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Healthy Home Environment, Low-Income Children, and Patient-Centered Medical Home

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Healthy Home Environment, Low-Income Children, and Patient-Centered Medical Home

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Abstract

Healthy Home Environment, Low-Income Children, and Patient-Centered Medical Home

By Xin Hu

The Patient-Centered Medical Home (PCMH) is an innovative primary care delivery system that sets high standards for quality of healthcare practices. Despite the nation-wide movement to implement PCMH, we are still seeing large variation in the quality of health service provision for children. Many studies have showed that demographic characteristics and availability of providers significantly influence the healthcare quality received. However, few studies have focused on the home environment, which may act as a proxy for child-rearing behaviors that may be important in predicting the medical care children receive. Therefore, this study examines whether home environment predicts the likelihood of receiving high quality healthcare, as measured by the PCMH criteria. We used the 2011-2012 National Survey of Children's Health (n = 20,801) to examine the association between home environment and quality healthcare and how it changes in settings with sufficient supply of PCMH providers. We used ordered logistic regression for both analyses. Children living in the healthiest home environments were 20% more likely to receive high quality of healthcare ($p=0.014$) compared to those in poor home environments, and in states with higher PCMH presence, children in healthy homes had 68% better chance to enter higher quality level than the those in poor quality homes ($p=0.008$). This suggests that caregivers who create a healthier home environment are more likely to choose higher quality of healthcare providers, especially when there are sufficient healthcare resources in the region. Our results also suggest that previous studies that demonstrated a significant positive impact of PCMH on healthcare outcomes may be subject to selection bias and may, therefore, overestimate the influence of PCMH practices to improve care. Future studies should control for home environment in order to accurately identify the net effects of PCMH.

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List of Abbreviations

AAAHC	Accreditation Association for Ambulatory Health Care
AHRQ	Agency for Healthcare Research and Quality
CPC	Comprehensive Primary Care
FPL	Federal Poverty Level
FQHC	Federally Qualified Health Center
MEPS	Medical Expenditure Panel Survey
NCQA	National Committee for Quality Assurance
NSCH	National Survey of Children's Health
NS-CSHCN	National Survey of Children with Special Health Care Needs
PCMH	Patient-Centered Medical Home
URAC	Utilization Review Accreditation Commission

INTRODUCTION

The Patient-Centered Medical Home (PCMH) is an innovative primary care delivery system that aims to improve the quality, safety, efficiency and effectiveness of health care services. Many state governments have adopted initiatives to implement PCMH or equivalent models of care, and with several years of practices, this model has shown its ability to improve the quality of care and health outcomes. However, there is still huge variation in children's health care quality despite the increasing availability of PCMH providers around the nation, and little research has been conducted to examine what other factors, in addition to the supply of PCMH, affect the chance of actually receiving PCMH qualified health care services, especially demand side factors that are controlled by children and parents themselves.

In particular, we believe that home environment may more meaningfully influence child health, both directly and indirectly. Direct influences, such as tobacco exposure, nutritional support, and parental support have been shown to have a significant effect on child health outcomes. Simultaneously, parents creating a healthy home environment are likely to have the knowledge and resources to seek out higher-quality health care services for their children.

Therefore this study will examine the association between home environment and children's use of PCMH qualified health care services. And we target the low-income children in this study, because the PCMH program was first implemented within this population. If we can demonstrate the positive association between home environment and PCMH enrollment, it will add to the evidence base as a possible solution to improve children's health care quality and finally their health.

Background

The Patient-Centered Medical Home (PCMH) was officially put forward by the American Academy of Family Physicians, the American College of Physicians, the American Academy of Pediatrics, and the American Osteopathic Association in 2007[1]. It was initially designed for children with special health care needs, and with consecutive success of practices, many organizations have been extending this concept to other populations. It is now recognized as an effective primary care system that emphasizes care coordination and communication, and improves patients' experience of care. Under a latest definition released by the Agency for Healthcare Research and Quality, PCMH encompasses five attributes: comprehensive care, patient-centered care, coordinated care, accessible care, and quality and safety.

To facilitate and regulate the expansion of PCMH models, national and state level organizations started providing financial incentives for health care providers to form PCMH, and they created a system whereby to formally identify these practices. For example, the Centers for Medicare and Medicaid Services offers bonus payment through their Comprehensive Primary Care (CPC) Initiative and Federally Qualified Health Center (FQHC) Advanced Primary Care Practice Demonstration. The Accreditation Association for Ambulatory Health Care (AAAHC), National Committee for Quality Assurance (NCQA), and Utilization Review Accreditation Commission (URAC) also established standardized evaluation tools and a process to recognize health care providers that satisfy PCMH criteria. There are also other stakeholders providing assessment tools that allow the providers to examine their PCMH practices.

More recently, measuring consumer report of health quality received in PCMH has received increased attention. Several national surveys have integrated PCMH standards to measure the quality of children's health care, and studies using these new quality standards in the data presented huge variation in caregiver-report healthcare quality among children with different demographic characteristics, diseases and health conditions. However, the variation was not consistently associated with the level of PCMH implementation in each state. In other words, even if there were a sufficient supply of PCMH providers, children did not necessarily report higher quality health care services. But some states, on the other hand, did not show substantially lower health care quality even with no or little PCMH implementation. Therefore, there may be other factors, in addition to the supply of PCMH and individual characteristics, which affect PCMH ratings from the caregivers. What is essentially important to achieving the desired outcomes not only in PCMH model, but also in other health care delivery systems, is figuring out what affect their ratings of children's health care quality and their selection of physicians offering high quality practices, especially in states which have had a long history of PCMH but without a consistent report of perceived health care quality.

The home environment is a place that children grow up with, and parents' lifestyle and health-related behavior plays a great role in its formation. This measure reflects caregivers' child-rearing practices. Evidence has shown that it could impact children's health directly and indirectly: healthier home environment with fewer physical triggers (i.e. second-hand smoke), better nutritional support (i.e. sharing family meals), and more mental support (i.e. efficient communication) can directly improve children's health; it also has indirect impacts because caregivers having higher health awareness will also

understand why shared decision making, care coordination, and timely referrals that featured in a high quality of health care services will better benefit the health of their children. Therefore , it is reasonable to think that a healthy home environment, as a reflection of parents' health cognition, can impact children's having PCMH qualified health care services, which then leads to better health outcomes.

Literature Review

A few interventional programs have studied the impact of PCMH enrollment on children. These studies were mostly in a hospital settings where children receiving care in PCMH had better health outcomes than those in the controls, such as reduced readmission rates and emergency department visits [2, 3]. Some studies demonstrated more specific health outcomes such as reduced weight for obese children[4]. In addition to better health outcomes, caregivers who reported meeting PCMH criteria generally had higher satisfaction and fewer unmet healthcare needs for their children [5]; they also tended to save more on their health care spending [2].

Other cross-sectional studies mostly used consumer/caregiver surveys that had comprehensive questions about whether children's health care services met PCMH criteria. Common data sources included the National Survey of Children with Special Health Care Needs (NS-CSHCN) and National Survey of Children's Health (NSCH) [6], Medical Expenditure Panel Survey [7] and Consumer Assessment of Healthcare Providers and Systems [8]. Some studies demonstrated the association between high quality of children's health care services and their better health outcomes, such as fewer unmet health care needs[9-13], better health care utilization patterns featuring increased

primary care visits and reduced outpatient and emergency department visits[14-20]. Some researchers found that PCMH qualified healthcare services were associated with higher total health care spending [17, 21, 22]. However, they argued that the increased total spending could result from increased primary care costs and decreased outpatient and ED costs. Other outcomes related to children included increased utilization of preventive care [23], fewer missed school days [24, 25], and higher vaccine receipt rate [26]. In addition to outcomes targeting children, there was evidence of better family outcomes: parents had more positive perceptions of care[27], a better chance to maintain employment status and ability to manage financial impacts[28, 29], and they had better family functioning[30], if children received health care in a PCMH.

Previous research using cross-sectional data also demonstrated that there were disparities of meeting PCMH criteria among children with different characteristics, especially for vulnerable populations [31-33]. Blacks and Hispanic children[9, 34], children living in low-income and non-English speaking families[35], and children with mental health problems[25, 36-38], behavioral health problems [36] and other health conditions[14, 39], as well as children with public insurance [40] were less likely to meet PCMH criteria. However, variation continued to exist even within these specific groups. For example, one study targeting children with behavioral health conditions showed that after taking individual and environmental characteristics into account, all of the factors together explained only a small part of the variation in meeting PCMH criteria [36].

These cross-sectional studies have been using “having a PCMH,” “receiving care in a PCMH,” or “presence of PCMH” reported by the caregivers as a substitute for supply side ratings. Unfortunately, the questions labeled as PCMH in these consumer surveys

did not actually measure children's enrollment in PCMH or whether their healthcare providers were PCMH certified. And given the inconsistency between states PCMH implementation level and caregivers' report, we can see a discordance between demand and supply-side ratings, suggesting other unknown factors may have affected children's health care quality even with sufficient supply.

On the other side, healthy home environment has been studied as an important factor directly impacting children's health for many years. As "Home Environment" was defined differently in previous literature, studies found different aspects of home environment contributed to different health outcomes for the child: positive nutritional element in home environment was beneficial to preventing and managing childhood obesity through promoting and monitoring children's healthy diet and regular physical activities [41, 42]; physical elements such as limiting smoking at home were shown positively associated with better asthma management for the child [43, 44]; and a positive emotional element in home environment was found to be a protective factor for children's mental health[45]. Some researchers argued that home environment was partially explained by other factors such as socioeconomic status (SES) [46]. However, even after controlling for all possible confounders, home environment remained as an independent predictor for children's health-related behavior and health outcomes [47, 48].

However, given the possible indirect effects of home environment on children's health, no studies have examined its association with use of PCMH, which would be an intermediate outcome before children finally achieve a better health outcomes. If this association is true, it has important implications for potential selection bias in previous

studies that concluded PCMH was associated with children's health outcomes. Because the actual effect of improved children's health was not entirely caused by PCMH, but might partially be caused by a healthy home environment because it increased parents' probability to pursue higher quality of healthcare, such as a PCMH.

In summary, we found two main problems in previous research: first, the association between PCMH and children's health outcomes in cross-sectional studies was inconclusive, because the surveys are in fact measuring the quality of children's healthcare services, where they used PCMH criteria as the standards of high quality. Second, the indirect impact of home environment on children's health through pursuing better healthcare services suggests potential selection bias in previous studies. Therefore, this study aims to explore whether a healthier home environment is associated with greater probability of meeting PCMH criteria.

METHODOLOGY

Conceptual framework

We used the Anderson Behavioral Model [49-51] as a theoretical framework (Figure 1) to predict children's use of high quality physician care, where quality is defined as meeting PCMH criteria based on caregiver report. As caregivers chose the physician practices from which children received care, we predicted their selection using the model, which contains three categories of predictors of health care use: predisposing, enabling and need characteristics. Predisposing variables were: home environment, children's race/ethnicity, whether the family attends religious services, and the number of children in the household. Our primary focus was on home environment, specifically healthy child-rearing behaviors. Enabling characteristics were either facilitators or barriers to the use of care, and in this study were: mother's age, caregivers' education, caregivers' physical and mental health status, primary language in household, family structure, poverty level, home ownership, the frequency of moving house in the previous 12 months (as a negative enabling factor), and caregivers' perception of neighborhood environment (whether or not there is rundown housing and whether or not they feel safe). Need conditions were children's age, gender, health status and special healthcare needs. These factors dynamically interact together to predict caregivers' choice of physician practices for their children.

Hypotheses

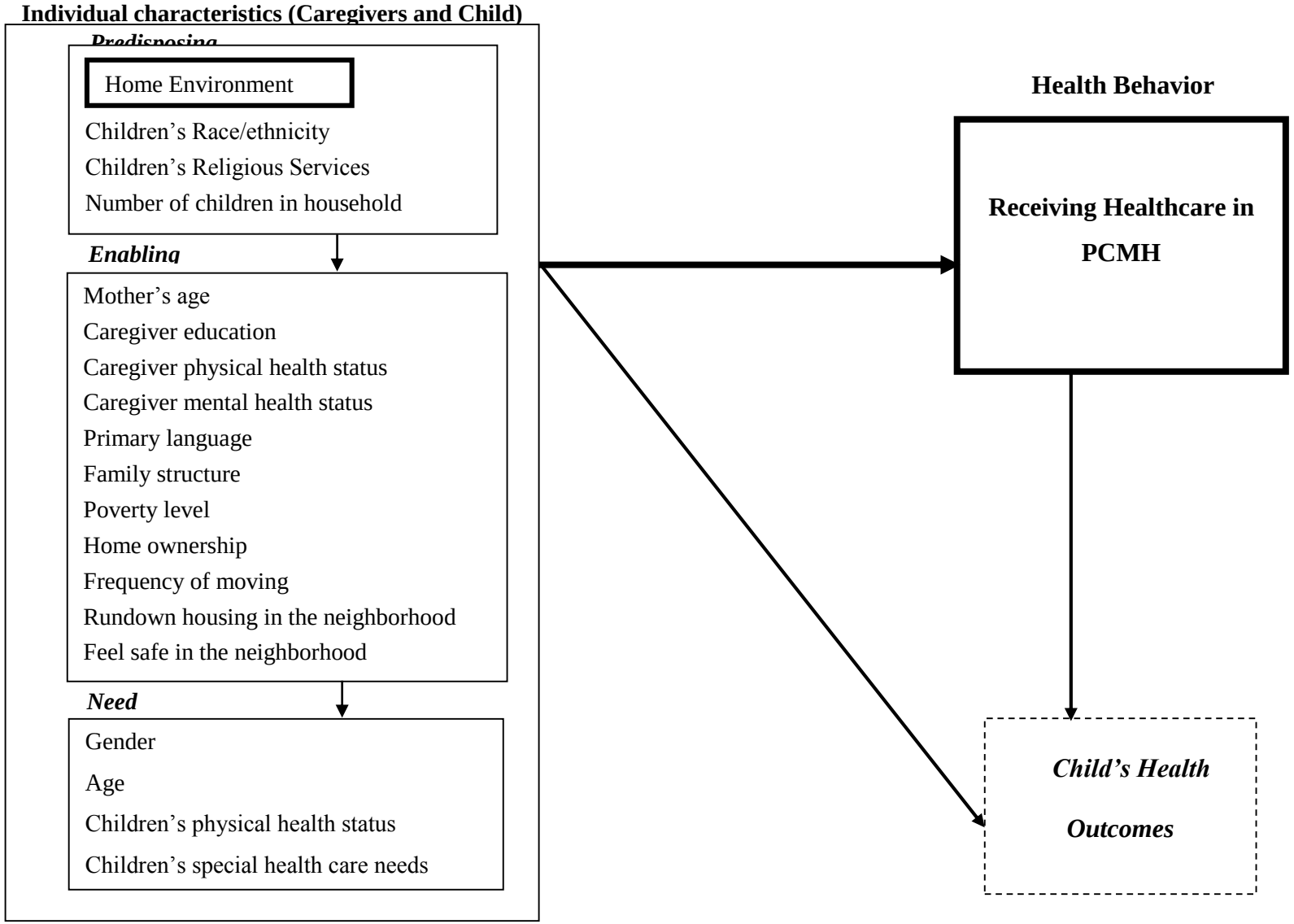
This study examined the association between a healthy home environment and the quality of physician practices children use, as reported by caregivers based on PCHM criteria, in low-income families. We hypothesized that a healthy home environment predicts use of higher quality physician practices. Caregivers that establish healthy home environments would also have the awareness to pursue better quality healthcare services for their children.

H_1: Home environment is positively associated with children's use of high quality physician practices

H1a: Within states that have the fewest access restrictions to PCMH, the association between home environment and children's quality of healthcare services will be positive and stronger compared to states with less developed programs

H_0: There is no association between home environment and caregiver choice of quality of physician practice

Figure 1. Conceptual framework



Sample

Our data came from the 2011-2012 National Survey of Children's Health (NSCH), a nationally representative telephone survey covering multiple aspects of children's lives, such as physical and mental health, access to quality health care, and the child's family and neighborhood [52]. The study was conducted by the National Center of Health Statistics at the Centers for Disease Control, and sponsored by the federal Maternal and Child Health Bureau. The survey results were weighted to represent the population of non-institutionalized children ages 0-17 nationally and in each state, allowing for comparisons across states as well as comparisons to the nation.

The 2011-2012 NSCH was the third time the survey was conducted with 95,677 children randomly selected using telephone numbers. Among the twelve sections of the survey, one contains a comprehensive set of questions especially designed to measure PCMH qualities of children's health care services based on caregivers' perception. We included only children: (1) with public insurance – as a proxy for low-income family – where eligibility is set under 400% Federal Poverty Level; and (2) who used medical services at least once in the previous year. We also excluded those with missing values for key variables (including home environment, PCMH, and other covariates), resulting in a final analytic sample of 20,801 observations. In a subset analysis, we selected only states that had advanced implementation of PCMH by 2011. There were 2,693 eligible children in the seven selected states. Figure 2 shows the detailed sample selection process.

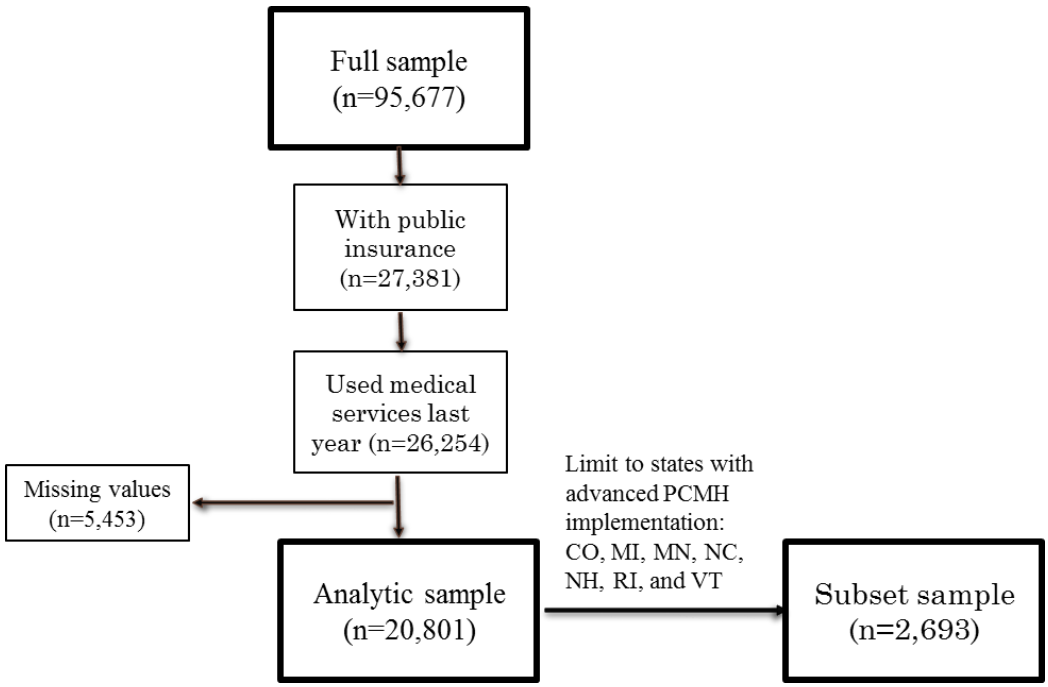


Figure 2. Sample selection flow

Measures

Dependent Variable – Quality of physician practices (assessed by PCMH criteria)

According to the Agency for Healthcare Research and Quality's (AHRQ) definition [53], essential qualities of a PCMH include being accessible, family-centered, continuous, comprehensive, coordinated, compassionate, and culturally effective. The NSCH provides a comprehensive measure of children's PCMH use based on AHRQ's definition. Compared to other survey tools, which rely on physician's declaration on PCMH standards, this survey enables us to evaluate children's PCMH use based on caregiver's interpretation. Therefore, the "PCMH" indicator in our study does not indicate whether the children are enrolled in a formally identified PCMH program, but rather caregivers' report of physician practice criteria. For a more accurate expression and for the convenience of discussion, we will refer to "high quality of healthcare" in lieu of meeting PCMH criteria in the following sections, based on the rationale provided above.

Based on the five criteria defined by AHRQ, there were five component variables of PCMH in NSCH constructed from a total of 19 survey items. These component indicators were: personal doctor or nurse, usual source for sick and well care, family-centered care, no problems obtaining needed referrals, and effective care coordination when needed. Previous studies have utilized PCMH as a dichotomous indicator for healthcare quality or analyzed each of the five components to refer to specific aspects of quality, both of which demonstrated considerable reliability and validity [54]. In this study, we reconstructed the PCMH item set as a three-level indicator for healthcare quality, based on five components in the survey, to distinguish important differences. To

approximate the highest level (level 2), answers should meet at least the first three PCMH criteria: personal doctor or nurse, usual source for care, and family-centered care; and among children who satisfied the three, those needing referrals or care coordination must have also received them in order to be considered as level 2. In other words, for those who did not need referrals or care coordination, meeting the first three criteria was sufficient to be classified as the highest level. A medium level (level 1) refers to those who had a personal doctor/nurse and usual source of care, but did not receive family-centered care, have problems getting referrals or have poor care coordination when needed. Finally, children without either a personal doctor/nurse or usual source of care, or both, were level 0. Although conceptually, level 0 should refer to meeting no criteria at all, we included meeting only one of two criteria in this level because too few children met no criteria, and meeting only one criteria but not the other differed little from meeting no criteria. Compared to the original dichotomous PCMH indicator, which took into account only the highest level and the lowest level as receiving care in PCMH and not receiving care in PCMH, this three-level indicator better differentiated the impact of home environment on the different levels of healthcare services the children received. Growing evidence shows that having a personal doctor and usual source of care is far from sufficient to secure a high quality of healthcare services. The core components are, in fact, family-centeredness and care coordination. Figure 2 shows the detailed measurement of PCMH.

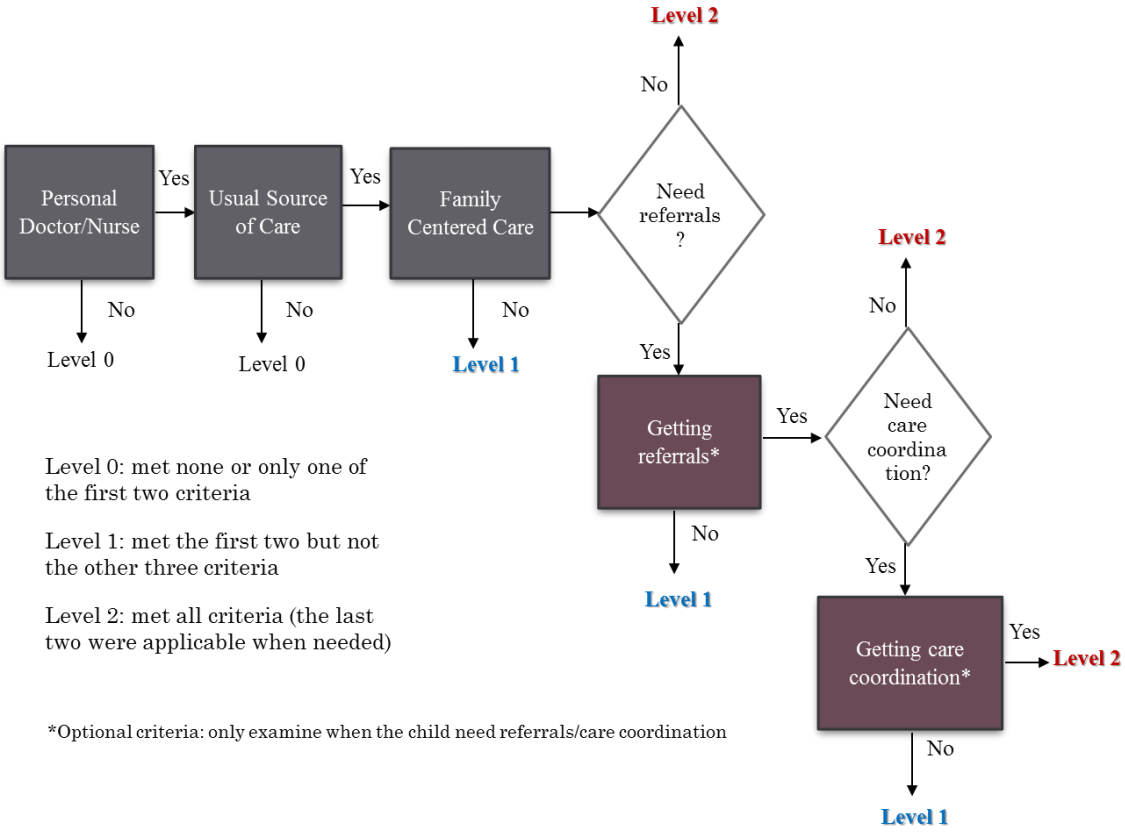


Figure 3. Measurement of Patient-Centered Medical Home

Home Environment Criteria	Age Group	
	0-5 year	6-17 year
No exposure to household smoking	✓	✓
Family shares meals on 4 or more days per week	✓	✓
Children watch less than 2 hours TV per day	✓	✓
Children are read/sung to everyday	✓	
Children were breastfed ever	✓	
Children always do required homework		✓
Parents met most of child's friends		✓

Count of satisfied indicators

Level 0 (0-2 criteria)
Level 1 (3 criteria)
Level 2 (4-5 criteria)

Figure 4. Measurement of home environment

Independent Variable – Healthy home environment

Home environment was the key individual predisposing characteristic and the independent variable of this study. The summary measure for home environment contained eight age-specific survey questions; originally there were five questions for "0-5 year" group and six for "6-17 year" group. Again, we reviewed and modified the measure to include five questions for each of the two age groups for scale comparability. Three questions were shared among both age groups, including exposure to household smoking, frequency of family sharing meals per week, and children's time watching TV per day. The other two questions only applied to one age group: ever being breastfed and being read/sung to everyday for 0-5 year-old children, and finishing required homework and parents meeting most/all of child's friends for those aged 6 to 17. The question asking whether children 6-17 years old had a TV in their bedroom was eliminated, because our analysis showed that it was highly correlated with the children's time watching TV component. We summed the total number of criteria met and assigned one of the three levels accordingly: those meeting 0-1 criteria were classified as level 0; those meeting 2-3 criteria as level 1; and meeting three or more criteria as level 2. Similar to the PCMH indicator, the purpose of constructing a three-level home environment was to examine the progressive impact of home environment on children's receiving care in PCMH. Detailed items and construction criteria of home environment for the two age groups are listed in Figure 2.

Covariates

For individual characteristics of children and their caregivers as described in the model, we selected the factors based on our conceptual framework. These factors included: demographics (children's gender, age, and race/ethnicity), respondents' education, primary language spoken in the household, children's special healthcare needs, children's physical health status, and respondents' physical health status, as well as their mental health status. Also measured in this study were family level features: housing conditions, which was measured as a dichotomous variable whether the family owned their home or not; household size, which asked the number of adults and the number of children living in the house; and family structure, which was categorized as "biological family," "step family," "single mother family," and "other family types." We also included a dichotomous indicator to further distinguish households under 100% of the Federal Poverty Level (FPL), because there is still a wide range of FPL within publicly insured children, and families in real "poverty" (<100% FPL) have minimal ability to pay for basic health care resources compared to those above 100% FPL. Finally, we took into account caregivers' perception of community environment, including the presence of rundown housing, and whether or not they felt safe in the neighborhood. Both of these two community indicators were dichotomous.

We maintained most of the original format of these variables and modified only variables that had very skewed distribution. For example, we combined the lowest two and highest two levels of the five initial levels of respondent' physical and mental health status (from "poor," "fair," "good," "very good" to "excellent") and re-categorized it into

three levels (from “less than average,” “average,” to “better than average”). A list of variables and more detailed information are provided in Table 1.

Table 1. Variable summary

Construct	Variable	Indicator used for variable		Variable Type	Variable Label
Independent Variable (Individual predisposing)	Home Environment	***0-5 year old***	***6-17 year old***	Ordinal	0 = "Met no/little criteria" 1 = "Met some criteria" 2 = "Met all criteria"
		1.ind6_4a_11: Does anyone living inside smoke cigarettes in the home? (No exposure to household smoking)	1.ind6_4a_11: Does anyone living inside smoke cigarettes in the home? (No exposure to household smoking)		
		2.ind6_8_11: How many days did all the family members eat a meal together last week? (4 or more days per week)	2.ind6_8_11: How many days did all the family members eat a meal together last week? (4 or more days per week)		
		3.tv_0to5: Hours of TV or video watching per weekday (less than 2 hours per day)	3.tv_6to17: Hours of TV or video watching per weekday (less than 2 hours per day)		
		4.ind1_3_11: Was the child ever breastfed or fed breast milk? (yes)	4.K7Q34: Have you met all of/most of/some of/none of child's friends? (met most or all of child's friends)		
		5.ind6_7_11 & ind6_7a_11: How many days did you or other family members read/sing to the child last week? (everyday)	5.K7Q83: Does he/she do all required homework? (usually or always)		
Dependent Variable	Patient-Centered Medical Home	ind4_8_11: The level that children (age 0-17) receiving coordinated, ongoing, comprehensive care within a medical home [Component] 1.ind4_9_11: Personal Doctor or Nurse 2.ind4_9a_11: Usual Sources for Sick Care 3.ind4_9b_11: Family-centered care 4.ind4_9c_11: Getting Needed Referrals 5.ind4_9d_11: Effective Care Coordination		Ordinal	0 = "Met no/little criteria" 1 = "Met some criteria" 2 = "Met all criteria"

Construct	Variable	Indicator used for variable	Variable Type	Variable Label
Individual characteristics: Predisposing	Race/ethnicity	race4_11	Categorical	1 = "Hispanic" 2 = "White " 3 = "Black " 4 = "Multi-racial/Other "
	Children's religious services	K8Q12	Dichotomous	0 = "No" 1 = "Yes"
	Number of children in household	TOTKIDS4	Dichotomous	0 = "One child" 1 = "More than one child"
Individual characteristics: Enabling	Mother's age	K9Q16R	Ordinal	0 = "20 or younger" 1 = "20-30 years old" 2 = "30-40 years old" 3 = "40 or older"
	Respondent education	1.Relation: Interviewee's relationship with children 2.EDUC_MOMR: Mother's highest grade of school 3.EDUC_DADR: Father's highest grade of school 4.EDUC_RESR: Non-parent respondent's highest grade of school	Dichotomous	0 = "Less than high school" 1 = "High school or above"
	Respondent's Health Status	1.Relation: Interviewee's relationship with children 2.K9Q20: Mother's health status 3.K9Q21: Father's health status 5.K9Q22: Non-parent's health status	Ordinal	0 = "Less than average" 1 = "Average" 2 = "Better than average"
	Respondent's mental health status	1.Relation: Interviewee's relationship with children 2.K9Q23: Mother's mental health status 3.K9Q24: Father's mental health status 4.K9Q25: Non-parent's mental health status	Ordinal	0 = "Less than average" 1 = "Average" 2 = "Better than average"
	Primary language	planguage	Dichotomous	0 = "Non-English" 1 = "English"
	Family Structure	famstruct_11	Dichotomous	0 = "Other than two-parent" 1 = "Two-parent"

Construct	Variable	Indicator used for variable	Variable Type	Variable Label
Individual characteristics: Enabling	Times of moving house	K11Q43	Ordinal	0 = "None" 1 = "Some" 2 = "Frequent"
	Is there rundown housing in your neighborhood?	K10Q22	Dichotomous	0 = "No" 1 = "Yes"
	How often do you feel the child is safe in your neighborhood?	K10Q40	Dichotomous	0 = "Sometimes or less" 1 = "More than sometimes"
Individual characteristics: Need	Gender	sex_11	Dichotomous	0 = "Male" 1 = "Female"
	Age	AGEYR_CHILD	Ordinal	0 = "0-5 years old" 1 = "6-11 years old" 2 = "12-17 years old"
	Child's Health Status	K2Q01	Ordinal	0 = "Average or less" 1 = "Good" 2 = "Excellent"
	Special Healthcare Needs	1.CSHCN	Dichotomous	0 = "No" 1 = "Yes"

Statistical Analysis

In order to examine the effect of home environment on increasing levels of children's healthcare quality, we used an ordinal logistic regression model, controlling for individual characteristics and contextual characteristics (Formula 1). Odds ratios were generated in the results and alpha was set at 0.05 to determine statistical significance. The same strategies were adopted for secondary analysis with subset states that have advanced implementation of PCMH prior to the survey start year of 2011. To be included into the subset analysis, states had to launch their first PCMH projects two years before the survey took place, which we determined to be a reasonable amount to time for the PCMH programs to show any effects. Seven states were selected based on this criteria: Colorado, Michigan, Minnesota, North Carolina, New Hampshire, Rhode Island, and Vermont. The subset analysis allowed us to minimize the restrictions from the supply side and therefore ensure that children's PCMH use was not strictly driven by supply. Data were analyzed using Stata/SE 13.1. This study was approved by the Emory Institutional Review Board.

PCMH= f (HE, individual characteristics) **(Formula 1)**

RESULTS

Descriptive statistics

Among the 20,801 respondents, 16.2% of the physician practices they used met no PCMH criteria, 35.2% met some criteria, and 48.5% met all of the PCMH criteria. For ease of discussion, higher quality ratings refer to physicians who meet more PCMH criteria based on caregiver report. Table 2 shows the values of predictor variables, categorized as predisposing, enabling and need, by three levels of meeting PCMH criteria. Children in the healthiest home environments, such as those meeting all criteria, were most likely to receive the highest quality of care at 58.5%. No significant differences were evident by whether children attended religious services, number of children in the household, and gender across quality ratings. Children who were 0-5 years old, White, were in excellent health status, had a mother age 30-40 years old and moved less frequently were more likely to receive higher quality care. They were also more likely to have a caregiver with a high school education or above and better than average physical and mental health status, live in families that have two-parent structure, speak English as primary language, own their house, have household income above 100% FPL, and move less frequently during the previous 12 months. Caregivers that rated practices as higher quality were more likely to feel safe in the community and less likely to have rundown housing in their neighborhood. When comparing the individual characteristics of the full sample to those in subset states, we found similar patterns, except that the latter had a higher percentage of Whites, had higher educated parents, spoke English in the household, and had overall better health status (Table 3).

In Table 4, we show the break-down distribution of each home environment component across three levels of meeting PCMH criteria. A majority of caregivers reported no smoking at home and sharing family meals frequently with their children. Among children from 0-5 years old, most had been breast fed; and for children in the 6-17 year-old group, most were able to always finish their homework. The three components that drove the variation and showed an increasing trend across three health care quality levels were whether the caregiver limited children's time spent on TV to less than two hours per day (from 50.9% to 58.2%); for younger children, whether they were read or sung to every day (from 23.1% to 37.4%); and for older children, whether the caregiver met most of their friends (from 62.0% to 74.5%). We also found a similar pattern in the subset states (Table 5).

Regression statistics

Ordered logistic regression model results are shown in Table 6. For the whole sample analysis, compared to meeting no criteria, children in homes meeting all healthy home criteria were significantly more likely, at 22%, to receive care from high quality physician practices, after controlling for caregiver and likely access, than those in less healthy homes. Other predisposing factors also predicted use of higher quality of physician services. Race/ethnicity was a strong predictor: the likelihood for Black, Hispanic and other racial group children is 43%, 33% and 27% lower than White children, respectively. Children attending religious services were 18% more likely to receive care from higher quality physician practices than their non-religious peers. Many caregiver characteristics were significant enabling factor for children and receipt of

higher quality care. Children with younger mothers (20 years or younger) were 28% less likely to receive care from physician practices meeting PCMH criteria, compared to those with mothers in older age groups. Caregivers with post high school education were 21% more likely to pursue quality physician practices than those with high school or less education. Although caregivers' physical health status was not significant, their mental health status – specifically those who rated it as better than average – increased children's likelihood of better healthcare quality by 28%. Primary language was also a significant enabling factor, where English speaking families were twice as likely as non-English speaking to report receipt of higher quality physician care.

Our results show that instability in the household negatively impacts the ability to receive good quality of healthcare services for children. Compared to families not moving in the past 12 months, those who moved 1-3 times and those who moved 3+ decreased the chance of receiving care from a physician meeting PCMH criteria by 27% and 34%, respectively. We also found that even among children all considered low-income, those under 100% of the poverty level were still 24% less likely to receive high quality health care than other low-income children. Finally, children's age and health status were two significant need characteristics: primary school age (6-11 years) children and middle to high school age children (12-17 years) were 17% and 22% less likely to receive higher quality of healthcare services compared to 0-5 year old children. Having excellent physical health contributed to a 28% better chance for children to receive higher quality of care from their physician. Neighborhood characteristics were included as enabling factors, specifically as a proxy for access to higher quality physician practices. Reporting

the neighborhood as safe increased the likelihood of a child receiving care from physicians meeting PCMH criteria by 51%.

In the subset analysis, the association between home environment and children's health care quality became even more dramatic. Having the healthiest home environment increased children's chance of receiving high quality health care by 68%. Children's age, race/ethnicity, primary language and family poverty level remained as significant factors: 6-11 year-old children were 40% less likely to have health care meeting all PCMH criteria; Black children were 60% less likely than White children to receive care meeting all PCMH criteria; English-speaking families were 2.83 times more likely to report high quality of physician practices than non-English speaking families; and children in households under 100% FPL had 27% less chance to receive high quality health care services. Many other factors, however, lost significance when we secured the supply of PCMH, such as mother's age, times of moving home, and feeling safe in the community.

Table 2. Children and caregiver characteristics across PCMH levels

Construct	Variable	PCMH (N=20801)			P-value (Chi^2)
		Met no criteria	Met some criteria	Met all criteria	
	Sample size	3374	7329	10098	
	Sample percentage (%)	16.2	35.2	48.5	
Individual characteristics: Predisposing	Home environment (%)				
	Met no criteria (0-2 items)	18.1	19.3	14.4	
	Met some criteria (3 items)	32.7	30.6	27.1	
	Met all criteria (4-5 items)	49.2	50.1	58.5	<0.001
	Race/ethnicity (%)				
	Hispanic	46.4	41.8	26.0	
	White, non-Hispanic	22.2	27.6	44.8	
	Black, non-Hispanic	23.7	21.0	19.7	
	Multi-racial/Other	7.7	9.6	9.5	<0.001
	Children religious services (%)				
	Yes	24.8	24.6	24.5	
	No	75.2	75.4	75.5	0.946
	Household children (%)				
	One	21.8	22.8	22.4	
	More than one	78.2	77.2	77.6	0.794
Individual characteristics: Enabling	Mother's age (%)				
	20 or younger	3.0	2.4	2.1	
	20.1-30	27.1	27.7	31.8	
	30.1-40	43.6	44.0	43.2	
	Older than 40	26.2	25.9	24.7	0.048
	Respondent education (%)				
	Less than high school	38.5	31.7	20.5	
	High school or above	61.5	68.3	79.5	<0.001
	Respondent health status (%)				
	Less than average	25.0	25.3	16.1	
	Average	30.2	33.7	28.8	
	Better than average	44.8	41.0	55.1	<0.001
	Respondent mental health status (%)				
	Less than average	13.6	16.3	8.7	
	Average	31.1	30.1	22.3	
	Better than average	55.3	53.6	69.0	<0.001
	Primary language (%)				
	English	63.2	67.3	85.1	
	Non-English	36.8	32.7	14.9	<0.001
	Family structure (%)				
	Two parents	54.3	59.0	58.2	
	Other	45.7	41.0	41.8	0.026
	Home ownership (%)				
	Own	28.1	34.4	40.2	
	Other	71.9	65.6	59.8	<0.001
	Times of moving house (%)				
	None	21.2	21.4	27.1	
	Some	51.9	53.4	51.5	
	Frequent	26.9	25.1	21.3	<0.001

Table 2. Children and caregiver characteristics across PCMH levels (cont'd)

Construct	Variable	PCMH (N=20801)			P-value (Chi^2)
		Met no criteria	Met some criteria	Met all criteria	
Individual characteristics: Enabling	Neighborhood: Rundown housing (%)				
	Yes	21.8	24.0	20.1	
	No	78.2	76.0	79.9	0.012
	Neighborhood: Feel safe (%)				
	Yes	72.0	73.3	86.9	
	No	28.0	26.7	13.1	<0.001
	Under 100% poverty level				
	Yes	60.0	50.3	40.8	
	No	40.0	49.7	59.2	<0.001
Individual characteristics: Need	Gender (%)				
	Female	49.3	48.1	49.6	
	Male	50.7	51.9	50.4	0.407
	Age (%)				
	0-5 years	35.3	35.8	40.6	
	6-11 years	34.2	34.8	33.4	
	12-17 years	30.5	29.4	26.0	0.003
	Children health status (%)				
	Average or less	30.2	31.4	17.3	
	Good	24.6	28.8	25.5	
	Excellent	45.2	39.8	57.2	<0.001
	Special healthcare needs (%)				
	Yes	19.9	28.8	22.8	
	No	80.1	71.2	77.2	<0.001

Table 3. Children and caregivers characteristics in all states and subset states

Construct	Variable	All states (n=20801)	Subset states (n=2693)	P-value (Chi^2)
	Sample size	20801	2693	
Individual characteristics: Predisposing	Home environment (%)			
	Met no criteria (0-2 items)	17.1	15.6	
	Met some criteria (3 items)	29.6	28.3	
	Met all criteria (4-5 items)	53.3	56.7	0.264
	Race/ethnicity (%)			
	Hispanic	37.5	21.8	
	White, non-Hispanic	32.8	44.6	
	Black, non-Hispanic	20.6	23.9	
	Multi-racial/Other	9.1	9.6	<0.001
	Children religious services (%)			
	Yes	24.3	27.1	
	No	75.7	72.9	0.071
	Household children (%)			
	One	22.3	23.6	
	More than one	77.7	76.4	0.357
Individual characteristics: Enabling	Mother's age (%)			
	20 or younger	2.4	2.0	
	20-30	29.1	30.9	
	30-40	43.8	42.0	
	40 or older	24.7	25.1	0.568
	Respondent education (%)			
	Less than high school	28.8	22.9	
	High school or above	71.2	77.1	0.001
	Respondent health status (%)			
	Less than average	21.2	21.7	
	Average	31.0	29.8	
	Better than average	47.8	48.4	0.771
	Respondent mental health status (%)			
	Less than average	12.5	12.2	
	Average	27.2	24.4	
	Better than average	60.2	63.4	0.182
	Primary language (%)			
	English	72.8	86.4	
	Non-English	27.2	13.6	<0.001
	Family structure (%)			
	Two parents	58.3	52.6	
	Other	41.7	47.4	0.002
	Home ownership (%)			
	Own	35.2	40.1	
	Other	64.8	59.9	0.004
	Times of moving house (%)			
	None	24.2	20.9	
	Some	52.1	54.5	
	Frequent	23.8	24.5	0.135

Table 3. Children and caregivers characteristics in all states and subset states (cont'd)

Construct	Variable	All states (n=20801)	Subset states (n=2693)	P-value (Chi^2)
Individual characteristics: Enabling	Sample size	20801	2693	
	Neighborhood: rundown housing (%)			
	Yes	21.7	23.8	
	No	78.3	76.2	0.157
	Neighborhood: feel safe (%)			
	Yes	78.7	81.5	
	No	21.3	18.5	0.069
	Under 100% poverty level			
	Yes	48.2	46.9	
	No	51.8	53.1	0.454
Individual characteristics: Need	Gender (%)			
	Female	49.1	48.1	
	Male	50.9	51.9	0.585
	Age (%)			
	0-5 years	38.0	35.9	
	6-11 years	34.1	33.7	
	12-17 years	27.9	30.4	0.281
	Children health status (%)			
	Average or less	25.7	19.7	
	Good	26.4	28.0	
	Excellent	47.9	52.2	0.001
	Special health care needs (%)			
	Yes	24.2	26.8	
	No	75.8	73.2	0.090

Table 4. Percent satisfying each home environment component (all states)

Component (%)	0-5 years old (n=8381)				6-17 years old (n=12420)			
	PCMH				PCMH			
	Met no criteria	Met some criteria	Met all criteria	Pearson (p-value)	Met no criteria	Met some criteria	Met all criteria	Pearson (p-value)
Breast feeding	71.2	75.2	72.3	0.294		N/A		
Read/sung to	23.1	26.1	37.4	<0.001		N/A		
Finish homework		N/A			79.7	81.0	85.7	0.003
Meet child's friends		N/A			62.0	62.7	74.5	<0.001
No smoking at home	94.9	96.0	95.4	0.632	90.2	89.5	88.1	0.283
Share family meals	85.1	80.4	85.0	0.045	76.0	74.9	80.8	0.002
Monitor time on TV	50.9	53.2	58.2	0.039	41.8	43.9	48.7	0.019

Table 5. Percent satisfying each home environment component (subset states)

Component (%)	0-5 years old (n=1,184)				6-17 years old (n=2,018)			
	PCMH				PCMH			
	Met no criteria	Met some criteria	Met all criteria	Pearson (p-value)	Met no criteria	Met some criteria	Met all criteria	Pearson (p-value)
Breast feeding	68.3	76.3	72.2	0.519		N/A		
Read/sung to	26.7	37.9	38.9	0.233		N/A		
Finish homework		N/A			83.0	77.2	86.0	0.047
Meet child's friends		N/A			68.5	63.9	79.4	0.001
No smoking at home	88.2	92.2	94.8	0.254	79.8	81.6	84.7	0.352
Share family meals	86.9	90.1	91.2	0.584	74.4	71.9	81.3	0.059
Monitor time on TV	54.2	55.0	61.9	0.401	36.7	40.0	45.5	0.232

Table 6. Odds ratios of home environment and other covariates for all states and subset states

Variable	All states (n=20,801)		Subset states (n=2693)	
	Odds ratios	P-value	Odds ratios	P-value
Home environment				
Met no criteria (0-2 items)	Ref			
Met some criteria (3 items)	0.99	0.899	1.39	0.103
Met all criteria (4-5 items)	1.20	0.014	1.68	0.008
Race/ethnicity				
White, non-Hispanic	Ref			
Hispanic	0.67	<0.001	0.72	0.175
Black, non-Hispanic	0.57	<0.001	0.40	<0.001
Multi-racial/Other	0.74	0.001	1.25	0.283
Children religious services				
No	Ref			
Yes	1.17	0.019	1.27	0.160
Household children				
One	Ref		Ref	
More than one	1.10	0.134	1.14	0.403
Mother's age				
20 or younger	Ref			
20-30	1.62	0.002	1.35	0.423
30-40	1.67	0.002	1.45	0.339
40 or older	1.56	0.011	1.61	0.246
Respondent education				
High school or less	Ref			
Higher than high school	1.17	0.038	1.23	0.287
Respondent health status				
Less than average	Ref			
Average	1.14	0.095	1.86	0.003
Better than average	1.10	0.278	1.31	0.196
Respondent mental health status				
Less than average	Ref			
Average	1.04	0.653	0.82	0.404
Good	1.28	0.008	1.17	0.499
Primary language				
Non-English	Ref			
English	1.98	<0.001	2.83	<0.001
Family structure				
Single-parent or other	Ref			
Two-parent	0.98	0.755	1.01	0.954
Home ownership				
Rent or other	Ref			
Own	1.01	0.850	1.04	0.821
Times of moving house				
None	Ref			
Some	0.83	0.009	0.93	0.688
Frequent	0.67	<0.001	0.67	0.074
Neighborhood: Rundown housing				
No	Ref			
Yes	0.92	0.201	1.40	0.040

Table 6. Odds ratios of home environment and other covariates for all states and subset states (cont'd)

Variable	All states (n=20,801)		Subset states (n=2693)	
	Odds ratios	P-value	Odds ratios	P-value
Neighborhood: Feel safe				
No	Ref			
Yes	1.50	<0.001	1.31	0.130
Under 100% poverty level				
Yes	Ref			
No	0.76	<0.001	0.73	0.040
Gender				
Female	Ref			
Male	0.98	0.669	0.89	0.398
Age				
0-5 years	Ref			
6-11 years	0.82	0.011	0.60	0.007
12-17 years	0.78	0.008	0.67	0.052
Children health status				
Average	Ref			
Good	1.11	0.191	0.90	0.591
Excellent	1.27	0.002	1.00	0.980
Special health care needs				
No	Ref			
Yes	0.98	0.758	0.92	0.631
	F (29,20771) = 20.04 P <0.001		F (29,2663) = 5.36 P <0.001	

DISCUSSION

Key Findings

Home environment is a strong predictor for children's use of PCMH

While many studies have examined demographic factors that may predict enrollment in a PCMH or equivalent practice, to our knowledge this is the first study to explore the role of the home environment in predicting whether a child receives high quality healthcare services in PCMH or equivalent practice. Children in a healthier home environment are more likely to receive high quality of healthcare services, even when we control for other factors that have been previously shown as strong predictors. We should be aware that although the quality of physician practices in this study was measured by PCMH criteria, this does not indicate whether the child was enrolled in a PCMH program. However, the association could possibly be limited by the availability of PCMH-certified providers in a local community who should be providing PCMH-qualified services. This could explain why caregiver's perception of community safety – a proxy of their access to healthcare resources – is significant in the national sample but became insignificant when we limited the sample to subset states. Likewise, even in the subset analysis, where there should be minimal restrictions on access, home environment remains a significant factor and presents an even larger effect in this relationship. The results suggest that caregivers who engage in healthier child-rearing behaviors are more likely to choose higher quality of physician practices.

Findings suggest that existing research may be subject to selection bias

Previous studies, a majority of which use the NSCH and NS-CSHCN, have found children in a PCMH to be associated with better health outcomes, such as improved healthcare utilization and decreased ED use [55]. However, our finding that the home environment significantly predicted children's use of PCMH suggests that there may be a selection bias in those studies. Home environment, to a large extent, reflects the health awareness of the caregiver, which can benefit a child's health directly, as shown in previous studies [41-45], and indirectly – as indicated in our study through pursuing high quality of healthcare services for the child. And in this case, more health aware families may enroll their children into a PCMH, which leads to better health outcomes for the child. Therefore, some of the health effects could be explained by the home environment rather than the benefits of PCMH. Because of the nature of cross-sectional data, we cannot test causality or the effect size of mediation by PCMH. However, our findings suggest that we may need to reconsider the impact on children's health that is truly caused by PCMH.

Additional findings compared to existing research

Our findings suggest a mis-specified relationship in a previous study, in which the author claimed that PCMH was associated with better family functioning [30]. Family functioning, similar to home environment as a reflection of caregiver's behavior, was defined by four components in the study: difficulty with parental coping, parental aggravation, childcare/work issues, and missed school days. However, no models or previous evidence has suggested that a PCMH affected caregiver's child-rearing behavior. Additionally, direct interventions targeting changing caregiver's behavior

showed weak effects [56]. Caregiver's child-rearing behavior is such a long term effect that it is not only hard to form but also hard to change. And given the limited time states had to determine if their PCMH policies had any effect before the survey was conducted in 2011, we have the reason to believe that the association between home environment and children's use of PCMH should not go in the inverse direction.

Our study also presents concordant results with some previous studies and readdresses the necessity to target children in certain minority groups in a less favorable situation to improve their healthcare quality. Blacks are at a disadvantage compared to White families, as are younger children compared to older ones; families under 100% of the poverty level have even more limited resources than low-income families; and language is an important barrier to accessing higher quality physician practices for non-English speaking families. Younger mothers and less educated mothers/caregivers may have insufficient knowledge and experience to pursue high quality healthcare services for their children. Although our focus in this study is caregiver's perception of health care quality, access to PCMH providers continues to play a role, suggesting that we should advocate for more healthcare providers to transfer to PCMH models.

Limitations and strengths

The major limitation in our study is a cross-sectional study design such that we cannot prove a causal relationship between home environment and the quality of children's healthcare services. However, as we have explained above, it is not likely to have reverse causality given previous evidence and limited time of PCMH implementation, while caregiver's behavior takes a comparatively long time to change. There are other issues due to the nature of survey data as well, including that the data are subject to self-report bias. One particular example is caregivers' smoking status being underestimated. Our analysis showed that about 90% of all respondents reported not smoking in the household, much lower than the level in a previous national report [57]. There are also missing values for other variables, the most important being mother's age, where we lost around 14.3% of the total sample size. This missing information could cause underestimation or overestimation of our results.

In spite of these limitations, the NSCH demonstrates that consumers are able to report PCMH characteristics; among publicly insured children that had utilized medical services during the previous 12 months, the response rate of PCMH questions was as high as 98.6%, and the responses showed considerable variability, suggesting its validity as a measure of children's health care quality. Furthermore, although the smoking component of home environment may be biased, other components showed adequate variability. Therefore, the entire scale of home environment is a valid measurement.

Policy implications and recommendations

Many state and federal programs, such as Medicaid, have begun to provide incentives and rewards to PCMH providers in order to expedite the transformation to a high-quality primary care model. Therefore, it is especially important to understand the true values that PCMH have brought to children, caregivers and health care providers. This study provides a new perspective with which to evaluate PCMH qualities for low-income children, or more accurately the healthcare quality measured by PCMH criteria. Our results show that home environment is a critical demand side predictor for children's healthcare quality, and therefore, we need to control for home environment in future studies that examine the health benefits of PCMH, especially those used as justification for care-management payments. In the national movement of expanding and promoting PCMH, we recommend preferentially targeting children in poor home environments, who can potentially be identified by physicians through their communication with families during prenatal care or regular doctor visits. In addition, educational campaigns about child-rearing behavior are recommended to impact caregivers' choice of physicians for children or their interactions with physicians.

Furthermore, this study demonstrates the benefits and necessity of integrating consumers' reports into PCMH evaluation. Current national recognition programs for PCMH are focusing on supply side quality measurements, which are healthcare providers' internal evaluation of their own practices. Yet, our results indicate how different the caregivers' actual perception of healthcare quality is from the providers' report. Healthcare systems may not deliver the services provided by the physician effectively, and therefore fail to attain the expected perception from consumers. If we want to achieve the ultimate goal of

matching up physician's ratings with consumer's perception, comparing the two can be beneficial for identifying problems in this process.

Given the concerns and problems we have identified in this study, future research should revisit previous studies on PCMH and re-examine the true effect of this primary care model, possibly using data from longitudinal studies. To evaluate the practices in PCMH, more studies are also needed to compare the consumer reports of PCMH with supply side rating claimed by physicians that practice PCMH.

CONCLUSION

Many states have been practicing Medical Home for many years, and especially after the concept of PCMH was official put forward in the 2010 Affordable Care Act, there has been a nationwide movement of PCMH transformation. Therefore, it is critically important for us to understand the true mechanism that PCMH has been functioning. Improved health outcomes that happened after PCMH may not result from PCMH, and the positive association between home environment and PCMH in our study suggests that home environment may operate through PCMH to deliver better health outcomes for the children. We encourage future longitudinal study to clarify the relationship between PCMH and children's health outcomes, especially adjusting for demand side behavioral factors. Finally, we should recognize the importance of integrating consumer's perception into future PCMH evaluations, given the discrepancy of quality reports between consumers and their physicians.

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