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A primary care learning collaborative to improve office systems and clinical management of pediatric asthma

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ABSTRACT

Objective: Pediatric asthma is a common, relapsing-remitting, chronic inflammatory airway disease that when uncontrolled often leads to substantial patient and health care system burden. Improving management of asthma in primary care can help patients stay well controlled.

Methods: The Vermont Child Health Improvement Program (VCHIP) developed a quality improvement (QI) learning collaborative with a primary objective to improve clinical asthma management measures through improvement in primary care office systems to support asthma care. Seven months of medical record review data were evaluated for improvements on eight clinical asthma management measures. Pre and post office systems inventory (OSI) self-assessments detailing adherence to improvement strategies were analyzed for improvement. Logistic regressions were used to test for associations between OSI strategy post scores and the corresponding clinical asthma management measures by month seven.

Results: This study found significant improvement from baseline to month seven on seven of the eight clinical asthma management measures and between pre and post OSI for seven of the nine strategies assessed ($N = 19$ practices). Additionally, one point higher average OSI scores on the assessment and monitoring of asthma severity, asthma control, asthma action plans, and asthma education strategies were associated with significantly greater odds of improvement in their respective clinical asthma management measures.

Conclusions: A QI learning collaborative approach in primary care can improve office systems and corresponding clinical management measures for pediatric patients with asthma. This suggests that linking specific office systems strategies to clinical measures may be a helpful tactic within the learning collaborative model.

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Introduction

Pediatric asthma is a common chronic inflammatory airway disease, with a relapsing-remitting course that must be monitored and managed consistently to achieve proper symptom control (1,2). Overall asthma prevalence in the United States has increased by nearly 15% in the past decade (3), especially in disproportionately affected groups such as rural populations, ethnic minorities and those below 100% of the federal poverty level (3–6). Approximately 10% of Vermont's pediatric population has asthma, one of the highest rates in the United States (7).

The burden of pediatric asthma is noteworthy. It is estimated that 10.5 million school days were missed by children ages 5–17 annually due to asthma

exacerbations, with the total annual health care cost of treating pediatric asthma estimated to be \$3 billion (8). The National Heart, Lung and Blood Institute (NHLBI) has published recommended guidelines for the diagnosis, treatment, and follow-up of pediatric asthma (9). While pediatric asthma care predominantly occurs in a primary care setting (10,11), therapy and symptom control remain suboptimal (2,12–15), as many asthma management guidelines are inconsistently implemented (16).

The Vermont Child Health Improvement Program (VCHIP) is a public-private improvement partnership founded in 1999 to lead statewide quality improvement (QI) initiatives to improve child and adolescent health (17). In 2012, VCHIP established Child Health

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Advances Measured in Practice (CHAMP), a voluntary network of now nearly 50 pediatric and family medicine primary care practices committed to longitudinal data collection and annual primary care focused QI learning collaboratives (18,19). These learning collaboratives use the Model for Improvement, a QI methodology designed to advance patient care and outcomes through setting an aim, measuring processes, and identifying areas of improvement through iterative Plan, Do, Study, Act (PDSA) cycles (20–22). The American Boards of Pediatrics and of Family Medicine require participation in QI to maintain certification, and primary care physicians involved in these annual collaboratives receive these maintenance of certification (MOC) credits (18,23–25). QI has been shown to be an effective tool in primary care management of pediatric asthma due to its efficacy (26–29), specificity for individual practices (30–32), and sustainability (32,33), especially when paired with MOC initiatives for physicians (25,34).

In 2015–2016, the CHAMP learning collaborative focused on pediatric asthma with the specific aim for participating practices to improve their management of asthma, measured by improvement in specific clinical asthma management measures by 20% over baseline through the use of QI methods. The secondary aim was for CHAMP practices to improve utilization of office systems to support asthma care. Office systems is a broad term referring to the infrastructure, tools, and workflow or processes in a practice that impact the desired outcomes. We assessed the impact of improvements in office systems on clinical asthma management measures, and hypothesized a positive association between office systems improvements and the aligned clinical asthma management measures (35).

Methods

Participants

Beginning in 2012, all practices caring for children in Vermont were invited to participate in the CHAMP network, and at the time of this learning collaborative, 46 pediatric and family medicine practices were members. From this network, 32 practices sent physicians and practice staff to attend an all-day learning session. Following the learning session, 19 of these practices fully participated in the asthma QI learning collaborative (See Figure 1 for exclusion details). Full participation for the practice was defined as 1) attending the learning session, 2) submitting medical record review data for six of seven months, including months one

and seven, and 3) attending three of six conference calls, and full participation qualified physicians to receive MOC credit. We made an exception for one practice that attended only one of six calls, because the physician from the practice was the key presenter on that call and did not seek MOC credit.

The 19 participating CHAMP network practices ranged in size, with approximately a quarter being small practices (less than 500 pediatric patients) and another quarter being large in size (1500 or more pediatric patients). There was almost an even split between pediatric and family medicine practices, with slightly more hospital owned than independent. Approximately a quarter registered as federally-qualified or rural health centers. Practices were located across the state, but the majority were in the largest hospital service area (Table 1). All practices cared for Medicaid patients.

QI learning collaborative description

The VCHIP team, in collaboration with state government, annually selects a focus for CHAMP. The CHAMP QI learning collaborative that took place from mid-September 2015 through mid-May 2016 focused on improving the care of children with asthma. VCHIP followed a modified learning collaborative approach based on the Model for Improvement (36), including an initial all-day learning session followed by six collaborative conference calls spaced over the eight month project with QI strategies and learning embedded throughout. Practices were encouraged to attend and work as multidisciplinary teams, including physicians, nurses and administrative staff.

At the learning session, practice teams learned about NHLBI guidelines for asthma management, validated tools for asthma control assessment, and innovations in asthma care from select Vermont practices. Educational breakout sessions included an overview of office strategies and systems for enhanced asthma care, planned asthma visits, asthma education and device technique, and smoking cessation. A presentation specific to QI was included, and other sessions incorporated QI methodologies and tools such as practice workflow and process mapping, team functioning and the roles of clinical and administrative staff in asthma care.

The ensuing conference calls were opportunities for practices to share their work and to receive QI coaching around the improvement process. Topic experts presented on assessing asthma control, asthma action plans and other communication tools, coding and

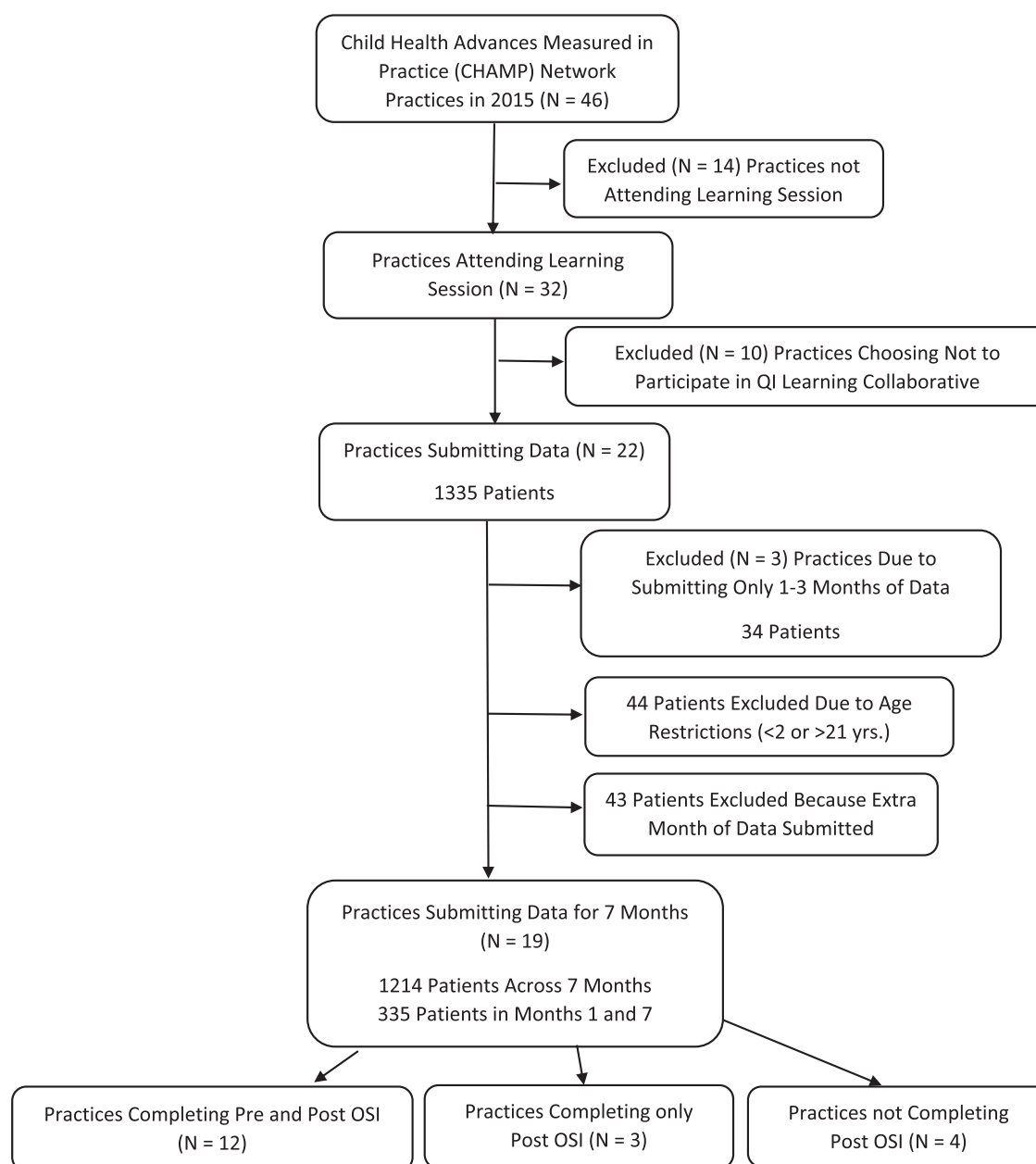


Figure 1. Selection of practices that submitted data for seven months and completed the office systems inventory.

billing, the use of registries, and the use of spirometry. The Easy Breathing program (37) was shared as an example of a systematic primary care program for pediatric asthma by a participating practice that utilized it (Supplemental Table 1).

To assess the clinical asthma management measures, data were submitted from a convenience sample of 10 patient visits seen by participating providers for asthma each month. For QI purposes, convenience samples were adequate to provide signals of change in processes of care delivery to the practices (38). If the number was 10 or less, providers submitted data on all asthma visits that month. One provider included patients from nonparticipating providers in his

practice as he had less than 10 visits per month. Visits were defined as any visit for asthma, planned or acute. Baseline (month 1) data were collected from health records of patients seen in September 2015, before the learning session. All but two practices had electronic health records. Data collection continued monthly thereafter with month 7 data collected from patients seen in March 2016. In addition, practices submitted monthly PDSA activity logs. VCHIP staff compiled the monthly data, and practices received monthly feedback reports with run charts. This feedback included QI specific recommendations from VCHIP's experienced faculty tailored to each practices' needs. Practices chose what improvements to make and what

Table 1. Description of participating practices in 2015.

	Participating CHAMP practice N (%)
Practice panel size*	
Less than 500 patients	4 (21%)
500-1499 patients	10 (53%)
1500 or more patients	5 (26%)
Practice specialty	
Pediatrics	10 (53%)
Family medicine	8 (42%)
Mixed	1 (5%)
Practice organizational structure	
Independent	7 (37%)
Hospital owned	12 (63%)
Practice Hospital Service Area (HSA)	
Largest metropolitan HSA	8 (42%)
All Other HSAs in Vermont	11 (58%)
Federally-Qualified Health Center (FQHC) or Rural Health Center (RHC)	
FQHC or RHC	4 (21%)
Not FQHC or RHC	15 (79%)

*Based on Attribution of children 0–26 years.

Note: Mixed: Practice with both Pediatrician and Family Medicine Physicians.

QI or topic specific tools to test based on their individual practice needs.

To assess improvements to office systems, practices completed an asthma office systems inventory (OSI); a self-assessment of the practice's current utilization of office systems strategies to support asthma care. The OSI was completed before and after the learning collaborative. Finally, at the end of the collaborative, participants answered balancing measure questions on the perceived impact this work had on practice efficiency.

QI data

Medical record review

Assessment of clinical management of asthma was based on nine clinical asthma management measures: 1) The percentage of patients with asthma severity documented as intermittent or persistent (mild, moderate, or severe); 2) The percentage of patients prescribed inhaled corticosteroids or other control medications if asthma severity is persistent; 3) The percentage of patients with asthma control assessed with a validated tool; 4) The percentage of patients with an asthma action plan initiated, reviewed or updated as needed within the last 12 months; 5) The percentage of patients with at least one planned asthma visit every 6 months; 6) The percentage of patients assessed for tobacco use/exposure; 7) The percentage of patients and their caregivers educated about their asthma; 8) The percentage of patients and their caregivers instructed on how to use their asthma delivery device; and 9) The percentage of patients between the ages of 5–21 who completed a spirometry test in the past 24 months. Measures 1–4 were required and teams chose any two of the remaining five to

improve at their practice. This was done to allow practices some choice in specific focus areas based on the local context within their practice. These clinical asthma management measures were based on the NHLBI guidelines for asthma and the National Improvement Partnership Network's (NIPN) asthma measures (9,39,40), which have been used for asthma QI projects by improvement partnerships in various states. Six months was chosen as the minimum follow-up interval recommended by the NHLBI guidelines. Practices chose from the following recommended validated asthma control tools: ACT (Asthma Control Test) (41); ACQ (Asthma Control Questionnaire) (42); TRACK (Test for Respiratory and Asthma Control in Kids) (43); ATAQ (Asthma Therapy Assessment Questionnaire) (44). All were utilized except the ACQ.

Office systems inventory strategies and balancing measures

The asthma OSI was adapted from the mental health practice readiness inventory (45). The OSI had 26 questions grouped under ten strategies, chosen based on the NHLBI guidelines for asthma and the NIPN asthma measures (9,39). Specifically, the questions highlighted different office systems changes and were purposefully directed toward the clinical asthma management measures to give practices direction in meeting the measures. The ten strategies and accompanying questions (Supplemental Table 2) were: a) Assessment and monitoring of asthma severity, two questions; b) Maximizing medications, four questions; c) Asthma control, two questions; d) Asthma action plans, three questions; e) Planned asthma visits, one question; f) Tobacco exposure and interventions, two questions; g) Asthma education, five questions; h) Asthma diagnosis, two questions; i) Use of registry and communication, four questions; and j) Spirometry, one question. The self-reported 26 item survey used a four point scale: 1) not done, 2) inconsistently done (<75% of the time), 3) consistently done (>75% of the time), or 4) consistently done and based on best practice.

The two balancing measures were 'How does incorporating asthma management activities within your practice and patient visits impact 1) the length of the patient's asthma visit, or 2) your overall practice flow and efficiency for all patients?' A five point scale was used: 1) Negatively (to a major degree), 2) Negatively (to a minor degree), 3) No change at all, 4) Positively (to a minor degree), or 5) Positively (to a major degree).

Table 2. Clinical asthma management measures aligned with office systems inventory strategies.

Clinical management measure	Office systems inventory strategy
1. Asthma documented as intermittent or persistent	a. Assessment and monitoring of asthma severity
2. Controller medication prescribed if asthma documented as persistent	b. Maximizing medications
3. Asthma Control Assessed with a Validated Tool	c. Asthma control
4. Asthma action plan reviewed/updated within past 12 months	d. Asthma action plan
5. Planned asthma visit within past 6 months	e. Planned asthma visits
6. Tobacco use/exposure assessed	f. Tobacco exposure and interventions
7. Patient/caregiver educated about child's asthma	g. Asthma education
8. Patient/caregiver instructed on device use	Not applicable
Not applicable	h. Asthma diagnosis
Not applicable	i. Use of registry and communication

Table 3. Summary of results for clinical asthma management measures.

Measure assessed	Month 1		Month 7		χ^2	P value	% Above baseline
	Total N	Yes N (%)	Total N	Yes N (%)			
1. Asthma documented as intermittent or persistent	161	111 (69%)	165	146 (88%)	18.65	<0.001	19%
2. Controller medication prescribed if asthma documented as persistent	72	70 (97%)	64	60 (94%)	†	0.325	−3%
3. Asthma control assessed with a validated tool	163	56 (34%)	162	90 (56%)	14.76	<0.001	22%
4. Asthma action plan reviewed/updated within past 12 months	163	82 (50%)	169	116 (69%)	11.58	0.001	19%
5. Planned asthma visit within the previous six months	120	31 (26%)	144	66 (46%)	11.26	0.001	20%
6. Tobacco use/exposure assessed	79	57 (72%)	79	78 (99%)	†	<0.001	27%
7. Patient/caregiver educated about child's asthma	65	33 (51%)	67	59 (88%)	21.72	<0.001	35%
8. Patient/caregiver instructed on device use	56	23 (41%)	44	30 (68%)	7.27	0.007	27%

Note: Measures 1–4 were required. Practices chose any two additional measures from measures 5–8. Sample sizes in questions 1,3,4 do not add up to 335 due to missing data. Question 2 only includes patients with persistent asthma.

†indicates that a Fischer's Exact Test was performed for the measure due to a sample size of less than five in a response category.

Statistical analyses

To test for significant improvement above baseline in the clinical asthma management measures, chi square tests for differences in proportions were performed on aggregated medical record review data between months one and seven for the 19 practices. For two of the clinical asthma management measures (controller medications prescribed and tobacco use/exposure assessment), Fischer's Exact Tests were used because there were fewer than five patients in a response category. Individual OSI questions were combined to calculate mean scores for each of the strategies analyzed (Supplemental Table 2). Paired *t* tests were used on the OSI data from the 12 practices completing both the pre and the post surveys to assess whether significant improvement was made by the end of the QI learning collaborative. Finally, OSI strategies were matched with aligned clinical asthma management measures and evaluated for associations between them (Table 2). For the 15 practices that had post OSI surveys, logistic regressions were used to test for associations between OSI strategy post scores and the corresponding clinical asthma management measures by month seven.

Results

Total sample size for the monthly medical record review pre-post comparisons (months 1 and 7) was

335 for the 19 practices. There were missing data for individual clinical asthma management measures (measure 1: *n* = 9 missing; 3%, measure 3: *n* = 10 missing; 3%, and measure 4: *n* = 3 missing; 1%) which the QI project team was unable to collect. Table 3 details the sample sizes in months 1 and 7 for each of the measures. Three practices missed one month of data submission, but were included in the analyses because they completed baseline and month seven data. Of the 19 practices that participated, 12 completed both the pre and post OSI and were included in that analyses. Three practices participated in the learning collaborative but only completed the post OSI (Figure 1); these practices were included in the later analyses of associations between average OSI post scores and clinical management measures in month seven.

Clinical asthma management measures results

Sixteen practices chose to focus on planned asthma visits, nine practices chose tobacco use/exposure, five practices chose patient/caregiver education, and seven practices chose patient/caregiver device instruction. Retrospectively, it was noted that many pediatric practices in the CHAMP network did not have access to spirometry equipment. Only four family medicine practices, with relatively few asthma patients, chose to improve upon spirometry, resulting in sample sizes

Table 4. Summary of office systems inventory strategies self-assessed by QI practice teams pre and post QI learning collaborative participation.

Office system inventory strategy	Pre mean	Pre standard deviation	Post mean	Post standard deviation	Test statistic	<i>p</i> value
a. Assessment and monitoring of asthma severity	2.25	0.62	3.54	0.50	5.03	<0.001
b. Maximizing medications	2.56	0.43	3.21	0.35	5.95	<0.001
c. Asthma control	2.00	0.60	3.00	0.56	4.06	0.002
d. Asthma action plan	2.42	0.67	3.14	0.70	5.12	<0.001
e. Planned asthma visits	1.67	0.65	2.58	0.51	4.75	<0.001
f. Tobacco exposure and interventions	3.08	0.63	3.42	0.67	1.48	0.2
g. Asthma education	2.44	0.51	2.97	0.55	3.68	0.004
h. Asthma diagnosis	2.49	0.67	3.32	0.39	3.23	0.008
i. Use of registry and communication	2.36	0.54	2.59	0.74	1.00	0.3

Note: 26 item survey used a four point scale: 1) not done, 2) inconsistently done (<75% of the time), 3) consistently done (>75% of the time), or 4) consistently done and based on best practice. See Supplemental Table 1 for complete office systems inventory questions within each strategy.

too small to analyze. Therefore, only clinical asthma management measures 1–8 were reported in this study.

There was significant improvement from baseline to month seven on seven of the eight measures. Five measures, asthma control assessment with a validated tool, planned asthma visits, tobacco use/exposure assessment, patient/caregiver education about asthma, and patient/caregiver instruction on device use, met the learning collaborative goal of 20% improvement above baseline (Table 3).

Office systems inventory strategies and balancing measure results

Significant improvements were found between pre and post OSI for seven of the nine strategies in the OSI, including assessment and monitoring of asthma severity, maximizing medications, asthma control, asthma action plans, planned asthma visits, asthma education, and asthma diagnosis (Table 4). The spirometry strategy was excluded from analyses due to few practices choosing to improve spirometry (See Supplemental Table 3 for practice PDSA activities). For the balancing measures, 61% (11/18) perceived a neutral or positive impact on 1) the length of asthma patient visits, and 50% (9/18) perceived a neutral or positive impact on 2) overall practice flow and efficiency.

Associations between OSI strategies and the aligned clinical asthma management measures

Among the 15 practices completing the OSI post assessment, a one point higher average score on the assessment and monitoring of asthma severity OSI strategy was associated with a nearly three times greater odds of documenting asthma severity as intermittent or persistent by month seven (Odds Ratio = 2.93, $p=0.04$). Additionally, a one point higher average score on the asthma control OSI strategy was

associated with about six times greater odds of assessing asthma control with a validated tool (Odds Ratio = 6.32, $p<0.001$). A one point higher average score on the asthma action plan OSI strategy was associated with about three times greater odds of having an asthma action plan reviewed/updated within the past 12 months (Odds Ratio = 3.39, $p<0.001$). Finally, a one point higher average score on the asthma education OSI strategy was associated with a 29 times greater odds of a patient/caregiver being educated about the child's asthma (Odds Ratio = 29.48, $p=0.03$). Results were inconclusive comparing the maximizing medications OSI strategy and controller medication prescriptions, the planned asthma visits OSI strategy and planned asthma visits, and the tobacco exposure and interventions OSI strategy and tobacco use/exposure assessment ($P_s > 0.05$).

Discussion

While QI has been shown to be an effective tool in improving primary care management of pediatric asthma (26–32,46), this study is unique in some key aspects. First, participating practices all had background experience in QI as members of the CHAMP network, which focuses on longitudinal data collection and annual participation in QI learning collaboratives. Although not tested specifically, this likely has bearing on the results, particularly given the short duration of the learning collaborative.

Secondly, this study is distinctive in its breadth. Based on 2016 estimates using the Vermont Healthcare Claims Uniform Reporting & Evaluation System (Vermont's all payer claims database) that approximately sixty percent of all Vermont children and adolescents were seen in a CHAMP practice, the practices participating in this collaborative would have seen at least 24% of the children with asthma in Vermont by conservative estimates. While we cannot estimate the extent that changes diffuse through an entire practice,

this CHAMP collaborative and its practice network structure can potentially reach a significant portion of all children with asthma in Vermont.

Dolins et al. reported on a national multi-wave quality improvement collaborative focused on asthma and facilitated through the Chapter Quality Network of the American Academy of Pediatrics (AAP) (47). In many ways, this collaborative follows a similar approach sharing the learning collaborative model and utilizing similar measures based on the NHLBI guidelines. In addition, they recruited AAP chapters based on existing QI infrastructure and experience conducting practice level QI, which are attributes that also may allow the CHAMP network to be successful.

The practices in this QI collaborative were highly successful, with significant improvement observed in seven of eight clinical asthma management measures (Table 3). Among the required measures (1–4), the largest improvement observed over baseline was in assessing asthma control with a validated tool (22%), coinciding with Vernaccio et al. (25), who showed increases of greater than 45% in asthma control assessment in three practice cohorts over a one year intervention. While this measure is important, as poor asthma control has been linked with higher incidence of emergency room visits and hospitalizations for pediatric asthma (10,11), we did not measure actual changes in control itself. In addition, though there was improvement, there is still significant room for enhancement. The four optional measures each met the goal of 20% or better improvement above baseline among the practices that chose them. The greatest improvement was in patient/caregiver education about asthma (35%), also shown by Ragazzi et al. with four of six practices meeting 30% improvement targets following a QI intervention (31). The only measure with no significant change observed over baseline was controller medications prescribed for persistent asthma and this was likely due to a high baseline proportion (97%), also noted by other studies (25,27,47). While important, as it has been shown to reduce hospitalizations from asthma (48), this leaves little room for improvement throughout a QI intervention.

Over the course of this QI learning collaborative, practices self-reported improvement broadly across office systems to support asthma care. Similar to Ragazzi et al. where primary care staff self-reported improvement in charting/documentation practices over a QI intervention (31), the largest improvements were in assessment and monitoring of asthma severity and asthma control. One reason for such broad improvement may be that an established learning

collaborative approach was utilized, (18,19). In addition, the OSI strategies tied directly to the clinical asthma management measures, which may have influenced practices improvement.

There are good reasons for why two of the OSI strategy areas did not improve. The tobacco exposure and interventions OSI strategy had the highest baseline score, with little room for improvement over the QI learning collaborative. The use of registry and communication strategy was one of the few not directly aligned with a clinical asthma management measure (Table 2). This may have impacted the degree to which practices focused on it. In addition, not all practices may have had registry capabilities in their electronic health record or had the ability to modify this over an eight month learning collaborative. Finally, as noted, most participating practices did not have the technical capability to undertake spirometry. This highlights the need to have an understanding of baseline data and practices capabilities in the design of a quality improvement intervention.

This study is novel in testing the association between improvement in specific office systems strategies and in clinical asthma management measures over a QI learning collaborative. Ragazzi and colleagues assessed both office systems and clinical management of pediatric asthma, but did not test for statistical associations linking the two (31). Dolin et al. provided practices with structured asthma encounter forms and population registries, but not a menu of strategies as in the OSI (47). In general, practices with higher self-ratings on OSI strategies had better outcomes in their clinical asthma management measures as seen in the medical record review. The results suggest that providing practices with an OSI linking strategies to clinical management measures is helpful. While directionality of the association is unknown, this may help focus QI efforts on particular office systems likely to produce positive change.

Limitations

A first potential limitation of this study was that medical record review data measured seven months following an intervention were compared to baseline data without a comparison group. Motivated practices may have self-selected to participate. Additionally, convenience sampling of monthly medical record review can be a source of bias and limits the generalizability of our findings. Secondly, data collected is dependent on accurate physician documentation and diagnosis of asthma. While the project emphasized

existing NHLBI guidelines around diagnosis, this is a limitation. A third potential limitation is that at eight months, this QI intervention was relatively short and may have not been of sufficient length for practices to implement change. While this may have been offset by the experience level of the practices in QI, the degree of this effect is unknown. The duration of monitoring also did not extend beyond the QI learning collaborative and so sustainability beyond the collaborative was not assessed. A fourth potential limitation is that OSI data is self-assessed and practices may be biased in their assessments of the degree of progress made. While important, using audits or observers to validate the OSI, for example, would have been complicated and expensive.

Finally, this study did not evaluate child health outcomes for pediatric asthma. Other studies have associated improvement in the clinical management of asthma with improvement in patient health outcomes such as reduction in emergency department visits and hospitalizations (27,29). This would be an important next step, especially in the context of no change in the appropriate controller medication measure. While we did not have that capacity within this collaborative, improvement in patient outcomes is the ultimate goal of quality improvement initiatives.

Conclusions

This eight month, practice-based, QI learning collaborative on pediatric asthma showed broad improvement in office systems with associated improvements to clinical management measures of asthma in primary care. This suggests that linking office systems strategies to clinical management measures may help focus QI efforts within the learning collaborative model. Finally, there is further support for the learning collaborative model of QI, particularly in the setting of an ongoing pediatric primary care network devoted to QI such as the CHAMP network.

Declaration of interest

All authors have made significant contributions to the manuscript following the International Committee of Medical Journal Editors recommendations. The authors have no conflicts of interest relevant to this article to disclose.

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Supplemental Table 1: CHAMP asthma learning collaborative conference phone calls (October 2015 - May 2016)

Date	Topic	Format: Presenter; Roll call question; Overview of call; Handouts
October	Asthma Control Tests	Presenter: Dr. Keith Robinson, pediatric pulmonologist Roll call question: Is your practice currently using asthma control assessment tools, and if so which ones? Are you trying to decide tools to use? Do you have any questions? Overview: Discussion of Asthma Control Tests Handouts: Information was included in MOC binders
November	Communication: Asthma Action Plans; MAPLE plan, and phone management	Presenters: Dr. Stanley Weinberger and Louise Mongeon, School Nurse Roll call question: How do you know when your patients have been seen in the ED, and what is your practice if they have been? Overview: Discussion of Asthma Action Plans and the MAPLE Plan for controlling asthma; School nurses and asthma care; Medication at school The MAPLE Plan is a discharge protocol to assist providers in delivering important asthma education to patients in a comprehensive and standardized way at the time of or following discharge from the hospital or Emergency Department
January	Asthma Coding and Billing	Presenters: Dr. Barbara Frankowski; Medicaid and BCBS coding/reimbursement specialists invited Roll call question: Would you share one of your successes and/or challenges with asthma coding and billing? For example, if you are doing planned asthma visits, and including asthma education, what is your experience with coding and billing for that visit? Overview: Overview of ICD – 10 and new coding for education Practice Highlight: MD from a practice presented on their asthma education efforts and the packet they use Discussed the survey being used as a balancing measures Hand-outs: (1) Information on CPT codes for Asthma Educators, with coding and billing tips (2) Asthma Education Packet (3) The link for the balancing measures survey was sent out after the call
February	Identifying Asthma Patients	Presenters: Drs. Stanley Weinberger and Jill Rinehart Roll call question: Do you have a registry? If so, how are you using it? Overview: Discussed use of an asthma registry: benefits, goals, defining the population; data collection, and process. Discussed the “Easy Breathing (copyright)” program, which an asthma management program available for clinicians through the VT Dept. of Health Handouts: Easy Breathing program handout
March	Interpreting spirometry curves (Adobe Connect)	Presenter: Dr. Robinson, pediatric pulmonologist Roll call question: Given the recommendation that children with asthma between the ages of 5 and 21 have spirometry done every 1 – 2 years, what is your current process (spirometry in your office, referring out for spirometry)? Can you share any barriers and/or lessons learned along the way? If you are moving toward a different process, please feel free to let us know. Overview: Office spirometry presentation included reasons to do office spirometry; how to review lung volumes; a strategy for spirometry interpretation; case reviews. Hand-out: Spirometry Interpretation information/hand-out

May	Final Wrap-up call	Overview: Reviewed results to date. Focused on a practice highlight with time for highlights from all practices willing to share. Discussed Information/Requirements for receiving MOC and CME credits.
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Supplemental Table 2: Office systems inventory survey used for pre and post office systems analysis**Strategies to Improve Asthma Care and Treatment in Primary Care Practices**

Following are strategies that healthcare professionals and practices can use to improve office systems to address and promote optimal asthma treatment. Read each idea and check the response as it applies to your practice:

Strategy	Impacts Asthma MOC Measure	1 Is not done	2 Inconsistently done (less than 75% of the time)	3 Consistently done (75% of the time or more)	4 Consistently done and based on best practice
Asthma Diagnosis					
We establish an asthma diagnosis based on history & exam.	NA				
We consistently ask patients standardized questions to determine if they may have asthma.	NA				
Assessment and Monitoring of Asthma Severity					
We assess and document the child’s asthma severity classification at least yearly, and more if needed.	1				
The classification determines the child’s follow-up plan.	1				
Asthma Control					
We assess the child’s asthma control at every visit using a validated tool: ACT, ACQ, TRACK, or ATAQ.	3				
We provide patients with appropriate information/details if there are new medications which may be beneficial.	3				
Asthma Action Plan (AAP)					
We use an asthma action plan (AAP) as a communication tool with the family. We talk with them about their asthma, and use the action plan to help guide the conversation. We encourage adherence to the AAP.	4				
We keep their AAP updated and in their medical record.	4				
For children with asthma, we send an updated AAP to their school or early childhood center every school year. We collaborate appropriately and effectively with school nurses or other school personnel.	4				
Maximize Medications					
We select medication and delivery devices that meet the patients’ needs and circumstances. We use an evidence based stepwise approach to identify appropriate treatment options.	2				
We prescribe inhaled corticosteroids (ICS) or leukotriene modifiers for effective long-term control therapy.	2				

We help patients with medication adherence by encouraging patients to bring their medications with them to every visit, reviewing them together during the visit, and discussing any medication changes and/or need for a refill.	2
We help patients with medication techniques by making sure they are using the correct device, and providing instruction on how to use their asthma medication delivery device (spacer) as needed.	9
Planned Asthma Visits	
We have a planned asthma encounter at least every 6 months or have documentation that they saw a pulmonologist or allergist specific to their asthma. The type of interaction depends on their asthma severity; management and control based on best practices are discussed. One planned visit can happen during the Health Supervision Visit (HSV).	6
Tobacco Exposure and Interventions	
We assess tobacco use/exposure.	7
If there is tobacco use or exposure, we talk with the family about smoking cessation interventions and offer cessation counseling.	7
Spirometry	
We use spirometry, or document that spirometry was done, every 1-2 years for children 5 to 21 years of age.	8
Asthma Education	
We discuss the patient/family home environment to help them focus on any problems that may trigger asthma exacerbations. This may include: pets, woodstoves, dust mites, or other triggers.	10
We help patients/families with their decisions regarding allergy testing to help identify and minimize triggers.	10
We provide asthma education that includes teaching patients about: self-monitoring to assess level of asthma control and to recognize signs of worsening asthma; taking medications correctly; avoiding environmental factors that worsen asthma; and agreeing on treatment goals.	10
We integrate education into all points of care involving interactions with patients by including members of all health care disciplines (physicians, pharmacists, nurses, respiratory therapists, and asthma educators).	10
We discuss social stressors that may impact asthma care with the patient/family (for example a change in housing, a change in insurance, etc).	10
Use of Registry and Communication	

We have implemented and demonstrated effective use of an asthma registry for reminder for annual influenza immunization and to assure at least semi-annual visits for children with asthma.	NA
We have a system in place to ensure optimal adherence for annual influenza immunization for patients with asthma.	NA
We know when patients have been to urgent or emergent care and we have a system for contacting them for appropriate follow-up care.	NA
We have a system in place to communicate with asthma specialists (pulmonologist, allergist).	NA

Note: Strategies adopted using the following sources: (1) National Improvement Partnership Network: Asthma Measures – Core and Optional Process and Outcome; Version 1; February 1, 2015. (2) National Heart, Lung, and Blood Institute (NHLBI) National Asthma Education and Prevention Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma – Full Report 2007 and NHLBI Asthma Care Quick Reference: Diagnosing and Managing Asthma, 2011.

Developed by Vermont Child Health Improvement Program (VCHIP) CHAMP (Child Health Advances Measured in Practice) using sources cited, August 2015, by: Barbara Frankowski, MD; Christine Pellegrino, MS; Keith Robinson, MD; Stanley Weinberger, MD; Kelly Cowan, MD; University of Vermont.

Supplemental Table 3: Summary of Office systems changes made by practices

Office System Strategies	Summary of changes submitted on monthly practice PDSA activity logs
Asthma Diagnosis	4 practices worked on establishing a clear diagnosis. Documentation included: - Establishing clear diagnosis of asthma severity and reconciling it with treatment plans. Use problem list as a “flag” to address asthma issues at each visit, and review problem list prior to visit. Get a more thorough history on asthmatic patients. Pay attention to diagnosis even if there for another reason for the visit. Look ahead in schedule for patients with asthma. Improved the documentation in EMR. 2 of the practices noted use of Problem Lists: - Putting in diagnosis with problem list appropriately. - Clean up asthma classification on problem list (below as well). 1 practice worked on making sure panel management reports were correct.
Assessment and Monitoring of Asthma Severity	- Work on process to review problem list prior to each visit. - Put asthma severity chart in each room (laminated) for easy reference. - Improve protocols/scheduling/assessment. - Office flow: RN’s automatically do peak flows and get paperwork “ready.” - Conducted chart review (added hours for a nurse reviewer) to clean up problem list specific to asthma (to help providers correctly dx and prescribe with accurate problem list)
Asthma Control	Used validated tools (ACT, TRACK) to assess control. 4 practices developed templates and improved documentation in their EHR. Some worked with their Information Services team. 5 practices worked on their office flow, for example: - Give asthma screen at beginning of each visit (i.e. work on visit flow). - Changed flow to have nurses/MA who checks in patient prompt the provider to use NHLBI guidelines and review ACT. - Have paperwork at check-in for WCC and F/U visits.
Asthma Action Plan	7 practices worked on ensuring AAP s were updated. Changes included: - AAPs part of the “Well Care Child” packet and visit when asthma is identified as a problem. - Increased review of chart for updated AAP. - New asthma protocol in EHR. - Flag patient needing AAP. - Go over AAP with each parent/patient and give them a copy for school. - Scrubbed their asthma diagnosis roster to identify patients needing closer education and followup. Each provider responsible for insuring that each asthma patient under his/her care has appropriate asthma designation and follow up plan. Saw “decreased” ED visits for asthma exacerbations and ... starting to tighten up use of AAP and “ACT completeness.” - Called school nurse to ensure AAPs are updated.
Maximize Medications	7 practices worked on processes to help patients with appropriate medications and adherence. To help with process/education with providers and staff they: - Reviewed codes with staff. - Developed medication sheet to improve physician awareness. - Implemented review of inhaler technique on regular basis for office providers, nurses,

	residents. Several practices had patients bring meds to visit and used teaching /asthma education about the meds at visit. Some had triage nurses and LPN's remind patients to bring them in. • Practices reviewed inhaler technique (proper use) with patient at visit. • Laminated inhaler med sheets used. One practice added pulse oximetry at all visits (sick or well) for asthma checks. This gave them a baseline pulse ox to compare when sick.
Planned Asthma Visits	3 practices focused on increasing planned asthma visits. Methods included: • Generate master list of asthma patients and review to see if seen in 6 months. Incorporate follow up scheduling into asthma template. • Generated report, identified pts needing 6 month visit, outreach/contact those patients to schedule them.
Tobacco Exposure and Interventions	1 practice activated a screening question in EHR and developed new workflow for universal screening for smoke exposure and tobacco use. 1 practice made Pre visit planning improvements. They used primary brief counseling for parents with smoke/tobacco exposure.
Spirometry	For practices working on spirometry, 2 documented improvements: • Working with RT Department on spirometry. The RT department acquired "better equipment" for dealing with pediatric patients. • Coordinated with nursing to obtain spirometry on all asthma patient > 6 on a annual basis or more frequently for suboptimal control.
Asthma Education	8 practices worked on asthma education. Improvements included: • Incorporate education/teaching in the visits. • Made changes/educated all staff /providers re diagnosis and documentation. • Asthma Educator available. Education and planning at staff meetings. • Put the asthma dinner plate in each exam room and ask pts to choose area in question. • Developed education sheet with asthma talking/teaching points and improved knowledge of education points for staff/physicians. • Asthma Education packet at all visits. Documenting in EMR.
Use of Registry and Communication	• Staff meeting used to educate staff about asthma and changes. • Increase awareness of team to have all reviewing the charts to participate. • Tracked and sent reminders for flu vaccines for asthmatics • Developed asthma visit template to standardize visits. • Pre-visit planning