The Value of the Medical Home for Children Without Special Health Care Needs

AUTHORS: Webb E. Long, MD,[a] Howard Bauchner, MD,[a] Robert D. Sege, MD, PhD,[a] Howard J. Cabral, PhD, MPH,[b] and Arvin Garg, MD, MPH[a]

[a]Department of Pediatrics, Boston University School of Medicine/Boston Medical Center; and [b]Department of Biostatistics, Boston University School of Public Health, Boston, Massachusetts

Address correspondence to Webb E. Long, Boston University School of Medicine/Boston Medical Center, Department of Pediatrics, Division of General Pediatrics, 88 East Newton St, Vose Hall 3rd Floor, Boston, MA 02118. E-mail: webb.long@bmc.org

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WHAT'S KNOWN ON THIS SUBJECT: The medical home is associated with beneficial outcomes in children with special health care needs and in the entire pediatric population. It is unknown if it benefits the majority of the pediatric population (ie, children without special health care needs).

WHAT THIS STUDY ADDS: This study is the first to demonstrate an association between the medical home and beneficial health care utilization, child health, and health-promoting behavior outcomes in children without special health care needs.

abstract

OBJECTIVE: Although the medical home is promoted by the American Academy of Pediatrics and the Affordable Care Act, its impact on children without special health care needs is unknown. We examined whether the medical home is associated with beneficial health care utilization and health-promoting behaviors in this population.

METHODS: This study was a secondary data analysis of the 2003 National Survey of Children's Health. Data were available for 70 007 children without special health care needs. We operationalized the medical home according to the National Survey of Children's Health design. Logistic regression for complex sample surveys was used to model each outcome with the medical home, controlling for sociodemographic characteristics.

RESULTS: Overall, 58.1% of children without special health care needs had a medical home. The medical home was significantly associated with increased preventive care visits (adjusted odds ratio [aOR]: 1.32 [95% confidence interval (CI): 1.22–1.43]), decreased outpatient sick visits (aOR: 0.71 [95% CI: 0.66–0.76]), and decreased emergency department sick visits (aOR: 0.70 [95% CI: 0.65–0.76]). It was associated with increased odds of "excellent/very good" child health according to parental assessment (aOR: 1.29 [95% CI: 1.15–1.45) and health-promoting behaviors such as being read to daily (aOR: 1.46 [95% CI: 1.13–1.89]), reported helmet use (aOR: 1.18 [95% CI: 1.03–1.34]), and decreased screen time (aOR: 1.12 [95% CI: 1.02–1.22]).

CONCLUSIONS: For children without special health care needs, the medical home is associated with improved health care utilization patterns, better parental assessment of child health, and increased adherence with health-promoting behaviors. These findings support the recommendations of the American Academy of Pediatrics and the Affordable Care Act to extend the medical home to all children. *Pediatrics* 2012;129:87–98

The American Academy of Pediatrics (AAP) defines the medical home as a model of care that is "accessible, family-centered, continuous, comprehensive, coordinated, compassionate and culturally effective" and promotes it as the source of primary care for all children.[1] Although it was conceived for all children, the medical home was initially promoted nationally by the Maternal and Child Health Bureau's Division of Services for Children with Special Health Care Needs (CSHCN)[1–4] and has been studied primarily in that population. Among CSHCN, it is associated with numerous positive health outcomes, such as decreased emergency department (ED) utilization[5–7] and hospitalization rates.[8–10] However, it remains unknown whether the medical home is beneficial for the majority of the pediatric population (ie, children without special health care needs). The need to address this question is emphasized by the recent enactment of the Patient Protection and Affordability Act, which promotes the "patient-centered medical home" for all patients.[11]

A recent study found an association between the medical home and both increased preventive care visits and decreased unmet needs in a nationally representative sample of the entire pediatric population.[12] However, this study included children with and without special health care needs. To our knowledge, no studies to date have investigated children without special health care needs as the sole group. In addition, studies have focused primarily on health care utilization outcomes. However, those short-term outcomes, such as ED utilization and hospitalization, are infrequent in healthy children. Measurement of the more common healthy behaviors included in the AAP's Bright Futures health supervision guidelines would also match the intent of the medical home model to promote all aspects of a child's health and well-being.[1]

We studied the association between having a medical home and health care utilization, child health, and health-promoting behavior outcomes using a nationally representative dataset. We hypothesized that having a medical home would be associated with better outcomes for children without special health care needs.

METHODS

Data Set

This study was a secondary data analysis of the 2003 National Survey of Children's Health (NSCH). The NSCH was designed by the Maternal and Child Health Bureau and conducted by the Centers for Disease Control and Prevention's National Center for Health Statistics. The NSCH was conducted over 2 years in English and Spanish via random-digit dialing using the State and Local Area Integrated Telephone Survey mechanism, and collected information on 102 353 children aged <18 years nationally.[13] An adult respondent in each participating household was asked 295 questions grouped into 11 sections regarding a single randomly selected child in the household. Sections included questions regarding the following domains: demographic information, health and functional status, health insurance coverage, health care access and utilization, the medical home, family functioning, parental health, and neighborhood characteristics. The survey was clustered at the household level and stratified at the state level. Weighting based on gender and telephone-ownership distribution was derived from national census data.[13]

Study Population

The 2003 NSCH collected data on 102 353 children. Because the study's focus was on children without special health care needs, we excluded CSHCN. This status was determined by the response to questions comprising the externally validated Child and Adolescent Health Measurement Initiative's CSHCN Screener.[14] Approximately 18% of the original sample were CSHCN (n = 18 578). To focus exclusively on the impact of a medical home among children with a regular provider of care, we only analyzed data from children with a personal doctor or nurse (PDN). More than 15% of children without special health care needs did not have a PDN (n = 12 968) and were excluded from all analyses. Data regarding the presence of a medical home were not available for 541 of the remaining children, leaving a study sample of 70 007 (68.4% of the original sample; Fig 1).

Medical Home

The presence of a medical home was established through a series of questions in the survey designed to measure 6 of the 7 key components of the medical home as defined by the AAP (Fig 2).[1] Our definition was consistent with the dataset's protocol; previous investigators have used this same definition.[15–17]

Questions for each component of the medical home were coded on an ordinal scale assessing frequency of access (never, sometimes, usually, or always). These ordinal responses were re-coded as numerical values representing percentages ("never" = 0, "sometimes" = 25, "usually" = 75, and "always" = 100) and were averaged across the questions. The component was considered present if the average was ≥67 (ie, usually or more frequently).

The accessible, coordinated, and comprehensive care components were first assessed via a dichotomous screening question to establish whether further questioning was needed. Affirmative answers to a screening question triggered

additional ordinal-scaled questions. A given component was considered present if the response to the screening question was "no" or the average of the ordinal-scaled questions was usually or more frequently.

Assessment of the comprehensive care component also included a single dichotomous question on preventive care visits in the previous 12 months. For children aged ≥24 months, the question was adjusted to inquire about the previous 24 months. Of note, this single question was excluded from the definition of the medical home when we examined the presence of a preventive care visit as a health care utilization outcome.
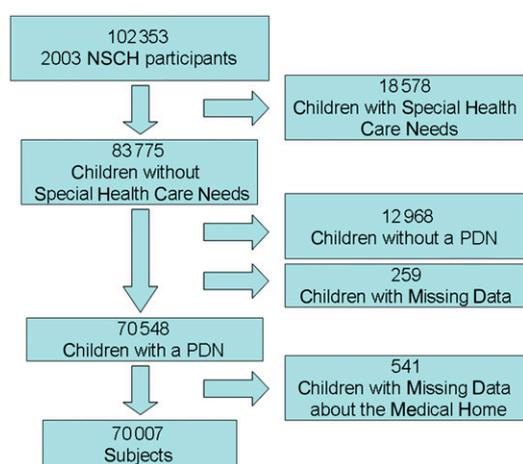
Compassion and family-centeredness were grouped together and assessed through 2 questions coded on an ordinal scale. Cultural effectiveness was assessed through a single ordinal-scaled question. The continuous care component of the medical home was not measured in this survey.

The medical home was only considered to exist if all 6 components were present.

Health Care Utilization, Child Health, and Health-Promoting Behavior Outcomes

Health care utilization outcomes previously demonstrated to be associated with the medical home in other study populations were included (preventive visits,[12] outpatient sick visits, and ED sick visits[7]), along with child health outcomes (parental assessment of global health[18,19] and missed days of school due to illness or injury) and health-promoting behaviors endorsed by Bright Futures[20] and considered evidence based (frequency of being read to daily,[21] frequency of obtaining sufficient sleep nightly,[22] helmet usage,[23] average school day screen time,[24–26] and history of ever being breastfed[27,28]).

We used variables as defined and reported by the designers of the 2003 NSCH (see Appendix 1). We constructed the variables ED sick visits and average school day screen time from

FIGURE 1
Subject selection.

FIGURE 2
Operationalization of the medical home.

the reported variables. To derive the number of ED sick visits, we subtracted the number of ED visits due to an accident, injury, or poisoning from the total number of visits. To derive average school day screen time, we added the average number of hours spent using the computer for purposes other than school work to the average number of hours spent watching television and videos or playing video games. We compressed reported categorical variables into dichotomous variables.[13] To ensure clinical relevance, we used the AAP-recommended <2 hours of screen time per day as the cutoff for average school day screen time[20] and the national average of 3 missed days of school per year due to acute illness as the cutoff for missed days of school.[29]

Data Analysis

Bivariate analyses between the presence of a medical home and sociodemographic characteristics were performed. For continuous variables, the 2-sided *t* test was used to evaluate the equivalence of the mean between those subjects with and without a medical home. Means and SEs, as well as *P* values, were calculated. For categorical variables, the χ^2 test of independence was used to evaluate the association between the medical home and covariates. Frequencies and percentages, as well as *P* values, were calculated. Statistical analysis was performed with SAS software version 9.2 (SAS Institute, Inc, Cary, NC). Survey-specific SAS procedures were used to account for weighting, clustering, and stratification in the survey design (PROC SURVEYMEANS and PROC SURVEYFREQ).

Logistic regression models were used to assess the association between each health care utilization, child health, and health-promoting behavior outcome and the medical home, controlling for

covariates. Each model was initially constructed with all sociodemographic covariates shown in bivariate analysis to be associated with the presence of a medical home, as well as those selected a priori due to demonstrated or theoretical clinical significance. For the health-promoting behavior outcomes, the presence of a preventive care visit in the previous 12 months was also entered into the regression model. Evaluation of the change in the crude effect estimate with and without each covariate was

then used to determine which covariates to include in the final main-effects model. Interaction terms selected in a priori fashion were then individually introduced into the model and assessed in the same fashion (Appendix 2). A survey-specific SAS procedure was used to account for weighting, clustering and stratification in the survey design (PROC SURVEYLOGISTIC). A survey-specific procedure was also used to perform age-group analyses (0–1, 2–5, 6–11, and 12–17 years of age) of each outcome

TABLE 1 Distribution of Sociodemographic Characteristics and Preventive Visits Among Children With and Without Medical Homes

Characteristic	All Children	Children With a Medical Home	Children Without a Medical Home	OR (95% CI)
	(N = 70 007)	(n = 40 678)	(n = 29 329)	
Gender				
Male	49.3 (0.3)	49.1 (0.4)	49.6 (0.5)	Reference
Female	50.7 (0.3)	50.9 (0.4)	50.4 (0.5)	1.0 (0.9–1.1)
Age, mean ± SE, y	8.2 ± 0	7.5 ± 0	9.1 ± 0.1	—
Age, y				
0–1	12.6 (0.2)	16.5 (0.3)	7.5 (0.3)	Reference
2–5	23.7 (0.3)	26.6 (0.4)	19.8 (0.4)	0.6 (0.5–0.7)[a]
6–11	32.3 (0.3)	29.0 (0.4)	36.5 (0.5)	0.3 (0.3–0.4)[a]
12–17	31.5 (0.3)	27.9 (0.4)	36.2 (0.5)	0.3 (0.3–0.4)[a]
Race and ethnicity				
Hispanic	15.1 (0.3)	11.9 (0.3)	19.2 (0.5)	0.5 (0.5–0.6)[a]
Non-Hispanic white	64.6 (0.3)	69.3 (0.4)	58.3 (0.5)	Reference
Non-Hispanic black	13.0 (0.3)	11.8 (0.3)	14.6 (0.4)	0.7 (0.6–0.8)[a]
Non-Hispanic, multiracial	2.9 (0.1)	2.9 (0.1)	2.9 (0.2)	0.9 (0.7–1.0)
Other, non-Hispanic	4.4 (0.2)	4.0 (0.2)	5.0 (0.3)	0.8 (0.6–0.9)[a]
Household income as % of the FPL				
0%–99%	13.9 (0.3)	11.1 (0.3)	17.7 (0.5)	Reference
100%–199%	21.5 (0.3)	19.0 (0.4)	24.7 (0.5)	1.2 (1.1–1.4)[a]
200%–399%	34.8 (0.3)	36.0 (0.4)	33.2 (0.5)	1.6 (1.5–1.8)[a]
≥400%	29.8 (0.3)	33.9 (0.4)	24.4 (0.4)	2.0 (1.8–2.2)[a]
Highest attained parental education				
<High school	5.9 (0.2)	4.2 (0.2)	8.1 (0.4)	Reference
High school	24.4 (0.3)	21.3 (0.4)	28.4 (0.5)	1.4 (1.2–1.7)[a]
>High school	69.8 (0.3)	74.5 (0.4)	63.5 (0.5)	2.1 (1.8–2.5)[a]
Primary language spoken in the home				
English	89.5 (0.3)	92.8 (0.3)	85.1 (0.5)	Reference
Any other language	10.5 (0.3)	7.2 (0.3)	14.9 (0.5)	0.5 (0.4–0.6)[a]
Current health insurance coverage				
No	6.4 (0.2)	4.5 (0.2)	8.8 (0.3)	Reference
Yes	93.6 (0.2)	95.5 (0.2)	91.2 (0.3)	1.7 (1.5–2.0)[a]
Family structure				
2-parent (biological/adoptive)	67.8 (0.3)	71.8 (0.4)	62.5 (0.5)	Reference
2-parent (step)	7.7 (0.2)	7.0 (0.2)	8.6 (0.3)	0.7 (0.7–0.8)[a]
Single mother	20.5 (0.3)	18.0 (0.4)	23.9 (0.5)	0.7 (0.6–0.7)[a]
Other	4.0 (0.1)	3.2 (0.2)	5.0 (0.2)	0.6 (0.5–0.7)[a]
No. of preventive visits in the past 12 mo				
0	20.5 (0.3)	18.3 (0.3)	25.5 (0.6)	Reference
≥1	79.5 (0.3)	81.7 (0.3)	74.5 (0.6)	1.5 (1.4–1.6)[a]

Data are presented as % (SE), unless otherwise indicated.
* Significant at $P < .05$.

(the "domain" statement for PROC SURVEYLOGISTIC). Odds ratios (ORs) and 95% confidence intervals (CIs), as well as P values, were calculated for each model.

Statistical significance was defined as a P value <.05.

Institutional Review Board

The Boston University School of Medicine/ Boston Medical Center Institutional Review Board determined that this study was exempt from human studies review.

RESULTS

Of the 70 007 children without special health care needs included in the analysis, the majority had a medical home (58.1%; n = 40 678).

All of the sociodemographic characteristics with the exception of the subject's gender were unevenly distributed between children with and without medical homes (Table 1). Children who received care within a medical home were more likely to be younger and non-Hispanic white. They were also more likely to speak English at home and to live in a 2-parent (biological/adoptive) family. Children living in households with income ≥400% federal poverty level (FPL) had twice the odds of having a medical home than children living below the FPL. Similarly, children with a parent who was educated beyond high school were more than twice as likely to have a medical home than those whose parents did not complete high school. Having a medical home was positively associated with having current health insurance coverage and a preventive care visit in the previous 12 months.

The majority of the health care utilization outcomes were beneficially associated with the presence of a medical home (Table 2). These results were largely unchanged after controlling for covariates. Children with medical homes

had increased odds of having had a preventive care visit in the previous 12 months (adjusted [aOR]: 1.32 [95% CI: 1.22–1.43]). They also had decreased odds of having had an outpatient sick visit (aOR: 0.71 [95% CI: 0.66–0.76]) and decreased odds of having had an ED sick visit (aOR: 0.70 [95% CI: 0.65–0.76]).

Children with medical homes had greater odds of receiving a parental assessment of "excellent/very good" compared with "good/fair/poor" global health (aOR: 1.29 [95% CI: 1.15–1.45]). There was no difference between the groups for missed days of school (aOR: 1.03 [95% CI: 0.95–1.11]) (Table 3).

Table 4 shows the association, both unadjusted and adjusted, between having a medical home and health-promoting behaviors. Children with medical homes had significantly greater odds of being read to daily (aOR: 1.46 [95% CI: 1.13–1.89]), getting sufficient sleep daily (aOR: 1.56 [95% CI 1.20–2.04]), always using a helmet (aOR: 1.18 [95% CI: 1.03–1.34]), and watching <2 hours of screen time daily (aOR: 1.12 [95% CI: 1.02–1.22]). Although they were more likely to have ever been breastfed in unadjusted analysis, this was not significant after controlling for covariates (aOR: 1.00 [95% CI: 0.88–1.14]).

TABLE 2 Association of a Medical Home With Health Care Utilization Outcomes Among Children Without Special Health Care Needs

Health Care Utilization Outcomes	Children Without Special Health Care Needs			
	% (SE)		OR (95% CI)	aOR (95% CI)[a]
	Children With a Medical Home	Children Without a Medical Home		
Preventive visits[b]				
≥1	81.7 (0.3)	74.5 (0.6)	1.53 (1.43–1.64)*	1.32 (1.22–1.43)*
0	18.3 (0.3)	25.5 (0.6)	Reference	Reference
Outpatient sick visits				
≥1	67.7 (0.4)	71.5 (0.6)	0.83 (0.78–0.89)*	0.71 (0.66–0.76)*
0	32.3 (0.4)	28.5 (0.6)	Reference	Reference
ED sick visits				
≥1	16.0 (0.3)	21.0 (0.5)	0.71 (0.66–0.77)*	0.70 (0.65–0.76)*
0	84.0 (0.3)	79.0 (0.5)	Reference	Reference

[a] Adjusted for gender, age, race and ethnicity, household income as % of the FPL, highest attained parental education, primary language spoken in the home, current insurance coverage, and family structure.
[b] Medical home status defined without number of preventive visits with the PDN in the past 12 months.
* Significant at P < .05.

TABLE 3 Association of a Medical Home With Child Health Outcomes Among Children Without Special Health Care Needs

Child Health Outcomes	Children Without Special Health Care Needs			
	% (SE)		OR (95% CI)	aOR (95% CI)[a]
	Children With a Medical Home	Children Without a Medical Home		
Parental assessment of global health				
Excellent/very good	93.0 (0.2)	87.1 (0.4)	1.93 (1.73–2.15)*	1.29 (1.15–1.45)*
Good/fair/poor	7.0 (02)	12.9 (0.4)	Reference	Reference
Missed days of school in the past 12 mo				
>3	32.1 (0.5)	31.0 (0.6)	1.05 (0.98–1.13)	1.03 (0.95–1.11)
≤3	67.9 (0.5)	69.0 (0.6)	Reference	Reference

[a] Adjusted for gender, age, race and ethnicity, household income as % of the FPL, highest attained parental education, primary language spoken in the home, current insurance coverage, and family structure.
* Significant at P < .05.

TABLE 4 Association of a Medical Home With Health-Promoting Behavior Outcomes Among Children Without Special Health Care Needs

Health-Promoting Behavior Outcomes	Children Without Special Health Care Needs			
	% (SE)		OR (95% CI)	aOR (95% CI)[a]
	Children With a Medical Home	Children Without a Medical Home		
Read to				
Daily	51.9 (0.7)	42.1 (1.0)	1.68 (1.38–2.04)*	1.46 (1.13–1.89)*
Sometimes	41.8 (0.6)	49.4 (1.0)	1.15 (0.94–1.41)	1.16 (0.90–1.50)
Never	6.3 (0.4)	8.5 (0.6)	Reference	Reference
Sufficient sleep				
Daily	68.9 (0.5)	69.6 (0.5)	1.50 (1.19–1.87)*	1.56 (1.20–2.04)*
Sometimes	29.1 (0.5)	27.4 (0.5)	1.60 (1.28–2.02)*	1.43 (1.10–1.88)*
Never	2.0 (0.1)	3.0 (0.2)	Reference	Reference
Helmet usage				
Always	43.8 (0.6)	35.8 (0.7)	1.61 (1.47–1.77)*	1.18 (1.03–1.34)*
Usually	16.2 (0.5)	14.2 (0.5)	1.50 (1.34–1.68)*	1.11 (0.94–1.30)
Sometimes	17.7 (0.5)	20.5 (0.5)	1.13 (1.02–1.26)*	1.10 (0.95–1.27)
Never	22.3 (0.5)	29.4 (0.6)	Reference	Reference
Average school day screen time, h				
<2	68.4 (0.4)	55.8 (0.5)	1.72 (1.63–1.82)*	1.12 (1.02–1.22)*
≥2	31.6 (0.4)	44.2 (0.5)	Reference	Reference
Breastfed ever				
Yes	75.2 (0.5)	70.9 (0.9)	1.25 (1.13–1.38)*	1.00 (0.88–1.14)
No	24.8 (0.5)	29.1 (0.9)	Reference	Reference

[a] Adjusted for gender, age, race and ethnicity, household income as % of the FPL, highest attained parental education, primary language spoken in the home, current insurance coverage and family structure, and number of preventive visits in the previous 12 months.

* Significant at $P < .05$.

In subgroup analysis stratifying according to age, children aged 0 to 1 year had the strongest association between a medical home and both increased preventive care visits (aOR: 1.67 [95% CI: 1.08–2.57]) and global health being excellent/very good (aOR: 1.44 [95% CI: 1.02–2.04]). The medical home was no longer significantly associated with increased parental global health rating for children aged 2 to 5 years. School-aged children (6–11 years) had the strongest association between a medical home and fewer ED sick visits (aOR: 0.64 [95% CI: 0.55–0.74]) (Table 5). Adolescents (12–17 years of age) had the strongest association between a medical home and fewer outpatient sick visits (aOR: 0.67 [95% CI: 0.59–0.75]). There remained no association with missed days of school stratified by age. Differences across groups also existed among health behavior outcomes, but no pattern emerged.

DISCUSSION

Our study found a beneficial relationship between numerous health outcomes and the medical home in children without special health care needs. Although some of the effect sizes were modest, the health care utilization outcomes (preventive visits, outpatient sick visits, and ED sick visits) were robust (~30%).

Children without special health care needs compose the majority of the pediatric population (>80% in this national dataset). The AAP has long promoted the medical home for all children,[4] and the Affordable Care Act of 2009 promotes the patient-centered medical home; this study provides further evidence supporting these policies. Our findings are significant given that studies to date have focused primarily on CSHCN. Although some studies have included all children, it was unclear if the positive associations found were due solely to

the effect of CSHCN in the study populations, or if they exist independent of CSHCN.[12,30–41] Our findings suggest that the benefits of the medical home for children without special health care needs mirror those experienced by CSHCN.

Our study broadened the outcomes measures assessed. Previous studies have focused on clinical outcomes such as ED utilization[5,6,32,34,37] and immunizations.[30,31,33,35–37,39–41] The medical home concept, however, is explicitly designed to provide care for all aspects of a child's health and well-being.[1] We therefore selected health-promoting behavior outcomes previously demonstrated to be positively associated with child health.[21,23–28] The presence of a medical home was associated with health-promoting behaviors such as family reading, sleep hygiene, helmet use, and decreased screen time. Although the effects are modest, the near-universal reach of health care for children suggests that there may be a significant public health impact. We believe that future studies examining the impact of the medical home should consider reporting similar health-promoting behaviors.

Our findings have several implications for public policy and the delivery of primary care. Our study supports previous findings which suggest that having a medical home may decrease unnecessary child health care utilization (eg, ED visits), leading to overall health care savings. Studies have estimated that care inappropriately received in the ED costs 2 to 3 times as much as the same care in the appropriate setting.[42,43] A reduction in ED utilization for sick visits of close to 30% would therefore represent a significant cost savings. Furthermore, our data demonstrated that preadolescents, who are more likely to have inappropriate ED utilization than adolescents or adults,[44] may benefit the

TABLE 5 Association of a Medical Home With Health Care Utilization, Child Health, and Health-Promoting Behavior Outcomes Among Children Without Special Health Care Needs by Age Group

Variable	Children Without Special Health Care Needs											
	Children Aged 0–1 y			Children Aged 2–5 y			Children Aged 6–11 y			Children Aged 12–17 y		
	% (SE)		aOR (95% CI)[a]	% (SE)		aOR (95% CI)[a]	% (SE)		aOR (95% CI)[a]	% (SE)		aOR (95% CI)[a]
	Children With a Medical Home	Children Without a Medical Home		Children With a Medical Home	Children Without a Medical Home		Children With a Medical Home	Children Without a Medical Home		Children With a Medical Home	Children Without a Medical Home	
Health care utilization outcomes												
Preventive visits[b]												
≥1	96.7 (0.4)	91.6 (1.1)	1.67 (1.08–2.57)*	88.5 (0.5)	82.8 (1.0)	1.35 (1.12–1.63)*	74.0 (0.7)	68.7 (1.1)	1.24 (1.10–1.41)*	77.3 (06)	70.3 (0.9)	1.38 (1.23–1.55)*
0	3.3 (0.4)	8.4 (1.1)	Reference	11.5 (0.5)	17.2 (1.0)	Reference	26.0 (0.7)	31.3 (1.1)	Reference	22.7 (0.6)	29.7 (0.9)	Reference
Outpatient sick visits												
≥1	69.2 (0.9)	75.9 (1.7)	0.73 (0.59–0.90)*	76.5 (0.7)	77.4 (1.3)	0.84 (0.71–0.99)*	68.8 (0.8)	73.8 (1.0)	0.73 (0.64–0.83)*	57.1 (0.8)	64.4 (1.0)	0.67 (0.59–0.75)*
0	30.8 (0.9)	24.1 (1.7)	Reference	23.5 (0.7)	22.6 (1.3)	Reference	31.2 (0.8)	26.2 (1.0)	Reference	42.9 (0.8)	35.6 (1.0)	Reference
ED sick visits												
≥1	22.5 (0.9)	35.3 (1.8)	0.69 (0.56–0.84)*	19.3 (0.7)	24.4 (1.2)	0.76 (0.64–0.89)*	12.8 (0.6)	19.1 (0.8)	0.64 (0.55–0.74)*	12.2 (0.5)	16.9 (0.7)	0.70 (0.60–0.80)*
0	77.5 (0.9)	64.7 (1.8)	Reference	80.7 (0.7)	75.6 (1.2)	Reference	87.2 (0.6)	80.9 (0.8)	Reference	87.8 (0.5)	83.1 (0.7)	Reference
Child health outcomes												
Parental assessment of global health												
Excellent/very good	92.9 (0.7)	85.0 (1.3)	1.44 (1.02–2.04)*	93.0 (0.5)	87.4 (0.8)	1.23 (0.96–1.58)	93.2 (0.5)	87.7 (0.7)	1.33 (1.08–1.65)*	92.8 (0.4)	86.9 (0.7)	1.33 (1.10–1.60)*
Good/fair/poor	7.1 (0.7)	15.0 (1.3)	Reference	7.0 (0.5)	12.6 (0.8)	Reference	6.8 (0.5)	12.3 (0.7)	Reference	7.2 (0.4)	13.1 (0.7)	Reference
Missed days of school in the past 12 mo												
>3	—	—	—	—	—	—	32.8 (0.8)	30.6 (0.8)	1.07 (0.96–1.19)	31.4 (0.8)	31.4 (0.8)	0.99 (0.89, 1.10)
≤3	—	—	—	—	—	—	67.2 (0.8)	69.4 (0.8)	Reference	69.6 (0.8)	68.6 (0.8)	Reference
Health-promoting behavior outcomes												
Read to												
Daily	44.1 (1.0)	36.3 (1.7)	1.38 (0.99–1.94)	56.8 (0.8)	44.3 (1.2)	1.78 (1.13–2.79)*	—	—	—	—	—	—
Sometimes	43.2 (1.0)	46.3 (1.8)	1.17 (0.85–1.63)	40.9 (0.8)	50.5 (1.2)	1.35 (0.86–2.11)	—	—	—	—	—	—
Never	12.7 (0.8)	17.5 (1.4)	Reference	2.3 (0.3)	5.1 (0.6)	Reference	—	—	—	—	—	—
Sufficient sleep												
Daily	—	—	—	—	—	—	75.9 (0.7)	77.1 (0.7)	1.00 (0.60–1.69)	61.7 (0.8)	62.1 (0.8)	1.68 (1.23–2.29)*
Sometimes	—	—	—	—	—	—	23.1 (0.7)	21.7 (0.7)	0.97 (0.57–1.64)	35.3 (0.8)	33.1 (0.8)	1.49 (1.09–2.05)*
Never	—	—	—	—	—	—	1.0 (0.1)	1.3 (0.2)	Reference	3.0 (0.3)	4.8 (0.5)	Reference
Helmet usage												
Always	—	—	—	—	—	—	53.0 (0.8)	43.3 (0.9)	1.17 (0.96–1.44)	31.8 (0.9)	25.9 (0.9)	1.19 (1.00–1.42)*
Usually	—	—	—	—	—	—	17.9 (0.6)	15.5 (0.6)	1.16 (0.91–1.48)	13.9 (0.7)	12.5 (0.7)	0.99 (0.79–1.23)
Sometimes	—	—	—	—	—	—	16.1 (0.6)	20.4 (0.7)	0.98 (0.78–1.23)	19.7 (0.8)	20.7 (0.8)	1.19 (0.98–1.44)
Never	—	—	—	—	—	—	13.0 (0.6)	20.8 (0.7)	Reference	34.7 (0.8)	40.9 (1.0)	Reference
Average school day screen time, h												
<2	—	—	—	—	—	—	51.4 (0.8)	46.0 (0.9)	1.14 (1.00–1.30)	37.4 (0.8)	32.3 (0.8)	1.124 (1.00–1.28)
≥2	—	—	—	—	—	—	48.6 (0.8)	54.0 (0.9)	Reference	62.6 (0.8)	67.7 (0.8)	Reference
Breastfed ever												
Yes	77.3 (0.8)	74.9 (1.5)	0.98 (0.79–1.22)	73.9 (0.7)	69.4 (1.1)	1.00 (0.85–1.18)	—	—	—	—	—	—
No	22.7 (0.8)	25.1 (1.5)	Reference	26.1 (0.7)	30.6 (1.1)	Reference	—	—	—	—	—	—

a Adjusted for gender, age, race and ethnicity, household income as % of the FPL, highest attained parental education, primary language spoken in the home, current insurance coverage, and family structure.
b Medical home status without number of preventive visits in the past 12 months.
* Significant at P < .05.

most from having a medical home. Thus, although further studies are needed, promoting the medical home among children without special health care needs presents a promising avenue for additional cost savings and improved health.

Our findings are consistent with those among the CSHCN and entire pediatric populations that disparities exist in children's access to medical homes. We found that non-white children without special health care needs were less likely to have a medical home than white children. In addition, we found gradients with respect to socioeconomic status measures such as household income and parental education. Given the associations demonstrated in our study between the medical home and beneficial health care utilization patterns, increasing access to the medical home for these families may yield downstream reductions in other health care disparities.

The study has a number of limitations. First, the operationalization of the definition of the medical home is not validated. Although the definition has been agreed upon,[45] measurement of it has not, which has prevented establishment of a validated questionnaire and limits comparison between studies. As used in our study, the definition of the medical home did not capture the continuity

component defined by the AAP.[1] In addition, the presence of a medical home was measured from the family's perspective; this operationalization is therefore different from the systems-centered approach as espoused by the National Committee for Quality Assurance.[46] However, this operationalization has been used by previous investigators who have analyzed this national dataset.[15] Second, the data may not reflect the promotion of the medical home that has occurred since 2003. We chose these data instead of the 2007 NSCH as the latter did not measure ED and outpatient sick visits. Our data are the most recent available for these key outcome measures, and we therefore believe that our findings remain relevant to current policy and practice. Additional studies using more recent data, such as the forthcoming 2011 NSCH, will be useful. Third, the data were collected by self-report and were not validated, with the exception of CSHCN status.[14] Fourth, this was a cross-sectional study, and therefore we cannot determine causality. Finally, although results were adjusted to account for the racial and socioeconomic disparities discussed here, it is possible that there were other unmeasured differences between the populations that may account for some of the differences attributed to medical home

status. Further prospective studies examining the causal relationships between the medical home and health outcomes in children without special health care needs are needed.

CONCLUSIONS

This study provides evidence that the medical home is associated with beneficial health care utilization, child health, and health-promoting behavior outcomes in children without special health care needs. Our findings strengthen the evidence base for the AAP's recommendation that all children have a medical home. With the advent of federal legislation promoting the medical home for all children, it is increasingly important that studies further investigate this subject to better understand and improve health care for all children.

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APPENDIX 1 Study Variables and Their Associated 2003 NSCH Question(s)

Study Variable	Associated 2003 NSCH Question(s)
Demographic characteristics	
• Gender	• Is [CHILD] male or female?
• Age	• Many of my questions are for children of certain ages. So, I'll know which questions to ask, please tell me the [age/ages] of the [child/children] less than 18 years old living in this household.
• Race and ethnicity	• Is [CHILD] of Hispanic or Latino origin?
	• Now, I'm going to read a list of categories. Please choose one or more of the following categories to describe [CHILD]'s race. Is [CHILD] white, Black or African American, American Indian, Alaska Native, Asian, or Native Hawaiian or other Pacific Islander?
• Household income	• Now I am going to ask you a few questions about your income. Please think about your total combined FAMILY income during (CATI: FILL LAST CALENDAR YEAR) for all members of the family. Include money from jobs, social security, retirement income, unemployment payments, public assistance, and so forth. Also, include income from interest, dividends, net income from business, farm, or rent, and any other money income received. Can you tell me that amount before taxes?
• Highest attained parental education	• What is the highest level of education attained by anyone in your household?
• Primary language spoken in the home	• What is the primary language spoken in your home?
• Current health insurance coverage	• Does [CHILD] have any kind of health care coverage, including health insurance, prepaid plans such as HMOs, or government plans such as Medicaid?
• Family structure	• Earlier you told me you are [CHILD]'s [mother/father]. Are you [CHILD]'s biological, adoptive, step, or foster [mother/father]?
	• Earlier you told me you are [CHILD]'s [ANSWER TO S1Q02)]. [Other than yourself does/Does] [S.C]. have any (other) parents, or people who act as [his/her] parents, living here?
• Presence of PDN	• A personal doctor or nurse is a health professional who knows your child well and is familiar with your child's health history. This can be a general doctor, a pediatrician, a specialist doctor, a nurse practitioner, or a physician assistant. Do you have one or more persons you think of as [CHILD]'s personal doctor or nurse?
• Child with special health care needs status	• Does [CHILD] currently need or use medicine prescribed by a doctor, other than vitamins?
	• Is [his/her] need for prescription medicine because of ANY medical, behavioral, or other health condition?
	• Is this a condition that has lasted or is expected to last 12 mo or longer?
	• Does [CHILD] need or use more medical care, mental health, or educational services than is usual for most children of the same age?
	• Is [his/her] need for medical care, mental health or educational services because of ANY medical, behavioral, or other health condition?
	• Is this a condition that has lasted oris expected to last 12 months or longer?
	• Is [CHILD] limited or prevented in any way in [his/her] ability to do the things most children of the same age can do?
	• Is [his/her] limitation in abilities because of ANY medical, behavioral, or other health condition?
	• Is this a condition that has lasted or is expected to last 12 mo or longer?
	• Does [CHILD] need or get special therapy, such as physical, occupational, or speech therapy? [SPECIAL THERAPY INCLUDES PHYSICAL, OCCUPATIONAL, OR SPEECH THERAPY. DO NOT INCLUDE PSYCHOLOGICAL THERAPY.]
	• Is [his/her] need for special therapy because of ANY medical, behavioral, or other health condition?
	• Is this a condition that has lasted or is expected to last 12 mo or longer?
	• Does [CHILD] have any kind of emotional, developmental, or behavioral problem for which [he/she] needs treatment or counseling?
	• Has [his/her] emotional, developmental or behavioral problem lasted or is it expected to last 12 mo or longer?
Health care utilization outcomes	
• Preventive visits	• [During the past 12 mo/Since [his/her] birth], how many times did [CHILD] see a doctor, nurse, or other health care professional for preventive medical care such as a physical exam or well-child check-up?
• Outpatient sick visits	• Excluding emergency department visits, hospitalizations, and well-child care, how many times [during the past 12 mo/Since [his/her] birth], did [he/she] see a doctor, nurse, or other health care professional for sick-child care?
• ED sick visits	• [During the past 12 mo/Since [his/her] birth], how many times did [CHILD] go to a hospital emergency department about [his/her] health? This includes emergency department visits that resulted in a hospital admission.
	• How many emergency department visits were because of an accident, injury, or poisoning?
Child health outcomes	
• Parental assessment of global health	• In general, how would you describe [CHILD] 's health? Would you say [his/her] health is excellent, very good, good, fair, or poor?
• Missed days of school	• During the past 12 mo that is, since [FILL: CURRENT MONTH, 1 YEAR AGO] about how many days did [CHILD] miss school because of illness or injury?
Health-promoting behaviors	
• Frequency of being read to daily	• During the past week, how many days did you or other family members read stories to [CHILD]?
• Frequency of obtaining sufficient sleep nightly	• During the past week, on how many nights did [CHILD] get enough sleep for a child [his/her] age?

APPENDIX 1 Continued

Study Variable	Associated 2003 NSCH Question(s)
• Helmet usage	• How often does [he/she] wear a helmet when riding a bike, scooter, skateboard, roller skates, or rollerblades? Would you say never, sometimes, usually or always?
• Screen time	• On an average school day, about how many hours does [CHILD] use a computer for purposes other than schoolwork? • On an average school day, about how many hours does [CHILD] usually watch TV, watch videos, or play video games?
• History of ever being breastfed	• Was [CHILD] ever breastfed or fed breast milk?

APPENDIX 2 Study Outcome Models Including Covariates, Interaction Terms, and Associated C-Statistics

Study Outcome	Covariates	Interaction Terms	C-Statistic
Health care utilization			
• Preventive visits	• Age • Race and ethnicity • Household income • Highest attained parental education • Primary language spoken in the home • Current health insurance coverage	• None	• 0.662
• Outpatient sick visits	• Gender • Age • Race and ethnicity • Household income • Highest attained parental education • Current health insurance coverage • Family structure	• None	• 0.605
• ED sick visits	• Gender • Age • Race and ethnicity • Household income • Highest attained parental education • Current health insurance coverage • Family structure	• Household income*age	• 0.606
Child health			
• Parental assessment of global health	• Age • Race and ethnicity • Household income • Highest attained parental education • Primary language spoken in the home	• Household income*age	• 4734368*
• Missed days of school	• Gender • Race and ethnicity • Household income • Highest attained parental education • Primary language spoken in the home • Family structure	• None	• 0.574
Health-promoting behaviors			
• Frequency of being read to daily	• Gender • Age • Race and ethnicity • Household income • Highest attained parental education • Primary language spoken in the home • Preventive visits	• Household income*age	• 2448333*
• Frequency of obtaining sufficient sleep nightly	• Age • Race and ethnicity • Household income • Highest attained parental education • Primary language spoken in the home • Current health insurance • Family structure • Preventive visits	• Household income*race and ethnicity	• 3094272*

Study Outcome	Covariates	Interaction Terms	C-Statistic
• Helmet usage	• Gender • Age • Race and ethnicity • Household income • Highest attained parental education • Family structure • Preventive visits	• Household income*age • Household income*race and ethnicity • Household income*family structure	• 4693080*
• Screen time	• Gender • Age • Race and ethnicity • Household income • Highest attained parental education • Family structure • Preventive visits	• Household income*age • Race and ethnicity*family structure	• 0.844
• History of ever being breastfed	• Age • Race and ethnicity • Household income • Highest attained parental education • Primary language spoken in the home • Family structure • Preventive visits	• Household income*race and ethnicity	• 0.657

* Akaike information criterion (AIC)

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