

The Pediatric Medical Home: What Do Evidence-Based Models Look Like?

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ABSTRACT

OBJECTIVES: To identify characteristics of effective, evidence-based pediatric medical home models using a primary care patient segmentation approach.

STUDY DESIGN: A systematic literature review of literature using the Medline database focusing on improving pediatric primary care and original studies of the pediatric medical home model was conducted. The primary care patient segmentation approach to organizing original studies resulted in 5 patient population segments used to further categorize and present findings.

METHODS: We searched the MEDLINE Ovid database with the keywords ["pediatric primary care"] and ["pediatric medical home"]. Inclusion criteria included data specific to pediatric primary care and data specific to the pediatric medical home. We excluded nonempirical data, non-peer-reviewed articles, medical case studies, articles not in the English language, and published abstracts.

RESULTS: We identified 94 studies that met all inclusion criteria. Of these studies, 6 were identified and described as evidence-based models that targeted 5 patient population segments. We found that studies that report statistically significant results are directed toward even more targeted sub-segments than the original primary care patient segmentation framework used for this study and so used specialized care teams targeted toward these segments.

CONCLUSIONS: The developed pediatric primary care patient segmentation framework developed in this study can be applied to improve implementation and operationalization of pediatric medical homes. This study demonstrates the importance of specialized sub-segments within pediatric population segments beyond the original primary care patient segmentation framework.

A pediatric medical home is comprised of a coordinated system of care encompassing a team of health and social providers who are focused on supporting the medical and nonmedical needs of the child and its family.¹ In light of the 2010 Affordable Care Act (ACA), medical homes have been implemented as a method to improve health outcomes, as well as reduce rising healthcare expenditures.²

The American Academy of Pediatrics (AAP) developed the medical home model with the aim of delivering better primary care to children and adolescents with special health needs in the late 1960s.³ It is purposed to facilitate an integrated healthcare system with an interdisciplinary team of patients and families, primary care physicians, specialists, subspecialists, hospitals and healthcare facilities, public health officials and the community.⁴ Interest in the patient-centered medical home (PCMH) model has grown exponentially across many spectrums of the healthcare system since 2010.⁴ It is important to note that the literature on PCMH has supplied primary care providers and policy makers with limited evidence and mixed results about the effectiveness of this patient care model, which calls for a systematic review of PCMH outcomes and effectiveness using a patient segmentation framework approach that can shed some light on the mixed messages in today's literature. In using a primary care patient segmentation framework approach for this study, we were able to identify evidence-based models of PCMH practice and refine the patient segmentation model for pediatric primary care.

The Primary Care Patient Segmentation Framework

As a way to better individualize and reduce discontinuity in health-care delivery, Porter and colleagues propose in their study that improving primary care should be approached through organizing subgroups of patients with similar needs as a way to better individualize and reduce discontinuity in healthcare delivery.⁵⁻⁸ They note that value is often improved by multidisciplinary teams of clinicians that act as integrated provider units and collaborate to meet the major needs of the patients.⁸

Moreover, Porter et al recommend that patients' outcomes and true costs should be measured by subgroups, and payment should be customized to bundle reimbursement for each subgroup to successively reward any improvement in care.^{8,9} By dividing the population into subgroups of patients with similar needs and conditions, progress can be made toward measuring outcomes and costs in regard to integrating primary care with specialty care.^{8,9} Additionally, collaboration and integration of care has the potential to improve and to increase by integrating primary care patient subgroup teams with relevant specialty care teams.⁸

In this current study, we propose that for pediatric practices, children can be segmented similarly into analogous groups. By grouping children according to similarities in chronic diseases, special needs, and health status, many pediatric practices have developed multiple "needs-based" delivery systems explicitly designed to measure and improve value for specific segments of pediatric patients and families.

METHODS

Literature Search

An exhaustive computer-assisted search was conducted in the Ovid interface to MEDLINE databases to identify relevant published articles. The search terms: ["pediatric primary care"] and ["pediatric medical home"] were used in the MEDLINE Ovid database. An additional search was also conducted in Google Scholar to identify any missing literature. Manual searches of references from relevant articles were performed to identify studies that were missed by the computer-assisted search. This study was approved by the Texas A&M University Institutional Review Board.

Study Selection

Two investigators (DT and BK) reviewed all publication titles of citations identified by the search strategy and confirmed the selected articles presented in this study. Study populations were then organized into the primary care patient segmentation framework by the second investigator (BK) and further reviewed and confirmed by both investigators (DT and BK). Potentially relevant studies were retrieved and articles were independently checked for inclusion. Inclusion criteria included data specific to pediatric primary care and data specific to the pediatric medical home. We excluded nonempirical data, non-peer-reviewed articles, medical case studies, articles not in the English language, and published abstracts.

Data Extraction

One investigator (DT) independently extracted required information from eligible studies using a standardized form adapted from Porter et al.⁸ The second investigator (BK) reviewed and confirmed all data extracted. Data was also collected on study design, date of the study, outcomes and impact of the study, and information related to the respective pediatric patient segmentation. These population segmentation groups were separated into 5 ordinal health categories: 1) Healthy, 2) Healthy With A Complex Acute Illness, 3) At Risk, 4) Chronically Ill, and 5) Complex; modeled after Porter and colleagues' framework.^{8,9} Frequencies of emergent themes in relation to pediatric primary care were also recorded.

This patient segmentation model served as the framework of analysis; the primary care patient segmentation strategy is therefore applied to pediatric primary care. This conceptual model is presented in **Table 1**.¹⁰⁻¹⁴

RESULTS

The computer-assisted search yielded 200 potentially relevant citations. After the initial review, 174 titles were considered appropriate, and these abstracts were reviewed. Of these articles, 31 did not meet inclusion criteria, and, subsequently, 143 articles underwent full-text review. Of these articles, 49 were excluded, as they did not have relevant information or evidence-based data specific to pediatric primary care or the pediatric primary care home. This left a total of 94 studies that met all inclusion criteria.

Of the remaining 94 studies, 6 were chosen and those evidence-based models were categorized into the framework of the aforementioned 5 population segments (Healthy, Healthy With a Complex Acute Illness, At Risk, Chronically Ill, and Complex). We found that a more sub-segmented approach was needed to serve pediatric populations with special needs because the primary care patient segmentation framework was too general for these populations. Sub-segments for various socioeconomic statuses, geography, and payer mix should also be considered when developing evidence-based programs of pediatric primary care. A summary table of the evidence-based pediatric primary home results is presented (**Table 2⁹⁻¹⁴**), and includes selected studies that also provided guidance and information on how to operationalize the evidence-based model of care.

Applying this primary care patient segmentation framework to the results of the systematic literature review, we find that studies that report statistically significant results are directed toward very targeted sub-segments. A detailed analysis of these evidence-based pediatric primary care models and correlated segment populations and subsequent sub-segments are presented next.

1. Limited English Proficiency

The medical home model has the potential to foster high-quality care and reduce disparities in treatment, especially among vulnera-

Table 1. Application of the Primary Care Patient Segmentation

SEGMENT	DEFINITION	EXAMPLE	KEY PRIORITIES	KEY PRIMARY CARE SERVICES NEEDED	KEY POTENTIAL TEAM MEMBERS	EVIDENCE-BASED ARTICLE FROM LITERATURE
Healthy	Children in good or excellent health with no ongoing physical, emotional, or social healthcare needs	A 6-year-old healthy boy with no known medical problems, but hurts himself playing soccer on the weekend	Maintenance of health	Age- and gender-appropriate preventive and screening care, as well as urgent care for minor medical issues, such as an ear infection	Primary care physician, pediatrician, practice-based nurse, medical assistant, medical technicians (for convenient laboratory tests)	The voices of limited English proficiency Latina mothers on pediatric primary care: lessons for the medical home ⁹ Patient safety in the pediatric emergency care setting ¹⁰
Healthy With a Complex Acute Illness	Children in good overall health with a complex acute illness	A 4-year-old girl with onset of coughing, wheezing, shortness of breath, and chest tightness	Early detection of potentially life-threatening issues, accurate diagnosis	Rapid access and evaluation that allows triage of issues, coordination with specialty integrated practice units	Primary care physician, pediatrician, specialty physician, practice-based nurse, care coordinator, social worker	Building healthy children: evidence-based home visitation integrated with pediatric medical homes ¹¹
At Risk	Children who are currently in good health but at elevated risk for developing acute or chronic disease and require a higher-level of service	A 13-year-old overweight boy with history of poor diet and lack of exercise but no major medical problems	Primary prevention of disease and maintenance of health, as well as modification of high-risk status	Interventions to avoid increase in risk and ready identification of development of acute or chronic disease	Primary care physician, pediatrician, practice-based nurse, patient education specialist, mental health clinician	Integrating behavioral health into primary care ¹²
Chronically Ill	Children with 1 or more chronic conditions with ongoing impact of functional status or that pose risk for long-term complications	A 7-year-old obese boy with hypertension, hyperlipidemia, and noninsulin-dependent diabetes	Disease management, prevention of secondary complications of chronic disease and maintenance of other aspects of health	Management of chronic disease and coordination of care with specialty providers	Primary care physician, pediatrician, practice-based nurse or nurse practitioner, pharmacist, patient education specialist, mental health clinician	Clinical quality improvement for identification and management of overweight in pediatric primary care practices ¹³
Complex	Children with multiple chronic diseases with complications or otherwise disabling conditions that require care from multiple specialty services and frequently lead to hospitalization or emergency department use	A 14-year-old boy with a congenital heart defect, diabetes, chronic kidney disease, and depression who has been hospitalized twice in the last year	Preventing and/or managing secondary complications of disease, avoiding emergency department services, inpatient admissions, and other escalations in level of healthcare services	Frequent interaction with primary care team including, but not limited to, intensive disease management support and prompt intervention for disease flare-ups to help avoid need for escalation of services	Primary care physician, pediatrician, specialty physician, case manager, education specialist, mental health clinician, social worker	Responding to the developmental consequences of genetic conditions: the importance of pediatric primary care ¹⁴

Table adapted from Porter ME, Pabo EA, Lee TH. Redesigning primary care: a strategic vision to improve value by organizing around patients' needs. *Health Aff (Millwood)*. 2013;32(3).

Table 2. Evidence-Based Pediatric Medical Home Framework

#	POPULATION SEGMENT	POPULATION SUB-SEGMENT	STUDY	AUTHOR, YEAR
1	Healthy	Limited English-speaking	The voices of limited English proficiency Latina mothers on pediatric primary care: lessons for the medical home ⁹	DeCamp LR et al (2013)
2	Healthy	Pediatric emergency	Patient safety in the pediatric emergency care setting ¹⁰	Frush K et al (2007)
3	Healthy With a Complex Acute Illness	Young, low-income mothers	Building healthy children: evidence-based home visitation integrated with pediatric medical homes ¹¹	Paradis HA et al (2013)
4	At Risk	Mental health	Integrating behavioral health into primary care ¹²	Laderman M et al (2014)
5	Chronically Ill	Management of overweight and obese children	Clinical quality improvement for identification and management of overweight in pediatric primary care practices ¹³	Brandt KL et al (2013)
6	Complex	Developmental genetic conditions	Responding to the developmental consequences of genetic conditions: the importance of pediatric primary care ¹⁴	Cooley WC (1999)

Table 3. Operationalizing the Pediatric Primary Home: Summary Table of High Functioning, Quality Primary Care Study

KEY PRIORITIES	KEY SERVICES NEEDED	KEY POTENTIAL MEMBERS
Work-life satisfaction for physicians	Reducing work through pre-visit planning and pre-appointment laboratory tests	Parents or caregivers
Low level of physician burnout	Transformation of roles of medical assistants, registered nurses, and health coaches	Pediatric primary care providers
Organization of practice environment (relief from paperwork and administrative hassles)	Telemedicine to alleviate projected primary physician shortages	Medical assistants
Opportunity to form meaningful relationships with patients	Reengineering prescription renewal work out of the practice	Registered nurses
Ability to provide high-functioning, quality care to patients		Pharmacists
Improving team communication and function		Health coaches
		Office staff

ble populations.^{9,15} In an effective medical home, a family’s cultural background—including beliefs, rituals, and customs—are recognized, valued, respected, and incorporated into the care plan. Pediatric primary care physicians should make an effort to improve their knowledge, skills, and attitudes in working and communicating with diverse children and families.^{9,16}

A qualitative study by DeCamp and colleagues assessed the views and experiences of Latina mothers with regard to expectations for pediatric primary care to inform medical home implementation in practices serving large limited English proficiency (LEP) populations.⁹ DeCamp and colleagues found that children with mothers with limited English proficiency were not receiving high-quality pediatric care.⁹ These mothers suggested methods to improve this, which included a composition of certain members of the patient care team.⁹ This team composition is analyzed in further detail below:

Pediatric primary care providers. The quality of the parent-provider relationship was central to the mothers’ satisfaction with care.⁹ Latina mothers described an excellent provider as someone who had a warm, friendly manner, and could relate to and engage

the child.⁹ Mothers also expressed that they valued providers who engaged them by asking how they were doing and taking time to provide a thorough examination, as well as evoke and answer all parent questions.⁹

Nursing and office staff. Mothers expressed that they anticipate nursing and clinic staff to be friendly and caring. Many mothers expected and appreciated nursing and office staff that could calm and comfort the child during blood draws or immunizations.⁹

Language services. Language services were often limited for specialty and emergency care, causing both misinformation and difficulty.⁹ Clinics without a Spanish-speaking provider usually had clinic nurses who provided interpretation to the mothers; however, the nurses were not constantly present in the exam room, resulting in impeded communication.⁹

Health system navigator. There was observed frustration in obtaining and maintaining public health insurance coverage for their children.⁹ Central barriers included lack of forms in Spanish and limited availability of interpreters at social services offices.⁹ Families who experienced much difficulty obtaining and maintaining public

health insurance delayed care when their child lacked coverage.⁹ Further, families encountered challenges regarding finding providers that accepted their child's Medicaid managed care plan.⁹

2. Pediatric Emergency Care

The pediatric emergency care study applies to the Healthy population segment, which outlines pediatric emergency care. A significant number of pediatric emergencies are seen in pediatric primary care practices¹⁰ and numerous studies have found that children are continuously taken to primary care offices by their parents or caregivers at the time of an emergency.^{10,17-20} The most common types of emergencies include seizures, infections in young infants, and dehydration.¹⁰ Upon these urgent situations, pediatricians and primary care providers may be required to provide emergent care in their offices for children with these conditions as they await the arrival of emergency medical services personnel.¹⁰ This suggests an opportunity to prepare pediatric primary care providers for these emergent situations in a pediatric medical home setting.

It is recommended that an office-based self-assessment should be done to analyze what types of patients and emergencies have already been experienced, or may be seen in the future.¹⁰ Reviewing answers from a standardized office-based self-assessment can help inform primary care practices in making knowledgeable decisions, identifying gaps, and optimizing office readiness.¹⁰ Appropriate equipment, such as airway equipment and medications to assist in pediatric medical emergencies, should be available at any moment to maximize office readiness.¹⁰ Furthermore, documentation regarding patient triage and office flow is the most effective tool for risk management in pediatric office emergencies, as it improves efficiency and promotes ongoing care, especially during transfer of care for the child.¹⁰

3. Building Healthy Children Collaborative

According to the AAP, evidence-based home visitation programs play a vital role in reducing child health disparities and developmental outcomes.²¹ Although there are numerous home visitation programs, many do not integrate with a child's medical home.¹¹ The Building Healthy Children (BHC) collaborative is a unique model that integrates home visitation into the medical care of infants born to young, low-income mothers.¹¹ Moreover, the BHC collaborative targets issues related to mental health, domestic violence, and relationship challenges that may increase the risk of child maltreatment.¹¹ The BHC model is combined with 3 primary care practices in Rochester, New York, and incorporates a partnership between social services and healthcare agencies, each providing evidence-based services to treatment families.¹¹ A randomized trial study by Paradis and colleagues compared families enrolled in BHC versus a comparison group; it found that the BHC collaborative model revealed high retention rates and explained multidimensional needs of young, at-risk families.¹¹ This study was classified under the Healthy population segment, shown in the **eAppendix** (available at www.ajmc.com).

Key potential members include parents or caregivers, pediatric primary care providers, outreach workers, and social workers.¹¹ Outreach workers and social workers play a vital role because they are assigned to various families based on ethnicity and culture to provide consistent support and to encourage a nurturing relationship that helps retain families in the program.¹¹ They meet with families at least bimonthly to assist with goals related to their individualized service plan and also provide immunization outreach, help ready parents for evidence-based treatments, and move families toward behavior change.¹¹

4. Mental Health Issues

Medical and behavioral comorbidities can be difficult for patients and families and fragmented care for these patients results in poor outcomes and higher healthcare costs.^{12,22,23} Integrating the management of behavioral health conditions into the primary care setting, such as the medical home, has the potential to improve quality of care, outcomes, and satisfaction for patients, while reducing healthcare costs.¹²

Focusing on key potential members, parents or caregivers, pediatric primary care providers, nurses and medical assistants, and education specialists and behavioral health specialists play vital roles in providing high-quality healthcare to the child.¹² Pediatric primary care providers help children and families who are resistant to seeking mental health care, and are able to recognize emergent situations that would require immediate intervention.¹² Nurses learn to conduct routine developmental screening, as well as complete assessments in conjunction with performing other tasks, such as weighing and measuring the child.¹² Behavioral health specialists also play an important role in cultivating primary care intervention teams that involve multidisciplinary providers within pediatric primary care clinics.¹²

5. Management of Overweight and Obesity

This population of Chronically Ill includes children with conditions such as hypertension, high cholesterol, and/or obesity.¹³ The pediatric medical home model can aid as a method and long-term strategy to reduce costs and improve care for overweight children. A study by Brandt and colleagues identified and managed overweight children by integrating life coaches and nutritionists into the care plan.¹³ This care plan, "Envision New Mexico's (Envision NM) Pediatric Overweight Quality Improvement Initiative (POWQII)" consisted of training care providers regarding pediatric obesity, clinical guidelines for management, and identification of set measures through a medical record review.¹³ The model also emphasized the importance of early screening and prevention in the pediatric primary care setting, opening telehealth clinics with a focus on instructive education, patient consultation for overweight medical management, coaching calls to go over improvement plans, and counseling with a nutritionist or dietician.¹³ Overall, POWQII providers rapidly improved body mass index percentile assessment, as well as rates for counseling for

physical activity and nutrition among high-risk patients.¹³

6. Developmental Consequences of Genetic Conditions

The last patient population segment is children with a “Complex” illness. These are children with multiple chronic diseases or complications that are disabling and require rigorous care. The key priorities include screening for developmental differences early in the child’s life if it has not already been diagnosed in the primary care setting, intervening early for children with established conditions causing developmental delays, supporting families of children with disabilities, and avoiding adverse events where the child may end up in the hospital.^{14,24} Tailoring care to this developmental disability population and providing collaborative, preventative, and family-centered healthcare can lead to optimum patient outcomes and patient and family satisfaction. Thus, this is a substantial sub-segment that should be given more attention in order to provide the best care possible.

Recommendations for Operationalizing Evidence-Based Pediatric Medical Home Models

Because this study is focused on providing actionable, practical results across all population segments, we have provided a breakdown of key priorities, services needed, and potential members, as well as recommendations regarding the improvement of office flow logistics based on recommendations from Sinkov and colleagues.^{25,26} This synthesis is provided in **Table 3** and is broken down similarly to Porter and colleagues’ framework.

Limitations

The primary limitation of the literature review is that not all the relevant terms related to improving pediatric primary care or the pediatric medical home are captured within the search strategy. To minimize this limitation, we improved the likelihood by identifying all articles meeting inclusion criteria by also reviewing the reference sections of all obtained articles and reaching out to 3 experts in the field. Another limitation is that findings regarding the evidence-based pediatric medical home models identified may not be generalizable to other geographic settings and smaller sub-segments of patients.

CONCLUSIONS

The primary care patient segmentation framework adopted from Porter and colleagues can be applied to the pediatric medical home model successfully, but needs to be further expanded and refined, as can be seen from the results of this study. For example, the Healthy patient segment is too broad of a patient target segment to observe improved clinical outcomes and reductions in cost of care. We found that primary care patient segments—such as Healthy, At Risk, and Chronically Ill—need to be further broken up into more specific sub-segments of patients to see significant improvements in

outcomes and cost of care.

Furthermore, it is important to go beyond the framework recommended by Porter and colleagues to provide more individualized and unique care for each patient. This can be done by considering the need for specialized sub-segments that take socioeconomic factors and those groups of patients that demonstrate high costs of care and high level of unmet needs within pediatric population segments.⁸ One segment to further explore in future studies would be vulnerable sub-populations within the Medicaid, and lower socioeconomic status segments residing in isolated geographic areas. For example, a recent study found that individuals with only Medicaid or CHIP were more likely to receive care from PCMH practices.²⁷ Cunningham suggests that in order to successfully implement PCMHs, new Medicaid beneficiaries should be connected to primary care providers to encourage usual sources of care.²⁷ The PCMH is especially recommended for individuals who are high-cost and high-need versus those who have very few healthcare needs.²⁷ The findings of our study also align well with a recent study performed by Hoff, as our results suggest that there is also “no standardized, one-size-fits-all approach to medical home implementation,” particularly for specialized patient populations.² Hoff also emphasizes expanding implementation to include substantial “social and relational components of care” beyond structural support for medical home work.²

There is still much to be done to improve the consistency and sustainability of the pediatric medical home. Pediatric medical home implementation remains complex and there is ongoing need for evidence-based, data-driven, practice-based studies for the pediatric medical home concept to become truly evidence-based and generalizable across neighborhoods, regions, and states.

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Source of Funding: National Science Foundation.

Author Disclosures: Drs Tomaszewski, Tan, and Kash, and Ms Tittle received funding for this project from the National Science Foundation and industry membership fees. The authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (BK, KT, LI); acquisition of data (BK, DT, KT, LI); analysis and interpretation of data (BK, DT); drafting of the manuscript (BK, DT); critical revision of the manuscript for important intellectual content (BK, DT); provision of study materials or patients (BK); obtaining funding (BK, LI); administrative, technical, or logistic support (KT); and supervision (BK).

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