver and child questions about PFMs as well as whether the provider educated the family about the PFM. The RAs coded 20 of the same transcripts (8% of total) throughout the study period to assess inter-coder reliability. There was 95% coder agreement for provider demonstrating peak flow technique and the provider asking the child to demonstrate peak flow technique. A median score was created to reflect the average number of times during which the PFM was discussed between the provider, caregiver and child for the entire sample (see items in Table 1).

Child interview and caregiver survey – baseline and one-month home visit

Demographics. At baseline, age and gender, as well as caregivers’ marital status (coded as married or not) and years of education were examined as potential confounders. Race was recoded into a dichotomous variable (white versus non-white). The child’s insurance status was measured using five categories (none; private insurance; Medicaid; the State Children’s Health Insurance Program; and other). Given that most children had health insurance, it was recoded into

Medicaid versus not because of the low medication copayments for patients on Medicaid (\$1 for generic and \$3 for brand name medicines [24]).

Asthma characteristics and outcomes. Year of diagnosis and medication use were collected via child report and used to create two variables, age of diagnosis and percent on a controller medication. Caregivers responded to five items about the child’s asthma outcomes. For asthma symptom days, caregivers reported how many days during the past 14 days the child had daytime or night-time symptoms, including wheezing, slow play and nights awakened. Caregivers also reported: (1) the number of days during the past two weeks the child was restricted from activities due to asthma; (2) the number of days during the past two weeks the child missed school because of asthma, and (3) the number of unplanned doctor visits (not including previously scheduled appointments) due to asthma during the past month; and (4) the number of asthma-related emergency room visits that occurred during the past month [25].

Psychosocial variables: self-efficacy, outcome expectations and impact of illness on family. Two psychosocial variables were asked of both respondents derived from Social Cognitive Theory (SCT [6,7]) and its application to asthma research [13]. According to SCT, those with higher levels of self-efficacy to perform a certain behavior such as PFM use are more likely to undertake the behavior [26]. Self-efficacy was measured with a previously validated 14-item scale [27] using response options of 1 = not at all sure to 5 = completely sure and coded to obtain a mean self-efficacy score such that a higher score represented greater confidence in managing his/her asthma ($\alpha = 0.85$ children, 0.86 caregivers).

Outcome expectations was measured with a previously validated 5-item scale that examined perceptions of how much engaging in asthma control behaviors would help alleviate symptoms associated with poor asthma control, with response options of 1 = not at all to 9 = extremely well [28]. As with self-efficacy, an outcome expectations mean score was computed so that a higher score indicated greater expectations that engaging in asthma control behaviors would help alleviate symptoms associated with poor asthma control ($\alpha = 0.64$ children, 0.84 caregivers).

Caregivers completed the 27-item Impact of Illness on Family scale [29]; this scale assesses how much the child’s illness is affecting family functioning, such as changing family plans due to child’s asthma. Response options range from 1 = strongly disagree to 4 = strongly agree. A single mean score is computed with higher scores representing a greater impact of the child’s illness on the family ($\alpha = 0.91$).

Child and caregiver reported access to and use of PFM

At the one-month home visit, access and use of a PFM were obtained from the child and caregiver using two separate questions. Children were asked using response options of “yes” or “no” and caregiver data were obtained on a categorical scale with 0 = never to 4 = every day during the past month. Responses were collapsed into two categories (never or only with symptoms versus one or more times per

Table 1. Percent (*n*) of occurrences of provider–caregiver–child interactions related to PFM use during baseline medical visit and average number of communication occurrences (*N* = 259).

	% (<i>n</i>)
Provider asks about PFM use	10.8 (28)
Provider explains zones in PFM	7.7 (20)
Provider explains what to do in various zones	6.6 (17)
Provider demonstrated how to use PFM	3.1 (8)
Provider informs about how often to use PFM	2.7 (7)
Provider asks child to demonstrate use of PFM	2.3 (6)
Caregiver asks provider questions regarding PFM	2.3 (6)
Provider suggests keeping a PFM journal	0.4 (1)
Child asks provider questions regarding PFM	0.4 (1)
Median number of communication occurrences (range) ^a	0.0 (0–4)

^aMedian number of times during which a PFM was discussed between the child, caregiver and provider for the entire sample.

Table 2. PFM availability, use and observed technique at one-month home visit ($N = 259$).

	Caregiver % (n)	Child % (n)	Sig. ^a
<i>Caregiver report</i>			
Child has PFM at home or school	39.1 (99)	33.6 (87)	$p < 0.001$
If child has a PFM, how often used			$p < 0.001$
Never	19.2 (19)	39.1 (34)	
Only with symptoms	51.5 (51)	33.3 (29)	
1 or more times per week	26.3 (26)	27.6 (24)	
<i>Child demonstration of PFM</i>			
Set marker to 0	–	45.2 (117)	
Hold meter upright	–	65.6 (170)	
Do not block marker movement	–	60.2 (156)	
Deep breath in with mouth open	–	56.8 (147)	
Place meter in mouth and close lips tightly	–	61.8 (160)	
Exhale hard and fast into meter	–	46.3 (120)	
Check the result	–	45.2 (117)	
Repeat steps two more times	–	26.3 (68)	
Median number of steps performed correctly (range)	–	6.0 (0–8)	
% who performed all steps correctly	–	19.3 (50)	

^aSignificant differences between caregiver and child report.

week) to facilitate comparing those who used PFMs regularly versus never or only with symptoms.

Child PFM demonstration protocol

As described in detail elsewhere [22], an RA was trained and then certified by a study investigator to observe and code the child's performance with a PFM during the one-month home visit. Briefly, the certification process involved participation in a training, followed by the presentation of a DVD with demonstrations of optimal and suboptimal techniques that the RAs were required to score. The study investigator then observed the RA conducting the protocol with three test subjects; the RA passed this observational assessment if there was a high degree of concordance compared with the gold standard. During data collection, the RA noted whether the child performed each of the eight steps as listed in Table 2. For the primary analyses examining predictors of demonstrated use, a dichotomous variable was created by taking the median split (fewer than six steps conducted incorrectly = 0 versus six or more steps conducted correctly = 1).

Statistical analyses

Analyses were conducted using SAS v9.2 (SAS Inc, Cary, NC). Descriptive statistics were run to ensure statistical assumptions were met. Bivariate analyses examined relationships between the variables of interest using Pearson's correlation coefficients (e.g. PFM use and education), two-tailed independent samples *t*-tests (e.g. differences between PFM users versus non-users), or Pearson's Chi-square statistics (e.g. PFM users and race). The variables that were included in the multivariate GEE analyses were included if the variables were significant in the bivariate analyses, controlling for previous education on PFM. GEE allows for clustering on a shared characteristic. Children were clustered based on which provider he/she saw during the study.

Table 3. Baseline demographic and asthma-related characteristics of caregiver and child respondents ($N = 259$).

	Caregiver M (SD) or % (n)	Child M (SD) or % (n)
<i>Demographic characteristics</i>		
Mean age (SD)	41.0 (8.6)	11.1 (2.4)
% Female	86.5 (224)	49.4 (128)
% Non-White	n/a	44.8 (116)
% Medicaid or other government insurance	n/a	50.6 (131)
% Married	56.0 (145)	n/a
Mean years of education (SD)	12.7 (2.5)	n/a
<i>Asthma-related characteristics</i>		
% Moderate to severe persistent	–	71.4 (185)
% On a controller medication	–	84.2 (218)
Mean years living with asthma (SD)	–	6.1 (3.9)
Provider has ever demonstrated use of PFM (Yes)	55.6 (144)	42.9 (111)

The primary outcomes of interest were: (a) child-reported access to a PFM, (b) child-reported preventive use (never versus only with symptoms) at the one-month home visit, (c) caregiver-reported access to a PFM, (d) caregiver-reported child's use of PFMs preventatively (versus with symptoms or not at all) at the one-month home visit, and (e) child-demonstrated PFM use of at least six steps correct at one-month.

To examine the clinical relevance of PFM use on asthma outcomes, regression analyses examined whether PFM use at baseline was associated with asthma symptom days, restricted days, school absences, unplanned doctor visits and emergency room visits assessed at the one-month home visit.

Results

Table 3 shows the demographic and asthma-related characteristics of children and caregivers.

Audio-recorded provider–caregiver–child communication about PFMs

Table 1 presents evidence of how frequently providers, caregivers and children discussed PFMs during the audio-taped medical visits. Providers educated about any PFM area in fewer than 15% ($n = 38$) of medical visits. Fewer than 8% ($n = 20$) of the providers explained zones on PFMs and only one provider suggested that a child keep a PFM journal. The most common PFM area that was discussed was when providers asked about PFM use (10.8%, $n = 28$). Only one child and six caregivers asked a question about PFMs.

PFM availability, use and observed demonstration at one-month home visit

Table 2 presents how often children and caregivers reported that the child had a PFM available at home or school. Among children, a third reported they had a PFM available at home or school. Of those who did ($n = 87$), 40% reported that they never used it, 33% reported using it with symptoms only, and 28% reported using it at least once per week. Fewer than half of the caregivers reported that their child had a PFM available at home or school. Of those who did ($n = 99$), less than a

Table 4. Predictors of reported availability and use of a PFM and observed performance.

One month home visit →	Child-report		Caregiver-report		Child observed
Baseline visit ↓	PFM availability OR (95% C.I.)	PFM use preventively OR (95% C.I.)	PFM availability OR (95% C.I.)	PFM use preventively OR (95% C.I.)	PFM use OR (95% C.I.)
Child race/ethnicity (1 = White, 0 = Other)	–	0.22* (0.07–0.65)		0.16* (0.06–0.41)	0.63 (0.39–1.03)
Caregiver education		–		0.84 (0.69–1.02)	–
Years with asthma	1.08* (1.03–1.15)	–	1.10* (1.03–1.18)	–	1.06 (0.99–1.13)
Asthma severity (2 = mild, 3 = moderate to severe)		–		2.93 (0.70–12.20)	–
Caregiver psychosocial – Impact of illness on family	1.65 (0.90–3.03)	2.75 (0.99–7.67)	2.08* (1.22–3.54)	1.30 (0.50–3.37)	–
Communication with provider – PFM communication occurrences	1.62* (1.18–2.23)	–	1.82* (1.27–2.60)	–	1.43* (1.04–1.96)

* $p < 0.05$; all analyses controlled for previous education on PFM.

fourth reported that their child never used it, more than half reported that their child only used it with symptoms and the remaining quarter reported that their child used it at least once per week or more.

Table 2 also presents the observed PFM techniques used by the child at the one-month home visit. Only 19% of children performed all steps correctly. The median number of steps performed correctly was six. The step that children performed correctly the most was holding the meter upright (66%) and the step that children performed correctly the least was repeating all steps two more times (26%).

Bivariate analyses

Caregivers were significantly more likely to report that their child had a PFM available at the one-month home visit if their child had lived with asthma longer (6.93 versus 5.66 years, $t = -2.55$, $p < 0.05$) and when there were more provider–caregiver–child PFM-related communication occurrences ($r = 0.25$, $p < 0.001$). Caregivers were significantly more likely to report that their child used their PFM preventatively (versus never or only with symptoms) when the child was non-white ($\chi^2 = 13.80$, $p < 0.001$), when the child's asthma was moderate-to-severe persistent ($\chi^2 = 4.40$, $p \leq 0.05$), and when the caregiver had fewer years of education ($r = -0.26$, $p \leq 0.01$). These caregivers also reported that the impact of the child's illness on the family was higher (2.11 versus 1.86, $t = -2.47$, $p < 0.05$) compared with caregivers who reported their child used a PFM never or only with symptoms.

Similarly, children were more likely to report having a PFM available at the one-month home visit if the child had asthma longer (6.83 years versus 5.75 years; $t = 2.10$, $p < 0.05$); more PFM-related communication occurrences with the provider ($r = 0.25$, $p < 0.001$); and when the impact of the illness on the family was higher (1.91 versus 1.75, $t = -2.35$, $p < 0.05$). Non-white children ($\chi^2 = 11.24$, $p < 0.001$) and those whose caregivers reported that the child's asthma had more impact on the family (2.16 versus 1.81, $t = -2.74$, $p < 0.01$) were more likely to report using a PFM preventatively compared with those who reported using it only with symptoms or never using it.

Children were significantly more likely to perform at least six PFM steps correctly if child was non-white ($\chi^2 = 4.47$,

$p \leq 0.05$), if the child had lived with his/her asthma longer (6.71 versus 5.65 years, $t = -2.18$, $p \leq 0.05$) and if they had more PFM-related communication occurrences with their providers ($r = 0.17$, $p \leq 0.01$).

Multivariate analyses

Not all bivariate associations remained significant in the multivariate models (Table 4). In the multivariate analyses, caregivers were more likely to report that the child had a PFM available with greater number of years that the child lived with asthma, more PFM-related communication occurrences with their provider during the baseline medical visit, and greater impact of illness on the family (the latter approached significance). White children were less likely to use a PFM (Table 4). Similar results were observed on child-reported availability and use of a PFM. Children were significantly more likely to perform at least six steps correctly when there was more PFM-related communication occurrences with their provider at the baseline medical visit (OR = 1.43, 95% CI = 1.04–1.96).

Clinical relevance of PFM

PFM use was positively associated with restricted days, such that children who reported using a PFM at baseline were less likely to have their caregiver report restricted days at the one-month home visit ($r = 0.30$, $p \leq 0.01$). A similar finding was observed for unplanned doctor visits ($r = 0.23$, $p \leq 0.05$), and a trend was observed for emergency room visits ($r = 0.20$, $p \leq 0.09$). No associations were found with asthma symptom days and school absences.

Discussion

Results of this prospective observational study support the importance of provider–caregiver–child communication in more frequent and accurate use of a PFM one month after a medical visit. This finding held even after controlling for numerous other variables, such as asthma duration which, not unexpectedly, was a significant and consistent predictor in the bivariate analyses. However, our results also indicate that communication about the PFM occurred infrequently, a finding similar to communication about other asthma control

strategies, despite evidence for the importance of provider–caregiver–child communication on proper medication use [30], medication adherence [31], as well as quality of life and symptom days [25].

Use of a PFM for monitoring asthma symptoms remains a contentious issue for providers and patients alike. Providers are advised to instruct patients with moderate-to-severe persistent asthma on how to use a PFM and watch their performance in order to provide feedback [11]. Research shows that children who are shown how to use a PFM are more confident in their abilities to prevent an asthma exacerbation [13]. Yet despite these findings, patients report that peak flow monitoring is burdensome compared with other monitoring approaches [16,32], and that daily use may not be necessary [18]. School personnel are more likely to use other forms of assessment than an objective assessment of symptoms provided by a PFM [33]. This study provides evidence that more communication occurrences were associated with more frequent use and better PFM skills. Research is now needed to determine if improving provider–caregiver–child communication about the PFM improves asthma control.

Although not a central focus of this study, the study design feature of having both child and caregiver reports provided a unique opportunity to examine discrepancies between these two sources of information. Significant discrepancies were observed between child and caregiver reports, with children reporting significantly less availability of a PFM than caregivers (data not shown). Additional discrepancies were observed in reported frequency of use (data not shown), with over a third of the children and caregivers disagreeing on how often the child used the PFM. The largest discrepancies observed were among a fifth of the caregivers who reported that their child used the PFM only with symptoms and the children who reported no use. As outlined in a review paper by Eiser & Varni [33], numerous studies have examined caregiver–child discrepancies in reports of quality of life and one study recently examined discrepancies in reports of lifestyle behaviors [35]; however, no published studies present evidence of discrepancies in asthma reports. In general, the preponderance of evidence indicates that children report fewer symptoms [34] and worse health behaviors [35] than their caregivers. The evidence that caregivers were more likely to report PFM availability and use compared with children warrants further research and lends additional support to Vetter and colleagues' [36] argument that health care providers need to consider obtaining reports from both in order to address this discordance in the treatment process.

Limitations

This study is limited in generalizability to pediatric clinics, providers and families that share characteristics with those included in the study. Enrollment rates were high; however, we were unable to ascertain the number of families approached by clinical staff. A second limitation is that we do not know if these children were referred for asthma education or specialist care, nor the full extent of PFM discussions in previous visits. A third limitation is that although providers were not aware of the study hypotheses,

they knew they were involved in an asthma study which could have altered their behavior. A final limitation is related to the type of PFM used during the child's performance. To ensure consistency the RA provided each child with a PFM; this PFM may have been different from the one the child was accustomed to using and may have impacted performance. Despite these limitations, with the prospective study design we were able to examine longitudinal predictors of self-reported and observed PFM use among children.

Conclusions

Asthma care guidelines [11] stress the importance of recommending self-monitoring to patients, and peak flow monitoring is one approach to provide an objective measure of symptoms. Evidence from a systematic review suggests that it can result in net savings of health care costs, though the evidence is mixed on clinical outcomes [37]. Nevertheless, without provider and other forms of social support [38], patients are unlikely to initiate and sustain a self-monitoring behavior such as peak flow monitoring [39]. Health care providers influence patient behaviors and are encouraged to continue doing so using evidenced-based methods [11].

Practice implications

In this study, provider communication on the PFM improved the child's ability to use his/her PFM correctly. Providers can model the use of PFMs, and other devices during asthma visits, and they can have children demonstrate how they use their PFMs during medical visits. If provider time is limited, modeling can take place with medical clerks, nursing assistants and other health care providers identified as effective at improving asthma management skills [40]. The more that children can be shown how to use PFMs and have time to practice using them during medical visits and receive feedback on their technique, the more opportunity there is to become skilled at managing their asthma. If children are better able to use their devices, they are more likely to use them and to use them correctly, which could lead to better asthma outcomes.

Declaration of interest

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

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