

Adolescent Access to Patient-Centered Medical Homes

Assessing Adolescent Outcomes by Patient Center Medical Home Access

by
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Thesis

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Adolescent Access to Patient-Centered Medical Homes

Abstract

Background Adolescents have specific health and developmental needs that make access to patient-centered medical homes (PCMH) especially important. We analyzed the distribution of PCMHs among US adolescents and examined whether disparities exist among subgroups.

Methods Data on adolescents ages 12-17 years (n=34,601) from the 2011-2012 National Survey of Children's Health (NSCH) were used to determine what proportion had access to a PCMH. Multivariable logistic regression was used to calculate the odds of having a PCMH, adjusting for sociodemographic characteristics and special health care needs.

Results While most US adolescents had a usual source of care (91%), only about half (51%) had access to a PCMH. Disparities in the prevalence of PCMHs were seen by race/ethnicity, poverty, and having special health care needs. There were lower adjusted odds in having a PCMH for Hispanic (aOR=0.55, 95% CI=0.45-0.68) and black adolescents (aOR=0.58, 95% CI=0.49-0.69) compared to white adolescents. Uninsured adolescents were less likely to have a PCMH (aOR=0.39, 95% CI=0.31-0.51) compared to those with private insurance. Those living below four times the poverty level had lower adjusted odds of PCMH access. Adolescents with special health care needs had lower adjusted odds (aOR=0.66, 95% CI=0.59-0.75) of having a PCMH compared to adolescents without any special health care needs.

Conclusion PCMH access was lower among minorities, those living in poverty, and those with special health care needs. These disparities in PCMH access among these typically underserved groups call for further study and interventions that would make PCMHs more accessible to all adolescents.

Introduction:

In 1967, the first concept of a medical home was put forth by the American Academy of Pediatrics (AAP) as a central repository for children's medical records [1]. In 1992, the AAP defined a patient-centered medical home (PCMH) as primary care that is accessible, family centered, continuous, comprehensive, coordinated, compassionate, and culturally effective [1-5]. The Future of Family Medicine Project in 2002 – aimed at transforming and improving family medicine – said everyone should have a medical home [6]. Efforts to provide medical homes nationally were boosted in 2007, when joint principles of the PCMH were established by major primary care medical societies, representing about 300,000 physicians [7]. These principles paved the way for the National Committee for Quality Assurance (NCQA) to develop a set of criteria in 2008 for recognizing and evaluating medical homes, which remains the most widely used PCMH recognition program [8]. As of 2012, PCMH policy and program efforts were made by 47 states [4]. PCMHs have evolved into a delivery model where care is coordinated by a primary care physician so patients receive help they need, in a manner they can comprehend [9] .

The AAP has specifically recommended all infants, children, and adolescents receive healthcare through PCMHs [3]. Healthcare management, however, is not necessarily consistent among infants, children and adolescents. While infants and children normally have their healthcare needs maintained by their parents, adolescents tend to take a bigger role in managing their own healthcare. Adolescence is a time of great physical, cognitive, social and behavioral changes, where healthcare needs can easily be overlooked [10]. The AAP recommends that adolescents receive

one wellness visit per year so healthcare providers can have the opportunity to evaluate any risky behavior and develop a relationship of trust [11, 12]. However, adolescents are not getting these vital preventive visits as often as they should. Only 1 in 15 adolescent visits to a healthcare provider are for preventive visits, and about 1 in 6 visits offer any sort of preventive guidance [11].

Although there have only been limited studies, there are indications that adolescents who receive care through a PCMH have higher odds of receiving preventive visits and medical care compared to adolescents who do not have access to a PCMH [13]. A cohort study determined adolescents with access to a PCMH were more likely to receive preventive services compared to those who had no PCMH access [13]. Similarly, a second study found children and adolescents ages 0-17 years without a medical home had a three to four-fold increased risk of having an unmet medical or dental need [14]. Particularly, children and adolescents ages 0-18 years with special health care needs have been shown to receive higher quality healthcare when enrolled in a PCMH, compared to those children without a PCMH [15]. A 2012 study also revealed that among children who are enrolled in medical homes, there were significantly fewer Hispanic and black children compared to white children. The same study found rates of having a PCMH were lower for minority adolescents, those with lower incomes, uninsured adolescents, and adolescents who come from non-English speaking households [16].

Statement of Purpose:

While these studies provide some information about adolescents' access to medical homes, questions remain, and there is a need for new analyses to inform

current medical home efforts with adolescents. The aim of this study is to examine the distribution of access to PCMHs among adolescents and look for any disparities by group, using the 2011-2012 National Survey of Children's Health (NSCH).

Methods:

Dataset: The 2011-2012 NSCH dataset was used as the data source for this study [17]. This comprehensive survey gathers quantitative data on a child's well-being, physical and mental health, and healthcare status, as well as information on family, neighborhood, school and social environment [18]. The telephone survey was conducted from February 2011 through June 2012 in English and Spanish with parents or guardians [18, 19]. The total number of surveys completed nationally was 95,677, with each state having more than 1800 surveys completed [18].

Age Range for Study: The AAP states that the adolescent age group is ages 12-18 [20]. We restricted our study sample to ages 12-17 because the NSCH does not collect data on 18 year olds. Of the 95,677 respondents, 34,601 were adolescents ages 12-17.

Definition of PCMH: The AAP defines a PCMH as care that is accessible, family-centered, continuous, comprehensive, coordinated, compassionate, and culturally effective [3]. This study uses a measure designed to approximate this definition with the exception of continuous care [3, 21-23]. The five components of the medical home measured are: 1) usual source of care, 2) personal physician or nurse, 3) receiving all needed referrals for specialty care (among those with need), 4) receiving needed help coordinating health and health-related care (among those with

need), and 5) receiving family-centered care. With the measure in this study, an adolescent would need to have all components to have medical home access.

Confounders and Potential Moderators: Confounders adjusted for in the regression model were: sex, gender, race/ethnicity, primary language spoken at home, region of country, health insurance, household poverty status, parental education, family structure, and special health care needs. Age was divided into two groups of adolescents: early adolescents (ages 12-14) and middle adolescents (ages 15-17). Race and ethnicity categories were defined as: Hispanic; black, non-Hispanic; white, non-Hispanic; multi/other, non-Hispanic. The two primary languages spoken at home were English and any language other than English. Four regions of the USA – Northeast, West, Midwest, and South –were defined according to the US Census regions [24]. Health insurance was categorized as public, private, or uninsured. Household poverty status was designated according to where a household fell in relation to the federal poverty level: 0-99%, 100-199%, 200-399%, and 400% or higher. Parental/caregiver education was computed as the highest level of parental or caregiver education attained, recoded into three levels: less than high school, high school, or more than high school. Family structure was categorized as two parents (either biological or adopted), two parents (one being a step-parent), single mother (no father present), or an “other” family type. Special health care needs were identified using a five-item questionnaire asking if a child: 1) needs or uses prescription medication, 2) has an above average use of routine services, 3) needs or uses specialized therapies or services, 4) needs or uses mental health counseling, and 5) experiences a functional limitation. If a child had one or more of those five items,

they were classified as having special health care needs. Adolescents reported to have one or more of these five items were classified as having special health care needs[25-27].

Statistical Analysis: All statistical analyses were computed using STATA, version 14.0 [28]. The NSCH data were weighted in order to account for complex survey design and to more accurately represent the population of non-institutionalized children in the US [23]. Univariate analyses were run on PCMH access, its components, and potential confounders, among those 12-17 years old. Bivariate analyses of the individual PCMH components and confounders were also conducted. Multivariable logistic regression was used to model PCMH access, controlling for age, gender, race/ethnicity, primary language spoken at home, region of residence, household poverty status, health insurance, parental education, family structure and special health care needs. Additional models were fitted, omitting parental education (Model 2) and poverty (Model 3) due to the high correlation of these two measures.

Results:

Slightly over half of adolescents (51%) had access to a PCMH. According to parent/guardian report, a total of 89% of adolescents had a personal physician or nurse, 91% had a usual source of care, 77% received all needed referrals for specialty care, 66% received needed help coordinating health and health-related care, and 65% received family-centered care (Table 1).

Bivariate analysis revealed relationships between sociodemographics and access to PCMHs (Table 2). Only 32% of Hispanic adolescents, 42% of black adolescents, and 47% of other race adolescents met criteria for PCMH access,

compared to 62% of white adolescents ($p<0.01$). Higher proportions of white adolescents had access to most PCMH components, while Hispanic adolescents had the least access. For example, adolescents with the highest prevalence of having a personal doctor or nurse were white adolescents (93%), followed by multi/other race adolescents (89%), black adolescents (84%) and Hispanic adolescents (82%) ($p<0.01$). All non-white adolescents had lower adjusted odds of having PCMH access compared to white adolescents (Table 3). The adjusted odds of Hispanic adolescents (aOR: 0.55, 95% CI: 0.45-0.68) and black adolescents (aOR: 0.58, 95% CI: 0.49-0.69) having a medical home were about half the adjusted odds of white adolescents (Table 3, Model 1).

Primary languages spoken at home also saw differences in access to PCMH. Among adolescents who spoke English as their primary language at home, 55% had medical home access, whereas 21% of adolescents whose primary language spoken at home was any other language had access ($p<0.01$). Similarly, among those who spoke English as their primary language at home, 91% had a personal physician or nurse, 93% had a usual source of care, 79% were receiving all need referrals for specialty care ($p<0.01$). Conversely, among those who spoke any other language primarily at home, 77% had a personal physician or nurse, 72% had a usual source of care, and 62% were receiving all need referrals for specialty care ($p<0.01$). Those who spoke a primary language at home other than English had 0.39 (95% CI: 0.29-0.53) the adjusted odds of having access to a medical home compared to adolescents who spoke English primarily at home (Table 3, Model 1).

Differences in patterns of having access to a PCMH, and having components of a PCMH were seen across regions. Parents/guardians in the Midwest reported the highest prevalence of PCMH (58%) followed by the Northeast (54%), and the South (51%), with the West having the lowest PCMH prevalence (44%). Generally, the highest prevalence of PCMH components was seen in the Northeast and Midwest. For all PCMH components, the West had the lowest prevalence.

Access to PCMH and its components was highest among those living above 400% of the federal poverty line, compared to those living at 0-99% of the poverty line. A total of 33% of adolescents living at 0%–99% of the poverty line, 44% of those living at 100%-199% of poverty, 56% of those living 200-399% of the poverty line, and 63% of those living 400% or more of the poverty line had PCMH access ($p<0.01$). Similar patterns – of poorer adolescents having less access to a PCMH – were observed for all PCMH components.

The poorer the adolescents were, the lower the odds of having access to a PCMH. Those living below the poverty line had 0.62 (95% CI: 0.50-0.77) times the adjusted odds of having access compared to those living at 400% or higher of the poverty. Adolescents living at 100% - 199% of the poverty line had 0.70 (95% CI: 0.58-0.84) times the adjusted odds of having medical home access, and those living at 200% - 399% of the poverty line had 0.83 (95% CI: 0.73-0.95) times the adjusted odds of having access compared to those living at 400% or higher above the poverty line. This effect was still observed even when parental education was removed from the model (Table 3, Model 2).

Differences were noted in the categories of both health insurance status and parental/caregiver education and access to PCMHs. Adolescents who were uninsured demonstrated the lowest rates of access to a PCMH (24%), while adolescents with private health insurance had the highest PCMH access (60%) ($p<0.01$). The same trends were observed across all components of a PCMH. Adolescents who were uninsured had lower adjusted odds of having PCMH access (aOR: 0.39, 95% CI: 0.30-0.51) compared to those with private insurance. The adjusted odds were not significant for public health insurance compared to private (Table 3, Model 1).

Adolescents whose parents received a high school education only had 0.79 (95% CI: 0.68-0.92) times the adjusted odds of having access compared to adolescents whose parents had more than a high school education. The adjusted odds were not significant for those whose parents received less than high school education, compared to those whose parents had more than a high school education. The effect was seen even when poverty was removed from the model (Table 3, Model 3).

Adolescents with any special health care needs (47%) and without (53%) exhibited small differences in access to PCMHs ($p<0.01$). For most PCMH components, those with special health care needs had a less access compared to those who did not have special health care needs. Notably, among those without any special health care needs, 72% received needed help coordinating care, while 57% of adolescents with special health care needs receiving needed help coordinating their healthcare ($p<0.01$). Adolescents who had any special health care needs had 0.66 (95% CI: 0.59-0.75) times the adjusted odds of having medical home access compared to those who had no special health care needs (Table 3, Model 1).

There were no significant differences by age group (early and middle adolescents) and gender for access to a PCMH or its components. Age, gender and region of living were not statistically significantly associated with the odds of having a PCMH.

Discussion:

Medical homes should continue to be at the forefront of patient care, especially among adolescents. According to the AAP, all adolescents should have their care organized through a PCMH [3], but according to our results based on recent data from a national dataset, only about half of adolescents do. In addition, there are notable disparities in access to a PCMH among different sociodemographic groups.

Among racial/ethnic groups, Hispanic adolescents consistently had the lowest prevalence and the lowest adjusted odds of having a PCMH, while white adolescents had the greatest prevalence and the highest adjusted odds. Medical home component distributions also show that Hispanic adolescents do not have high rates of having a personal physician/nurse, or even a usual source of care, compared to white adolescents. Similarly, black adolescents also had significantly lower rates of having a PCMH, and lower odds of having a PCMH, compared to white adolescents. Our results indicate the need for effective interventions on behalf of Hispanic and black adolescents, as well as designing PCMH settings that can better accommodate minority groups.

Not surprisingly, those who were uninsured or in poverty had lower rates of access to a PCMH. These results align with a study that looked at PCMH distributions among children and adolescents using 2007 NSCH data [14]. When

comparing findings from both studies, however, it is interesting that the 2007 NSCH study results show higher percentage of having a PCMH for all race and insurance categories, compared to the same race and insurance categories reported in this study [19]. Since the previous study included individual's ages 1-17, one explanation is that infants and children may have contributed to the higher percentages of PCMH. This suggests that adolescents should receive more attention in future PCMH policies [10, 29].

While medical homes were intended to be a better care delivery system for all patients, the emphasis of having medical homes was originally placed on children and adolescents with special health care needs [2]. This population has particular need for the medical home array of services because of their higher use of the healthcare system: specialty services, lab tests, and medications, for instance. Our analysis, however, suggests that adolescents with special health care needs not only have a lower prevalence of having a PCMH, they also have significantly lower adjusted odds of having a PCMH compared to adolescents with no special health care needs. As policy recommendations are made for adolescent PCMH, it is important to address adolescents with special health care needs - a group that policy implementations originally targeted.

Rates were higher for having a personal doctor or a usual source of care compared to the other three PCMH components, suggesting that even though adolescents have a usual source of care, they still don't have PCMH access. Children with complex medical needs have particular necessity of medical home services, and need to meet all PCMH components to be considered to have PCMH access,

including needed referrals for specialty care and needed care coordination. Their requisite may be one reason why this study showed lower odds of PCMH for children with special health care needs compared to those without. It's unclear whether children with special health care needs are receiving care in sites that have not made PCMH innovations or if they are receiving care in comparable practices but due to higher needs, are not meeting the medical home criteria. Better efforts need to be made to make sure adolescents receive all needed referrals, receive needed help coordinating care, and that they and their families receive family centered care in order to have PCMH access.

Limitations to this study may have masked the true distributions of adolescent PCMHs. While the AAP define adolescence as 12-18, the NSCH does not collect data on 18 year olds. It may be that at the age of 18, when most are transitioning to adulthood, the greater disparities of PCMH are observed. A second limitation would be that there are many varying definitions of PCMH that do not all align with the NSCH's questionnaire. For example, continuity of care is missing in the NSCH even though a therapeutic relationship with a provider over time is viewed as critical to high quality primary care and PCMH [7-9]. Finally, a limitation is that the survey is parent reported, without adolescent input.

Conclusion:

Future directions for this research might look at analyzing outcomes among those who do and do not have a PCMH, in order to make inferences about quality of care for adolescents with PCMH. This research suggests that policies to improve

referrals, care coordination, and family centered care would improve medical care for adolescents –especially those in underserved populations.

Table 1 - Demographic Characteristics of Children Ages 0-17 from the 2011-2012 National Survey of Children's Health

	Unweighted N	Weighted %
Patient Centered Medical Homes		
Patient Centered Medical Homes	19,347	51.4%
Personal Physician or Nurse	31,546	89.2%
Usual source of care	32,259	90.6%
Receiving all need referrals for specialty care (among those with need)	5289	77.4%
Receiving needed help coordinating health and health-related care (among those with need)	11583	65.7%
Receiving family-centered care	23396	65.3%
Age		
Early adolescence 12-14	16157	49.3%
Middle Adolescence 15-17	18444	50.7%
Gender		
Male	18110	51.2%
Female	16453	48.8%
Race/Ethnicity		
Hispanic	3780	20.4%
Black, Non-Hispanic	3190	14.3%
White, Non-Hispanic	23698	56.1%
Multi/Other, Non-Hispanic	3218	9.2%
Primary Language Spoken at Home		
English	32597	87.8%
Other	1987	12.2%
Region of Living		
Northeast	6381	17.1%
Midwest	8389	21.8%
West	8700	23.8%
South	11,131	37.2%
Household Poverty Status		
0-99%	4436	19.3%
100-199%	5805	20.5%
200-399%	10684	28.9%
400% or higher	13676	31.2%
Health Insurance		
Public	8000	30.7%
Private	24588	63.3%
Uninsured	1661	6.1%
Parental Education		
Less than high school	1670	11.1%
High school graduate	5131	19.8%
More than high school	25788	69.2%
Family Structure		
Two parent, biological or adopted	22302	58.6%
Two parent, step	3558	13.0%
Single mother, no father present	5573	19.6%
Other family type	2793	8.8%
Special Health Care Needs		
Any	8911	25.1%
None	25690	74.9%

Table 2: Demographics Stratified by Patient-Centered Medical Home use and Receipt of Medial Home Components from 2011-2012 NSCH*

	Have PCMH	Personal Physician or Nurse	Usual Source of Care	Receiving all needed referrals for specialty care (among those with need)	Receiving needed help coordinating health and health-related care (among those with need)	Receiving family-centered care
Age						
Adolescence, 12-17	51.4%	89.2%	90.6%	77.4%	65.7%	65.3%
Early adolescence, 12-14	51.5%	90.1%	91.2%	76.5%	66.5%	64.8%
Middle adolescence, 15-17	51.2%	88.3%	90.0%	78.1%	65.0%	65.8%
Gender						
Male	50.8%	88.5%	90.2%	77.3%	65.6%	64.7%
Female	52.1%	90.0%	91.0%	77.4%	65.7%	65.9%
Race/Ethnicity						
Hispanic	31.5%	82.3%	79.8%	62.2%	55.3%	45.8%
Black, Non-Hispanic	42.4%	84.1%	87.6%	82.3%	64.4%	54.7%
White, Non- Hispanic	61.7%	93.2%	95.1%	82.4%	70.1%	75.9%
Multi/Other, Non-Hispanic	47.2%	88.8%	91.6%	73.7%	61.7%	60.1%
Primary Language Spoken at Home						
English	55.4%	90.8%	93.2%	79.2%	66.5%	69.4%
Other	20.8%	77.4%	71.6%	62.0%	59.8%	33.7%
Region of Living						
Northeast	54.4%	94.7%	93.2%	81.1%	67.7%	68.1%
Midwest	57.5%	91.5%	92.5%	82.2%	66.6%	71.1%
West	44.5%	85.3%	88.1%	70.5%	61.0%	59.1%
South	50.8%	87.7%	89.9%	77.6%	67.2%	64.4%
Household Poverty Status						
0-99%	33.2%	81.2%	78.9%	66.7%	58.6%	47.6%
100-199%	43.9%	85.2%	88.2%	79.5%	61.5%	56.5%
200-399%	55.8%	91.2%	93.4%	77.2%	66.6%	69.2%
400% or higher	63.2%	94.9%	96.8%	83.3%	71.2%	77.3%
Health Insurance						
Uninsured	24.0%	61.6%	66.5%	54.1%	44.4%	29.8%
Public	40.3%	86.3%	85.9%	73.0%	59.8%	54.7%
Private	59.9%	93.4%	95.4%	81.8%	69.9%	73.1%
Parental Education						
Less than high school	28.1%	78.1%	73.4%	60.7%	58.7%	39.6%
High school graduate	42.4%	84.9%	87.0%	76.7%	61.6%	57.0%
More than high school	58.6%	92.6%	94.5%	79.4%	67.3%	72.3%
Family Structure						
Two parent, biological or adopted	55.6%	91.8%	92.8%	79.5%	68.8%	68.4%
Two parent, step	50.1%	88.0%	90.3%	76.7%	66.9%	63.1%
Single mother, no father present	44.0%	85.2%	86.2%	71.9%	59.9%	60.7%
Other family type	42.6%	83.3%	87.0%	78.5%	58.8%	57.6%
Special Health Care Needs						
Any	46.8%	92.9%	92.7%	74.3%	56.6%	67.2%
None	52.9%	87.9%	89.9%	79.5%	71.7%	64.6%

*Bolded values correspond to those with statistically significant p values <0.05

Table 3: Unadjusted and Adjusted Odds Ratios of Having a Patient-Centered Medical Home By Demographic

	Unadjusted OR (95% CI)	Adjusted OR, Model 1 ^a (95% CI)	Adjusted OR, Model 2 ^b (95% CI)	Adjusted OR, Model 3 ^c (95% CI)
Age				
Early adolescence 12-14	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Middle Adolescence 15-17	0.99 (0.99, 1.14)	0.98 (0.88, 1.09)	0.97 (0.87, 1.08)	0.98 (0.88, 1.10)
Gender				
Male	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Female	1.0 (0.96, 1.17)	1.03 (0.92, 1.14)	1.02 (0.92, 1.14)	1.02 (0.92, 1.14)
Race/Ethnicity				
Hispanic	0.28 (0.24, 0.33)	0.55 (0.45, 0.68)	0.55 (0.45, 0.67)	0.55 (0.44, 0.67)
Black, Non-Hispanic	0.46 (0.39, 0.53)	0.57 (0.48, 0.67)	0.56 (0.47, 0.66)	0.56 (0.47, 0.66)
White, Non-Hispanic	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Multi/Other, Non-Hispanic	0.55 (0.46, 0.67)	0.64 (0.52, 0.77)	0.66 (0.55, 0.81)	0.64 (0.53, 0.78)
Primary Language Spoken at Home				
English	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Other	0.21 (0.17, 0.27)	0.39 (0.29, 0.53)	0.38 (0.29, 0.51)	0.37 (0.27, 0.50)
Region of Living				
Northeast	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Midwest	1.13 (0.99, 1.29)	1.08 (0.93, 1.25)	1.09 (0.95, 1.26)	1.05 (0.90, 1.21)
West	0.67 (0.57, 0.79)	0.88 (0.73, 1.06)	0.88 (0.73, 1.05)	0.87 (0.72, 1.04)
South	0.86 (0.76, 0.98)	1.00 (0.86, 1.17)	1.03 (0.89, 1.20)	0.98 (0.84, 1.14)
Household Poverty Status				
0-99%	0.29 (0.25, 0.34)	0.62 (0.50, 0.77)	0.58 (0.47, 0.71)	Not included
100-199%	0.46 (0.39, 0.53)	0.70 (0.58, 0.84)	0.70 (0.58, 0.83)	Not included
200-399%	0.74 (0.65, 0.83)	0.83 (0.73, 0.95)	0.82 (0.72, 0.94)	Not included
400% or higher	1.00 (ref)	1.00 (ref)	1.00 (ref)	Not included
Health Insurance				
Public	0.46 (0.41, 0.51)	0.89 (0.75, 1.06)	0.87 (0.74, 1.03)	0.75 (0.65, 0.86)
Private	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Uninsured	0.21 (0.17, 0.28)	0.39 (0.30, 0.51)	0.40 (0.29, 0.50)	0.34 (0.26, 0.45)
Parental Education				
Less than high school	0.28 (0.22, 0.35)	0.85 (0.65, 1.11)	Not included	0.77 (0.59, 1.00)
High school graduate	0.53 (0.46, 0.60)	0.79 (0.68, 0.92)	Not included	0.74 (0.63, 0.86)
More than high school	1.00 (ref)	1.00 (ref)	Not included	1.00 (ref)
Family Structure				
Two parent, biological or adopted	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Two parent, step	0.80 (0.67, 0.94)	0.91 (0.77, 1.07)	0.90 (0.76, 1.06)	0.88 (0.74, 1.04)
Single mother, no father present	0.63 (0.55, 0.72)	0.88 (0.76, 1.02)	0.87 (0.75, 1.00)	0.82 (0.71, 0.94)
Other family type	0.59 (0.49, 0.72)	0.65 (0.49, 0.85)	0.71 (0.58, 0.88)	0.64 (0.48, 0.84)
Special Health Care Needs				
Any	0.78 (0.70, 0.88)	0.66 (0.59, 0.75)	0.67 (0.60, 0.76)	0.67 (0.59, 0.75)
None	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)

^aModel 1 adjusted for age, sex, race, primary language spoken at home, region of living, insurance, parental education, poverty, family structure and CSHCN.

^bModel 2 adjusted for all the same covariates as Model 1, but with parental education removed.

^cModel 3 adjusted for all the same covariates as Model 1, but with poverty removed.

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Assessing Adolescent Outcomes by Patient Center Medical Home Access

Abstract

Background: Adolescents have specific health and developmental needs that make access to PCMH especially important.

Methods: Data on adolescents ages 12-17 years from the 2011-2012 National Survey of Children's Health (NSCH) were used (n=34,601) to determine what proportion had access to a PCMH. Adolescent outcomes analyzed were preventive care visits, flourishing, school engagement, general health, school attendance, physical activity, preventive dental visits and condition of teeth. Multivariable Poisson regression was used to calculate the risk of having an outcome, adjusting for sex, gender, race/ethnicity, primary language spoken at home, region, insurance, poverty, parental education, family structure and children with special health care needs. All analyses accounted for weighting and complex survey design of the NSCH.

Results: Adolescents with PCMH access had 1.04 (95% CI: 1.01, 1.06) times the adjusted risk of having a yearly preventive visit compared to those without PCMH access. Those with medical home access had 1.04 (95% CI: 1.03, 1.07) times the risk of having excellent or very good general health compared to those with no access. Across performance outcomes, those with PCMH access had 1.25 (95% CI: 1.18, 1.33) times the risk of usually or always meeting all three criteria measuring flourishing, 1.06 (1.04, 1.09) times the risk of usually or always meeting the two criteria measuring being engaged in school, and 1.04 (95% CI: 1.01, 1.08) times the risk of missing less than 5 days of school in the past year compared to those without access.

Conclusions: Medical home access is independently correlated with adolescents receiving more preventive care and having healthier outcomes. PCMH access may help adolescents get more preventive care, be healthier, and perform better than those without medical home access.

Introduction

Patient centered medical homes (PCMH) have long been considered a preferred method of health care organization and delivery in the US [1]. They are models of health care where care is patient-centered, coordinated, comprehensive, accessible, and focused on quality and safety [1, 2]. They are not a physical location, but rather an approach to providing high quality care that allows trusting relationships to be built between patients and their families, and their clinical care team throughout the course of a patient's lifetime [1, 3, 4]. It has been recommended that all US Americans have their care coordinated through a PCMH [5], but it is especially important for adolescents to have access to PCMH due to numerous life changes that impact health care.

Adolescent years are a time of critical transition where quality health care is vital. Teenagers undergo many biological, social and behavioral changes and as a result, it is important for adolescents to have preventive visits related to substance use, mental health, reproductive health, physical health, and infectious diseases [6]. For instance, *Bright Futures: Guidelines for Health Supervision of Infants, Children, and Adolescents* recommends screening adolescents for numerous behaviors and risk factors annually [7]. Even though adolescence is an important period for well visits and preventive care, adolescents often do not receive the recommended care and there are disparities in well visits by age, gender, race/ethnicity, health insurance status, and poverty [8].

Adolescents with PCMH access have been shown to have higher receipt of preventative visits compared to those with no PCMH access, but studies examining

this relationship are limited. Using the 2007 National Survey of Children's Health (NSCH), one study found that adolescents who enrolled in a PCMH are more likely to receive preventive visits [9]. Literature has also shown that access to PCMHs improves health outcomes such as primary care utilization in low-income populations [10], and found that medical homes were associated with "excellent/very good" health in adolescents [11]. Previous literature, however, has had a large focus on preventive outcomes such as immunizations and sexual transmitted infection screenings [12]. Literature is limited when looking at medical homes and care outcomes occurring outside of the medical setting such as school performance and general flourishing, as well as looking at dental care and medical home access.

Statement of Purpose:

In addition to preventive visits, understanding the effect of PCMH access on multiple adolescent health outcomes can help facilitate better interventions to increase quality adolescent health care. Evaluating this relationship is also important due to heightened interest in medical home access, and can also support allocating more funding for adolescent care transformation. This study uses the 2011/2012 NSCH to assess the independent association of PCMH with receipt of preventive visits (medical and dental) and important adolescent health outcomes such as flourishing, school engagement, health status, and physical activity.

Methods:

Dataset: This cross-sectional study used data from the 2011-2012 NSCH dataset [13]. The 2011-2012 NSCH is a telephone survey administered by the Center for Disease Control and Prevention (CDC), National Center for Health Statistics. The

survey gathers a spectrum of parent-reported information about a child's health and well-being, as well as information about their family and other environmental influences for children and adolescent ages 0-17 [14].

Age Range for Study: The American Academy of Pediatrics (AAP) states that the adolescent age group is from 12 to 18 years of age [15]. We restricted our study sample to ages 12-17, since the NSCH collects no data on 18 year-olds. Of the 95,677 NSCH participants, 34,601 were adolescents ages 12-17.

Definition of PCMH: The medical home is defined by the AAP as an approach to providing high quality care that is comprehensive, accessible, family centered, continuous, coordinated, compassionate and culturally effective [4]. This study uses a measure designed to approximate the AAP-defined medical home concept by operationalizing PCMH access using 5 components: 1) usual source of care, 2) personal physician or nurse, 3) receiving all needed referrals for specialty care (among those with need), 4) receiving needed help coordinating health and health-related care (among those with need), and 5) receiving family-centered care [14, 16-18]. An adolescent must have all five components to be considered to have medical home access.

Confounders and Potential Moderators: The adjusted regression model controlled for: age, gender, race/ethnicity, primary language spoken at home, region of country, health insurance, household poverty status, parental education, family structure, and special health care needs. Age was divided into early adolescents (ages 12-14) and middle adolescents (ages 15-17). Race and ethnicity categories were defined as: Hispanic; black, non-Hispanic; white, non-Hispanic; multi/other, non-

Hispanic. Categories for languages spoken at home in the NSCH were English and any language other than English. Regions of the USA were characterized according to the US Census Bureaus' definition of the Northeast, the Midwest, the West, and the South [19]. Health insurance was categorized as public insurance, private insurance, or no insurance. Household poverty level was computed according to household income in relation to the federal poverty level: 0-99%, 100-199%, 200-399%, and 400% or higher. Parental/caregiver education was computed as the highest level of parental or caregiver education attained, recoded into three levels: less than a high school education, a high school education, or more than a high school education. Family structure was categorized as: two biological or adoptive parents; two parents with one being a step-parent; a single mother; or an "other" family type. Special health care needs were identified using a five item questionnaire asking if a child: 1) needs or uses prescription medication, 2) has an above average use of routine services, 3) needs or uses specialized therapies or services, 4) needs or uses mental health counseling, and 5) experiences a functional limitation. Adolescents reported to have one or more of these five items were classified as having special health care needs [20-22].

Adolescent Outcomes: The outcomes analyzed were flourishing, school engagement, general health, school attendance, physical activity, preventive dental visits, condition of teeth, and well visits and preventive services. Flourishing is a binary variable where "usually/always flourishing" corresponds to those who endorsed usually/always to all three flourishing components on the NSCH, and those who endorsed sometimes, rarely, or never to any flourishing component were labeled

as “sometimes/rarely/never flourishing.” The three flourishing components asked about finishing tasks and follows through with plans, staying calm when presented with a challenge, and showing an interest in learning new things [14, 23]. The well visit and preventive services binary variable was categorized by either having had one well visit in the past 12 months, or having had no visit in the past 12 months. The binary school engagement variable was categorized as “usually/always” for those who endorsed both school engagement questions asked in the NSCH, and “sometimes/rarely/never engaged in school” for all other responses. The components of school engagement were if a child completed all their homework and cared about doing well in school over the past month [14]. General health was endorsed and categorized into one of two groups: 1) “excellent or very good” or, 2) “good, fair or poor.” School attendance was categorized as a binary variable with adolescents placed in one category if parents/guardians reported they missed less than 5 days of school, and a second category if they missed 5 or more days of school. Physical activity was categorized as either having 5 or more days with 20 or more minutes of vigorous physical activity in the past week, or having 4 or fewer days with 20 or more minutes of vigorous physical activity in the past week, as reported by a parent/guardian. Preventive dental visits were categorized as either having 2 or more dental visits in the past 12 months, or having less than 2 dental visits in the past 12 months. Teeth condition was categorized as either “excellent or very good” or “good, fair, or poor” according to a parent/guardian.

Statistical Analysis: All statistical analyses were computed using STATA, version 14.0 [24]. All analyses accounted for the weighting and complex survey

design of the NSCH [14]. After excluding those with invalid information for medical homes, outcome variables, and all covariates, the final analytic sample contained 33,701 adolescents. First, bivariate analyses evaluated the relationship between PCMH access and covariates as well as the relationship between PCMH access and adolescent outcomes. Next, we ran separate regression models using the binomial distribution with a log link to obtain risk ratios for each outcome, controlling for age, gender, race/ethnicity, primary language spoken at home, region of country, household poverty status, health insurance, parental education, family structure and special health care needs. Next, models stratified by special health care needs of the child were run since those who have special health care needs require more care and must meet higher PCMH access criteria. We also examined models without poverty and parental education. Since the results were substantially the same, we present the full models.

Results:

A little over half of all adolescents (52%) had access to a PCMH, but significant racial and ethnic disparities were seen. Among adolescents with PCMH access, 12% were Hispanic, 12% were black, 68% were white, and 8% were a multi/other race. Among adolescents without PCMH access, 28% were Hispanic, 17% were black, 45% were white, and 10% were a multi/other race ($p<0.01$). Disparities in PCMH access were also seen by primary language spoken at home, with 95% of those with medical home access primarily speaking English, compared to 82% of those without medical home access primarily speaking English as their primary language at home ($p<0.01$). Among those with access, there were a lower

proportion of poor adolescents and a higher proportion of wealthy adolescents. For example, 12% of adolescents with access were living at 0-99% of the federal poverty level, while 39% were living at 400% or more of the federal poverty level. No pattern was seen by income level among those without medical home access. There were fewer adolescents who had public health insurance compared to private insurance for those with and without PCMH access. For example, 24% had public insurance, while 74% had private insurance among those with medical home access ($p<0.01$). Among those with and without medical home access, there were fewer adolescents who had parents with less than a high school education compared to those with more than a high school education. For example, among parents of adolescents with medical home access, 6% had less than high school education, while 78% had more than a high school education ($p<0.01$). In relation to family distributions, the largest percentage of adolescents with and without PCMH access had two biological parents, followed by a single mother, then two parents with one being a stepparent. For example, 63% of those with medical home access had two biological parents, 17% had a single mom, and 13% had two parents with one being a stepparent ($p<0.01$). Among those with medical home access, 23% had special health care needs, compared to 27% of those without access ($p<0.01$).

Disparities were also seen by adolescent health outcome. Out of those with medical home access, 86% had a preventive visit in the past year, compared to 78% of adolescents without access ($p<0.01$). The adjusted risk of having a preventive visit in the past year for those with medical home access was 1.04 (95% CI: 1.01, 1.06) compared to those without access. As for general health of those with PCMH access,

90% had excellent or very good health, while among adolescents with no access, 77% had excellent or very good health ($p<0.01$). The adjusted risk of having excellent or very good general health for those with medical home access was 1.04 (95% CI: 1.03, 1.07) compared to those without access. A total of 72% of those with PCMH access missed less than 5 days of school, while 68% of those without PCMH access missed less than 5 days of school ($p<0.01$). A total of 68% of those with medical home access had 2 or more dental visits in the past year, compared to 57% of those without PCMH access who had 2 or more dental visits in the past year ($p<0.01$). The adjusted risk of having a dental visit in the past year for those with medical home access was 1.06 (95% CI: 1.01, 1.10) compared to those with no access. For the condition of teeth, 78% of those with PCMH access had excellent or very good teeth condition, compared to 62% of those without PCMH access who had excellent or very good teeth ($p<0.01$). For those with PCMH access, the adjusted risk of having excellent or very good teeth was 1.10 (95% CI: 1.06, 1.13) compared to those without PCMH access.

Among those with PCMH access, 56% of adolescents were flourishing, compared to adolescents without PCMH access who had 40% flourishing ($p<0.01$). Among those with medical home access, the adjusted risk of flourishing was 1.25 (95% CI: 1.18, 1.33) compared to those without medical home access. School engagement among those with medical home access had 80% engaged, while 72% of those without access were engaged ($p<0.01$). The adjusted risk of being engaged in school for those with PCMH access was 1.06 (95% CI: 1.04, 1.09) compared to those without medical home access. Those with access to a medical home had 1.04 (95%

CI: 1.01, 1.08) times the adjusted risk of missing less than five days of school compared to those who had no access. Those with PCMH access had 53% with 5 or more days of physical activity compared to those without PCMH access who had 45% with 5 or more days of physical activity ($p < 0.01$). The adjusted risk of having 5 or more days of physical activity among those with PCMH access was 1.06 (95% CI: 1.00, 1.11) compared to those with no PCMH access.

Discussion:

In the 2011-2012 National Survey of Children's Health (NSCH), adolescents with PCMH access had healthier outcomes and received more preventive care compared to those without medical home access. There were modest differences in adolescent outcomes based on medical home status, and these associations persisted after adjusting for covariates. Our study suggests that PCMH access can help adolescents attain the goal of receiving one preventive visit per year, as recommended by the AAP [7, 25], and supports the findings of previous literature, in which adolescents with access to a PCMH were more likely to receive preventive services compared to those without access [12].

Study findings suggest PCMH access relates positively to several health-related outcomes. Adolescents with medical home access were healthier than those without access and performed better in school settings as seen in the areas of flourishing, school engagement, and school attendance. Previous studies have largely analyzed process measures that occur during health care visits, such as receipt of flu shots, STD screenings, and other immunizations, but our study contributes novel analyses on outcomes that occur outside of the medical setting, such as school

performance and flourishing [9, 12]. Our study also contributes evidence that PCMH practices can improve oral health. Literature on the relationship between dental care outcomes and medical home access is scant, but according to the Patient Centered Primary Care Collaborative, dental care should be incorporated into a PCMH model of health care to facilitate more dental care delivery [26].

Historically, the emphasis in the pediatric medical home movement was placed on children and adolescents with special health care needs due to their higher use of the healthcare services such as specialty services, lab tests, and medications [27]. Our study shows, however, that adolescents with special health care needs have less access to medical home compared to those without special health care needs. We're hesitant, however, to draw conclusions about these findings. It is unclear from our study whether or not we are measuring true PCMH access for adolescents with special health care needs. Those who have special health care needs are in need of more care, and therefore must meet higher criteria for PCMH (needed referrals for specialty care, and needed care coordination). As one study previously reported, less than half of children with special needs (ages 0-17) had all PCMH components, with many of those lacking care coordination and family centered care in particular [28]. Meeting all of the criteria for PCMH access among those in need is difficult, and therefore when we look at those with and without medical home access, we don't know if it is that an adolescent doesn't have access to a medical home, or that the clinical setting has implemented medical home innovations but due to higher requisite of medical home criteria, an adolescent with special health care needs simply cannot meet all the criteria. In addition, these results are based on parent reports rather than

assessment of the services a clinical setting offers. There might be something about healthy adolescents that influences their parents' responses to questions about medical home access such that a parent might view their healthy child's clinical care as positive, report that their child has medical home access, and as a result the clinical setting seemingly gets credit for that healthy individual. In that case, we may be measuring perceptions of PCMH practices, rather than measuring true medical home access and true non-access.

To better understand the relationship between adolescents with special health care needs and adolescent outcomes, the regression results were stratified by special health care needs. While the unstratified results showed a significant relationship between PCMH access and having a preventive care visit compared to those without medical home access (Table 4), the stratified results revealed that those special needs adolescents with medical home access did not have a significant relationship between PCMH access and preventive visits compared to special needs adolescents without medical home access (Table 5). This suggests that if an adolescent has special needs, they are likely receiving preventive care services regardless of medical home status. We could also be seeing the effect previously mentioned, in which an adolescent may have special needs, receives care in a setting that has made PCMH advances, but due to the high medical home criteria in the NSCH, is not considered to have a medical home.

One limitation of this study, as noted above, is that medical home access is based on report rather than direct assessment of clinical settings and care provision, so we don't know if we are measuring perceptions of medical homes/medical home

criteria or true PCMH access. A second limitation is that these responses are parent, rather than adolescent reported, which may have introduced reporter bias into this study. Previous literature has shown parents overestimate their child's health outcomes. For example, 80% of parents reported in the National Health and Nutrition Examination Survey (NHANES) that their child received at least one dental visit in the past year, but objective surveillance reports that only about 50% of those ages 6-20 received at least one dental visit [29].

Conclusion:

Adolescents in the US who have access to medical homes receive more preventive medical and dental care, perform better in school and thrive more than adolescents who do not have access. Our findings display the positive impact of medical homes in an adolescent development. Investing in medical home initiatives may help improve medical, behavioral and social aspects of an adolescents life, and may help them have healthy adolescent years.

Table 1: Demographics of Adolescents ages 12-17 from the 2011-2012 NSCH*

Outcome Measure	All Adolescents <i>unweighted n, (weighted %)</i>	Has PCMH	Does Not Have PCMH
All Adolescents	33,701 (100%)	19,007 (51.86%)	13,598 (48.14%)
Age			
Early adolescence 12-14	15,791 (49.62%)	9,046 (49.64%)	6,272 (49.62%)
Middle Adolescence 15-17	17,910 (50.38%)	9,961 (50.36%)	7,326 (50.38%)
Gender			
Male	17,638 (51.29%)	9,837 (50.4%)	7,196 (51.80%)
Female	16,026 (48.71%)	9,153 (49.60%)	6,384 (48.20%)
Race/Ethnicity			
Hispanic	3,621 (19.96%)	1,369 (12.13%)	2,123 (28.20%)
Black, Non-Hispanic	3,094 (14.42%)	1,364 (11.9%)	1,630 (17.31%)
White, Non-Hispanic	23,231 (56.48%)	14,464 (67.74%)	8,070 (44.77%)
Multi/Other, Non-Hispanic	3,100 (9.14%)	1,502 (8.23%)	1,461 (9.71%)
Primary Language Spoken at Home			
English	31,850 (88.40%)	18,571 (95.46%)	12,281 (81.64%)
Other	1,835 (11.60%)	430 (4.54%)	1,309 (18.36%)
Region of Living			
Northeast	6,247 (17.15%)	3,725 (18.16%)	2,306 (16.02%)
Midwest	8,172 (21.80%)	4,937 (24.44%)	3,008 (19.06%)
West	8,467 (23.74%)	4,415 (20.55%)	3,734 (26.93%)
South	10,815 (37.31%)	5,930 (36.85%)	4,550 (37.99%)
Household Poverty Status			
0-99%	4,169 (18.55%)	1,565 (11.98%)	2,432 (25.20%)
100-199%	5,581 (20.58%)	2,617 (17.32%)	2,768 (23.96%)
200-399%	10,466 (29.22%)	6,084 (31.65%)	4,073 (26.82%)
400% or higher	13,485 (31.63%)	8,741 (39.05%)	4,325 (24.03%)
Health Insurance			
Public	7,629 (30.23%)	3,379 (23.60%)	3,978 (36.91%)
Private	24,195 (63.95%)	15,060 (73.62%)	8,409 (54.03%)
Uninsured	1,571 (5.82%)	465 (2.78%)	1,039 (9.06%)
Parental Education			
Less than high school	1,551 (10.48%)	449 (5.68%)	1,033 (15.47%)
High school graduate	4,960 (19.74%)	2,317 (16.15%)	2,494 (23.42%)
More than high school	25,329 (69.78%)	15,385 (78.17%)	9,151 (61.11%)
Family Structure			
Two parent, biological or adopted	21,854 (59.00%)	13,194 (63.48%)	7,972 (54.24%)
Two parent, step	3,478 (13.04%)	1,821 (12.88%)	1,564 (13.51%)
Single mother, no father present	5,383 (19.47%)	2,592 (16.66%)	2,611 (22.42%)
Other family type	2,646 (8.49%)	1,224 (6.98%)	1,302 (9.83%)
Special Health Care Needs			
Any	8,625 (24.96%)	4,294 (22.95%)	4,084 (27.46%)
None	25,076 (75.04%)	14,713 (77.05%)	9,514 (72.54%)
Well-visits & Preventive Services			
1 or more wellness visit in the last 12 months	27,810 (82.08%)	16,351 (85.93%)	10,679 (78.47%)
No wellness visits in the last 12 months	5,750 (17.92%)	2,598 (14.07%)	2,864 (21.53%)
Flourishing			
Usually/always flourishing	17,315 (48.10%)	11,055 (55.90%)	5,703 (39.85%)
Sometimes/rarely/never flourishing	16,386 (51.9%)	7,952 (44.10%)	7,895 (60.15%)
School engagement			
Usually/always engaged in school	26,019 (76.37%)	15,520 (80.44%)	9,656 (72.01%)
Sometimes/rarely/never engaged in school	7,682 (23.63%)	3,487 (19.56%)	3,942 (27.99%)
General Health			
Excellent or very good	29,341 (83.89%)	17,486 (90.23%)	10,923 (77.23%)
Good, fair or poor	4,360 (16.11%)	1,521 (9.77%)	2,675 (22.77%)
School Attendance			
Missed less than 5 days	23,405 (70.54%)	13,644 (71.97%)	8,966 (68.62%)
Missed 5 or more days	10,296 (29.46%)	5,363 (28.03%)	4,632 (31.38%)
Physical Activity			
5 or more days of physical activity	16,856 (48.98%)	10,021 (52.55%)	6,324 (45.49%)
4 or fewer days of physical activity	16,844 (51.02%)	8,985 (47.45%)	7,274 (54.51%)
Preventive Dental Visits			
2 or more dental visits per year	22,549 (62.55%)	13,459 (67.72%)	8,401 (57.19%)
Less than 2 dental visits per year	11,152 (37.45%)	5,548 (32.28%)	5,197 (42.81%)
Condition of Teeth			
Excellent or very good	26,125 (71.03%)	15,991 (79.88%)	9,332 (61.75%)
Good, fair or poor	7,576 (28.97%)	3,016 (20.12%)	4,266 (38.25%)

*Bolded values represent p-value less than 0.01

Table 2: Child Health Outcomes for Those with PCMH Access Compared to Those Without PCMH Access, Stratified by CSHCN

	Unadjusted RR	Adjusted RR*	CSHCN Adjusted RR**	Non-CSHCN Adjusted RR***
Well Visits and Preventive Services	1.10 (1.07, 1.12)	1.04 (1.01, 1.06)	1.04 (1.02, 1.06)	1.04 (1.02, 1.06)
Flourishing	1.40 (1.33, 1.48)	1.25 (1.18, 1.33)	1.25 (1.18, 1.32)	1.26 (1.19, 1.33)
School engagement	1.11 (1.09, 1.15)	1.06 (1.04, 1.09)	1.06 (1.04, 1.10)	1.07 (1.04, 1.10)
General Health	1.17 (1.14, 1.20)	1.04 (1.03, 1.07)	1.05 (1.03, 1.07)	1.05 (1.03, 1.07)
School Attendance	1.05 (1.02, 1.08)	1.04 (1.01, 1.08)	1.05 (1.01, 1.08)	1.05 (1.01, 1.08)
Physical Activity	1.16 (1.10, 1.22)	1.06 (1.00, 1.11)****	1.07 (1.02, 1.13)	1.06 (1.01, 1.11)
Preventive Dental Visits	1.18 (1.14, 1.23)	1.06 (1.01, 1.10)	1.06 (1.02, 1.11)	1.07 (1.03, 1.11)
Condition of Teeth	1.29 (1.25, 1.34)	1.10 (1.06, 1.13)	1.10 (1.07, 1.13)	1.11 (1.07, 1.14)

* Model 1 adjusted for age, sex, race, primary language spoken at home, region of living, insurance, parental education, poverty, family structure and CSHCN.

** Model 1 results with only CSHCN.

*** Model 1 results with only non-CSHCN.

**** P value is 0.033

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