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Association between Practice Participation in a Pediatric-focused Medical Home Learning Collaborative and Reduction of Preventable Emergency Department Visits by Publicly-insured Children in Massachusetts

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ABSTRACT

Introduction: This study evaluates the impact of practice participation in a pediatric patient-centered medical home learning collaborative on preventable emergency department (ED) visits among children in MassHealth (Massachusetts Medicaid/Children's Health Insurance Program). **Methods:** Claims and enrollment data were extracted for child MassHealth members (aged 3–18) comprising 2 groups: members enrolled in a group of 13 child-serving practices that participated in an intensive, 29-month long patient-centered medical home learning collaborative (intervention group), and members enrolled in a group of 12 comparison practices with roughly similar panel size, type, and geographic location (comparison group). Preventable ED visits were identified using a modified version of the New York University ED algorithm. Two analyses were then conducted: (1) a repeat cross-sectional analysis among children enrolled in intervention or comparison group practices during baseline (first half of 2011) and follow-up (second half of 2013) periods; and (2) a longitudinal analysis among a subset of children enrolled for the full study period (2011–2013). Both analyses tested whether the effect of the intervention differed for children with versus without chronic conditions (effect modification). **Results:** Preventable ED visits declined from baseline to follow-up among children in both intervention and comparison practices. In the cross-sectional analysis, the decrease was the same in both practice groups, and for children with versus without chronic conditions. The longitudinal analysis shows a statistically significantly greater decrease among children with chronic conditions enrolled in the intervention practices ($P = 0.02$). **Conclusion:** Children with chronic conditions might receive the greatest benefit from receiving care in a medical home setting. *(Pediatr Qual Saf 2018;3:e097; doi: 10.1097/pq9.0000000000000097; Published online August 10, 2018.)*

INTRODUCTION

The patient-centered medical home (PCMH) model of care delivery has been increasingly central to efforts to improve the U.S. health care system. PCMH principles have been widely applied in pediatric primary care settings. The American Academy of Pediatrics defines a pediatric medical home as "a family-centered partnership within a community-based system that provides uninterrupted care with appropriate payment to support and sustain optimal health outcomes" that will "address preventative, acute, and chronic care from birth through transition to adulthood."[1]

A growing body of research has searched for associations between practice-level PCMH characteristics and improvement in measures of health care quality, utilization, and health outcomes.[2,3] Within pediatrics, recent work has examined the association between a variety of measures of medical homeness and trends in emergency department (ED) utilization, particularly when such utilization could have been avoided with improved primary care. Reduction of preventable ED utilization for ambulatory care sensitive conditions is an important goal for all children, but is of particular concern for children with chronic conditions and/or special health care needs (SHCN).

Most studies have used measures of medical homeness derived from parent survey data or from self-administered practice-level instruments that assess medical home

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characteristics [such as the Medical Home Index (MHI[4])]. Findings from such research have shown no consistent pattern of associations between medical home characteristics and reduced ED use, regardless of whether the populations studied were limited to children with SHCN or included all children.[5–10] However, measuring the concept of medical homeness using practice-reported and/or survey data can be problematic, due to the subjective nature of responses and the wide diversity of instruments used.[3]

A more promising approach involves interventions designed to develop pediatric medical home characteristics in practice settings. Several evaluations of small site-based interventions have shown promise in reducing ED utilization for children with SHCN, or complex and/or chronic conditions.[11–13] These interventions are limited by their small scope, however, with sample sizes of only about 50–100 patients each in the evaluations cited above.

Our study builds and expands upon these studies of PCMH-based interventions in several ways. First, we follow the above studies in focusing on pre- and postintervention patient outcomes (ED visits), rather than focusing on measuring medical homeness. Second, we improve on these studies by dramatically expanding the size of the population of medical practices and enrolled children studied. Finally, because of our expanded study population, we can examine subgroup differences. We will look at subgroups based on continuity of practice-level enrollment and chronic condition status.

METHODS

Intervention

Through the Children's Health Insurance Program (CHIP) Reauthorization Act Quality Demonstration Grant program, the Massachusetts Medicaid agency (MassHealth) implemented a learning collaborative to support PCMH transformation at 13 practices that serve children enrolled in Medicaid and CHIP. Practices responded to a Request for Application, then participated in a 29-month long learning collaborative (August 2011 to December 2013) focused on a set of 6 primary drivers: family and youth centered care; comprehensive coordinated care; linkage to, and mobilization of, community resources; systems improvement; medical home care team; and engaged leadership. Practices each convened an improvement team consisting of a senior leader, provider champion, 1–2 family partners, and a Practice Transformation Facilitator. The Practice Transformation Facilitators served as the primary liaison to the learning collaborative faculty. They collected and used clinical data to drive improvements, supporting the practice team in the development and implementation of quality improvement activities. The 13 practice teams were convened in-person 6 times during the learning collaborative, along with virtual meetings. Each practice also received up to 8 hours per week of on-site technical assistance from care coordination staff employed through the state's Title V agency, the MA Department of Public Health. Practices received a fixed monthly fee to offset the administrative costs of participating in the learning collaborative. Additionally, 12 Medicaid and CHIP child-serving practices were recruited to serve as comparison sites. They were selected based on similarity of practice size, type (pediatric only versus multi-specialty), and region. While the research team attempted to recruit 1 or more matched practices for each intervention site, the original evaluation design called for some level of interaction with the comparison practices, thus requiring their affirmative consent to participate on a voluntary basis, which only 12 sites agreed to do. The comparison group is therefore not a true control group.

Study Design

Health care utilization data on publicly-insured (MassHealth) children enrolled in the intervention and comparison practices were collected and analyzed for a baseline and follow-up period: 6 months before the intervention (January to June 2011) and the last 6 months of the intervention (July to December 2013). To assess the association of participation in the PCMH learning collaborative with reduction of unnecessary ED use, we conducted 2 analyses: (1) a repeat cross-sectional analysis among the study practices' patients at baseline and at follow-up; and (2) a longitudinal analysis among a subset of children in that received care in a study practice for the full length of the intervention. In both analyses, we tested whether the effect of the intervention differed for children with versus without chronic conditions (effect modification).

Study Sample

The study population was composed of children enrolled in MassHealth (combined Medicaid and CHIP program in Massachusetts), aged 3–18 years, who were attributed to an intervention or comparison practice. The population includes only those children receiving coverage through MassHealth. Children were attributed to the practices through data supplied by MassHealth-contracted managed care organizations (for members enrolled in those MCOs) or from the state's Medicaid Management Information System (for members in the state's primary care case management program). Children were excluded from the analysis if they were covered under Fee-For-Service Medicaid due to the difficulty of attributing Fee-For-Service children to primary care practices. Children under age 3 were excluded to allow a 3-year lookback on claims and encounter data to determine the chronic condition status of children in the study population (discussed below). Because the study uses only deidentified administrative (member claims) and practice-level data, it was exempted from review by the University of Massachusetts Medical School Institutional Review Board.

Children included in the analytic sample had to be continuously enrolled in Medicaid and attributed to an intervention or comparison practice during the baseline or follow-up period. We used a continuous enrollment

criterion of no more than 1 gap in enrollment, not exceeding 45 days in length, during each 6-month period. The longitudinal analysis applied an additional continuous enrollment requirement: children must have maintained continuous enrollment, as described above, in either an intervention or comparison practice in each 6-month period from 2011 through 2013. We excluded children without any claim or encounter records during the baseline or follow-up period (fewer than 300 beneficiaries).

Data and Measures

The analysis uses claims and encounter data from MassHealth's MMIS. The outcome measure is ED utilization for nonurgent, potentially avoidable, or primary-care treatable conditions ("unnecessary ED visits"). These are ED visits that we hypothesize could be reduced though continuous, accessible primary care within a medical home. First, we identified all ED visits and excluded those resulting in an inpatient admission. The remaining ED visits were categorized using a modified version of the New York University ED algorithm.[14] ED visits were classified as unnecessary if (1) the algorithm estimated that the probability of the visit being classified as "Emergent, ED Care Needed, Not Preventable/Avoidable" was less than 0.5; or (2) if they were coded with a diagnosis consistent with a pediatric-specific nonurgent ED visit, as identified by an expert panel in a prior study.[15]

We assessed chronic condition status using the Pediatric Medical Complexity Algorithm (PMCA),[16] a claims-based algorithm developed for pediatric populations in Medicaid. The PMCA sorts children into 3 categories: children without chronic conditions, children with noncomplex chronic conditions, and children with complex chronic conditions. For this analysis, we constructed a binary variable (complex or noncomplex chronic conditions versus no chronic conditions). We used the "more conservative" version of the PMCA as described by the algorithm's creators.[16]

Statistical Analysis

We estimated 2 regression models to assess whether the intervention had an effect on unnecessary ED visits, and whether the effect (if any) differed for children with and without chronic conditions. Both models account for within-practice clustering of children and control for child-level covariates (age, chronic condition status) and practice-level covariates (pediatric versus family practice, practice size, geographic region). Both models include interaction terms to assess (1) whether the change in unnecessary ED visits differed for intervention and comparison practices (time × intervention); and (2) whether the effect described in (1) varied for children with and without chronic conditions (time × intervention × health). We conducted all analyses using SAS/STAT software, version 9.3 (SAS Institute, Cary, NC). We first conducted a repeat cross-sectional analysis of the study practices' patients at baseline and at follow-up, using a fixed-effects logistic regression model (PROC LOGISTIC). We then conducted a longitudinal analysis among a subset of children who received care in a study practice for the full length of the intervention, using a general linear model with binomial distribution and logit link (PROC GENMOD).

RESULTS

Practice Characteristics

Table 1 shows practice characteristics of the intervention and comparison practices. Practices varied in the number of enrolled MassHealth beneficiaries, practice type, and region within Massachusetts. Intervention practices were more likely than comparison practices to have over 1,000 MassHealth beneficiaries and to be located in Boston. Comparison practices were more likely than intervention practices to be pediatric-only practices.

Repeat Cross Section

The repeat cross-section sample includes 22,449 children at baseline and 27,461 at follow-up. Table 2 shows sample characteristics for the panels of children attributed to intervention and comparison practices at each period. The average age was around 10.5 for each group. Over 40% had a chronic condition, with a higher prevalence of chronic conditions in the comparison practices.

A fixed-effects logistic regression model estimated that the decrease in unnecessary ED visits among children without chronic conditions was the same in intervention and comparison practice panels ($\beta_{time*intervention} = 0.13$, $p = 0.20$). A similar pattern was seen among children with chronic conditions ($\beta_{time*intervention*health} = -0.24$, $p = 0.07$); that is, the decrease in unnecessary ED visits was the same in intervention and comparison practices.

Longitudinal Analysis

The longitudinal analysis included a sample of 10,069 children who were attributed to an intervention practice (n = 6,906) or comparison practice (n = 3,163) for the entirety of the medical home learning collaborative intervention. The children were slightly younger and more

Table 1. Practice Characteristics

Characteristics	Intervention Practices (N = 13)	Comparison Practices (N = 12)
Practice size in number of Medicaid beneficiaries		
0–500 beneficiaries	3	6
501–1,000 beneficiaries	4	2
1,000+ beneficiaries	6	4
Practice type		
Pediatric only	6	10
Family practice	7	2
Region		
Boston	5	3
Central	1	2
Metrowest	3	4
Northeast	2	1
Western	2	2

Table 2. Sample Characteristics

Characteristics	Children in Intervention Practices	Children in Comparison Practices	*P* (Intervention versus Comparison)
Repeat cross-section (baseline)	n = 15,336	n = 7113	
Mean age (SD)	10.6 (5.1)	10.7 (5.1)	0.31*
Percentage with a chronic condition	41.3	46.7	< 0.0001†
Repeat cross-section (follow-up)	n = 18,595	n = 8866	
Mean age (SD)	10.5 (5.0)	10.5 (4.9)	0.15*
Percentage with a chronic condition	42.4	45.9	< 0.0001†
Longitudinal analysis group (baseline data)	n = 6906	n = 3163	
Mean age (SD)	9.4 (4.1)	9.5 (4.1)	0.08*
Percentage with a chronic condition	44.8	50.2	< 0.0001†

*Independent samples *t* test.
†Chi-square test of independence.

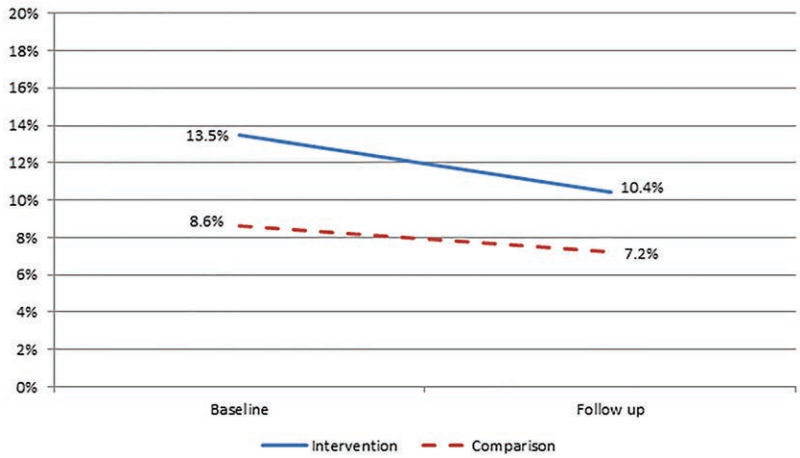

Fig. 1. Percentage of children in longitudinal sample with an unnecessary ED visit (n = 10,069).

likely to have a chronic condition than the panel sample (Table 2). There was a higher prevalence of chronic conditions among children in the comparison practices (50.2%) than intervention practices (44.8%).

Unnecessary ED visits were more common among children in intervention practices than comparison practices (Fig. 1). These visits declined from baseline to follow-up among children in both groups of practices. Figure 2 shows the decrease in unnecessary ED visits, stratified by children's chronic condition status. Visits were more common for children with chronic conditions than those without chronic conditions. Unnecessary ED use declined over time for all groups, with the greatest decrease among children with chronic conditions in the intervention practices, decreasing from 17.4% to 12.7%.

A longitudinal regression model (general linear model with binomial distribution and logit link) estimated that the decrease in unnecessary ED use among children without chronic conditions was the same for the intervention and comparison practice panels ($\beta_{time*intervention} = 0.22, P = 0.23$). However, the effect of the intervention differed for children with chronic conditions versus children without chronic conditions ($\beta_{time*intervention*health} = -0.52, P = 0.02$): a test of a linear combination of coefficients showed that for children with chronic conditions, ED visits decreased more in intervention practices than comparison practices ($\beta_{time*intervention} = -0.30, P = 0.03$). The results from this model with a 3-way interaction term (time × intervention × health) was replicated and confirmed via stratified regression models with a 2-way interaction term (time × intervention).

DISCUSSION

The proportion of children having preventable ED visits fell over the course of the study period for both the intervention and comparison groups of practices; however, the decrease was greatest among children with chronic conditions who received care in the intervention practices for the full duration of the medical home learning collaborative. This pattern held even after controlling for child-level and practice-level variations. These findings align with 2 observations found in the existing literature. First, stability of health insurance enrollment may help support quality of care. For example, an association has been found between interruptions in Medicaid coverage and hospitalizations for ambulatory care sensitive conditions[17] (an outcome measure related to the present study). Second, there may be a benefit to continuous enrollment within a particular primary care practice, especially when

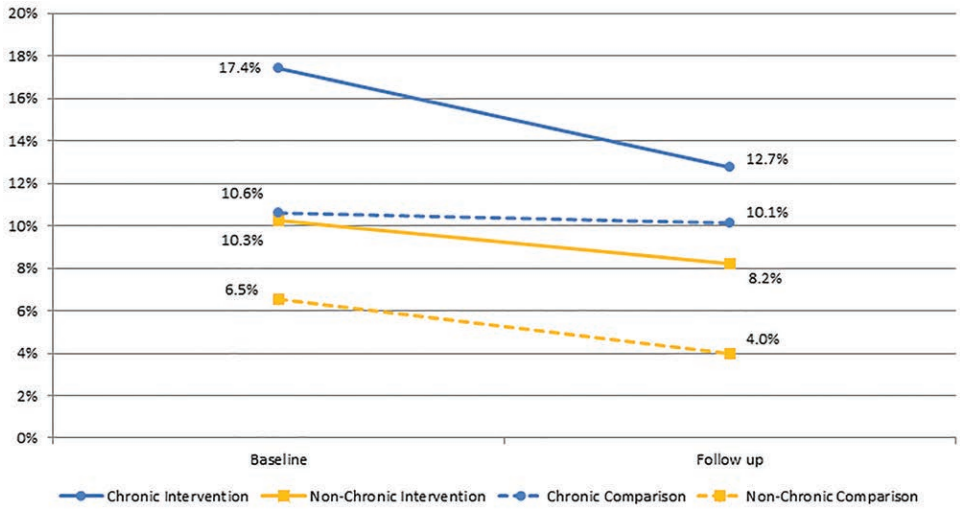

Fig. 2. Percentage of children in longitudinal sample with an unnecessary ED visit, by children's chronic condition status (n = 10,069).

that practice exhibits medical home characteristics. An evaluation of an intervention that assigned low-income uninsured individuals to PCMH sites looked specifically at the issue of continuity within a specific medical home and found an association between changes in medical home site assignment over time and increased likelihood of having ED visits.[18]

Our findings suggest potential benefits to children of interventions designed to develop PCMH characteristics at practice sites. Nonetheless, several important limitations of our research must be noted. First, our study cannot correlate measures of medical homeness with the outcome of interest, preventable ED visits. Although MHI scores for participating practices were collected over the course of the learning collaborative, and showed improvement, we could not obtain complete MHI data for the comparison group. Second, both the intervention and comparison groups of practices were nonrandomly selected; in particular, selection bias in the intervention group could be present (since these practices responded to a Request for Application issued on behalf of the state Medicaid agency). Third, the baseline characteristics of the intervention and comparison practice groups differed with respect to practice variables, member chronic condition status, and percentage of enrolled children having preventable ED visits (higher among intervention practices). Fourth, the fact that the observed percentage of children in both practice groups having preventable ED visits declined over the 3-year study period suggests the possibility that other systemic factors, unmeasurable in our models, may be contributing to the reduction of preventable ED utilization. Fifth, we are unable to examine the issue of cost reduction, due to the absence of claim-level cost data for MassHealth members enrolled in (capitated) MCOs. Sixth, the study population excluded children under 3 years of age at baseline; this was necessary to apply the chronic condition algorithm (PMCA), which includes a 3-year lookback period. Finally, we would expect some amount of measurement error in both the New York University algorithm for identifying potentially preventable ED visits and the PMCA algorithm for identifying children with chronic health conditions.

We cannot causally attribute the sharper decrease in preventable ED visits among intervention practice-enrolled children with chronic conditions to a measureable increase in practice-level PCMH characteristics among those practices. However, we believe the finding is of interest, as the present study has several advantages compared with others that look for associations between PCMH-based practice interventions and improvements in health care utilization. First, our work includes a much larger sample of practices and patients than previous pediatric PCMH research, improving its potential generalizability. Second, the study includes a comparison group of practices in which to observe trends in preventable ED use in the absence of the intervention. Third, this study evaluates, over an extended period, the association between an intervention to help practices function as medical homes and reduction of preventable ED visits; many existing studies instead attempt to measure medical homeness, then compare outcomes cross-sectionally. Finally, because of this larger population size, we can make policy-relevant comparisons between subgroups (children with and without chronic conditions, all children enrolled in either intake period versus only children continuously enrolled for the 3-year study period) while maintaining statistical power.

CONCLUSIONS

The findings of our study point to the potential value of practice-level interventions, such as the PCMH-based learning collaborative evaluated here, in reducing unnecessary utilization such as preventable ED visits. Our finding that children with chronic conditions who maintained

continuous, long-term enrollment with the intervention practices experienced the greatest drop in unnecessary ED visits suggests directions for additional research. Studies that can connect the specific content of PCMH interventions to measurable improvements in medical homeness and patient outcomes, and that can clarify the role of continuous enrollment in supporting improved outcomes, would help advance the case for the medical home model as a driver of health care quality improvement.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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