In the patient-centered medical home (PCMH) model of primary care, management of patients with chronic diseases, such as asthma, requires patient-centered approaches that ensure appropriate ongoing assessment and treatment for all patients. The Asthma Control Score (ACS) and the Asthma Action Plan (AAP) are validated tools for assessment and management of asthma. ACS use by phone has been shown to accurately assess patients’ asthma control; however, no studies to date demonstrate the utility of AAP implementation by phone to improve asthma control. This study tested the effectiveness of AAP implementation by phone to improve asthma control.

**METHODS:** Adult patients with asthma (n=48) participating in a managed care insurance plan at a university-based family medicine residency clinic were enrolled in the study. Patients were contacted by phone, and an initial ACS was assessed. Patients with an ACS <20 (uncontrolled asthma) had their medication adjusted and a new AAP implemented by phone. Uncontrolled patients were reassessed by phone monthly and management was adjusted until control was achieved.

**RESULTS:** Of 48 patients, 42 (87.5%) were reached by phone. On initial assessment, 33 (69%) were controlled. After implementation of the new AAP by phone, seven of nine (78%) initially uncontrolled patients were controlled, for a total of 40 (83%) patients controlled by the end of the study.

**CONCLUSIONS:** Asthma management using the ACS and AAP by phone is a feasible strategy that is acceptable to patients and can improve asthma control without the need for an office visit.

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department with two clinics, one of which is a residency teaching clinic. The combined clinic population is approximately 70% HMO/managed care, 10% PPO/FFS, 10% student health, 5% public aid, and 5% Medicare.

A convenience sample of all patients ages 18 years and older with a diagnosis of asthma as identified by a single HMO insurer, based on either a billed visit with a diagnosis of asthma or a claim for an asthma medication prescription, was initially identified. Eligibility criteria included (1) age >18 years, (2) HMO insurance, and (3) diagnosis of asthma, confirmed by review of patients’ medical records. The initial list comprised 56 patients; eight patients were excluded on the basis of not having asthma based on their medical record, yielding a total sample of 48. The study protocol was approved by the university’s Institutional Review Board.

Three third-year family medicine residents (first three authors) contacted the potential research subjects via telephone. After describing the study and obtaining verbal informed consent, investigators administered the initial ACS. Patients with ACS scores <20 had a new AAP developed and discussed, adjusting or adding medication to improve control. Asthma control was defined as ACS score >19. Each participant was contacted monthly for a repeat ACS until they were controlled, up to 5 subsequent months. Data were analyzed using the Pearson chi square test to compare the proportion of controlled versus uncontrolled patients before and after the intervention.

**Results**

Of 48 study-eligible patients, 42 (87.5%) were reached by phone. On initial assessment, 33 (69%) were controlled, nine (19%) were uncontrolled, and six (13%) could not be reached by phone despite multiple attempts. At the conclusion of the study, 40 (83%) subjects were controlled (χ²=4.75, P<.05) (see Table 1).

<table>
<thead>
<tr>
<th>Number Controlled (%)</th>
<th>*Number Uncontrolled (%)</th>
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<tbody>
<tr>
<td>Before intervention</td>
<td>33 (69%)</td>
</tr>
<tr>
<td>After intervention</td>
<td>40 (83%)</td>
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</tbody>
</table>

* Analysis includes six patients who were not reached by phone in uncontrolled group, both before and after intervention.

**Discussion**

With clear evidence-based practice guidelines, asthma management can be a straightforward process when patients are regularly seen by their clinician. However, many patients with asthma do not seek out regular care and face potential adverse outcomes. The challenge of the PCMH model is to reach out to those patients who do not regularly seek care to improve the health of the entire population.

This study adds to the well-established body of evidence related to the effectiveness of telephone-based interventions in improving patient outcomes in a variety of situations, including dietary counseling, weight management, smoking cessation, management of chronic conditions such as heart disease and hypertension, medication compliance, and improving quality of life of parents with children with asthma.

Our findings indicate that asthma control can not only be assessed by phone but can be significantly improved without an office visit. Our analysis includes patients who were not reachable by phone; while an argument could be made for excluding them, it is important to consider this segment of the patient population when assessing the effectiveness of an outreach program. Improving control from 69% to 83% including unreachable patients as “uncontrolled” is a clinically significant achievement. Further, for a majority of patients with uncontrolled asthma (seven/nine), it only took 1–2 months for their asthma to be controlled. The remaining two were not able to fill their medications.

This study is limited by its small sample size and relatively short time frame; validation in a larger population is certainly needed. Future studies should also examine the sustainability of telephone-mediated asthma control by longitudinal follow-up for longer duration after achieving control in initially uncontrolled patients. Perhaps the most important factor limiting the generalizability of our study, however, is that physicians performed the phone calls. From a practical standpoint, physicians would likely not have the time to call patients for the initial assessment. The strength of this model is that it would not be necessary for physicians to perform the initial assessment; they would only be needed to adjust or prescribe new controller medications. Depending on the specific laws of any given state’s prescribing regulations, adjustment of medications and even new medication prescribing also could be done more cost-effectively by nurse practitioners or physician assistants.

Given emerging evidence indicating that targeted telephone care management programs can be successful in reducing medical costs and hospitalizations, the role of telephone management of asthma has special implications in improving the quality and cost-effectiveness of care. The overall utility of telephone management will, however, be constrained by the proportion of patients who are difficult to reach by telephone because they lack functioning message systems and/or seldom answer their phone when care providers try to call them.
Implementation of the PCMH model requires creativity, flexibility, and adaptation of patient-centered approaches to manage chronic diseases. This pilot study provides useful evidence regarding the feasibility, acceptability, and effectiveness of telephone-based asthma management. Our approach emphasizes the importance of effectively utilizing key PCMH principles including support for chronic diseases self-management, utilization of patient registries to keep track of patients, and team-based care. Hopefully as more dollars are directed toward targets for quality measures such as asthma control, primary care practices will be able to support the resources necessary for this type of patient-centered, population-based chronic disease management and fully implement the goals of the PCMH.

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