

Geographic Disparities in Access to the Medical Home Among US CSHCN

abstract

OBJECTIVES: In this study we examined geographic disparities in medical home access among US children with special health care needs (CSHCN) aged 0 to 17 years.

METHODS: The 2005–2006 National Survey of Children With Special Health Care Needs was used to estimate prevalence and odds of not having a medical home and 5 component outcomes according to state. Logistic regression was used to examine individual-level and state-level determinants of access.

RESULTS: Medical home access varied substantially across geographic areas. CSHCN in Alaska, Arizona, Washington, DC, Florida, Illinois, Massachusetts, New Jersey, Nevada, and Virginia had at least 50% higher adjusted odds of not having a medical home than CSHCN in Iowa. The adjusted prevalence of CSHCN lacking a medical home varied from a low of 46% in Iowa and Ohio to a high of 59% in Alaska and 61% in New Jersey. CSHCN in several western and southwestern states experienced greater problems with access to a personal doctor/nurse, a usual source of care, specialty care referrals, care coordination, and family-centered care. Adjustment for age, gender, race/ethnicity, household socioeconomic status, language use, insurance coverage, and functional limitation reduced state disparities in access. CSHCN in states with higher immigrant and non-English-speaking populations had significantly lower medical home access. Increases in state health care expenditure and infrastructure and Medicaid/State Children's Health Insurance Program eligibility were associated with increased access to a personal doctor/nurse.

CONCLUSIONS: Although individual-level sociodemographic and state-level health policy variables are important predictors of access, substantial geographic disparities remain, with CSHCN in several western and northeastern states at high risk of not having a medical home. *Pediatrics* 2009;124:S352–S360

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KEY WORDS

medical home, CSHCN, disparities, geography, socioeconomic status, macrosocial, health policy, United States

ABBREVIATIONS

CSHCN—children with special health care needs
NS-CSHCN—National Survey of Children With Special Health Care Needs
SCHIP—State Children's Health Insurance Program

The views expressed are the authors' and not necessarily those of the Health Resources and Services Administration or the US Department of Health and Human Services.

www.pediatrics.org/cgi/doi/10.1542/peds.2009-1255E

doi:10.1542/peds.2009-1255E

Accepted for publication Aug 3, 2009

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PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

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FINANCIAL DISCLOSURE: *The authors have indicated they have no financial relationships relevant to this article to disclose.*

Health and health care inequalities in the United States remain substantial,^{1–3} and in some instances such inequalities have widened over time.^{4–6} Reducing social and geographic inequalities in health and health care continues to be a high priority for the US Department of Health and Human Services.⁷ Providing increased access to a medical home is an important policy objective toward reducing health care disparities and improving health and well-being among all children.^{8,9} A medical home is defined as a source of ongoing, comprehensive, coordinated, family-centered care in the child's primary health care environment.^{8–11} Access to a medical home has been associated with increased use of preventive health services, treatment adherence, and increased care coordination among both the general population and children with special health care needs (CSHCN).^{8,9} Medical home access has also been associated with fewer hospital admissions and emergency department visits, shorter length of hospital stays, reduced familial burden, increased access to needed services, and reduced risks of delayed/forgone care, unmet health care needs, and school absence.^{8,9,12–14} Racial/ethnic and socioeconomic disparities in medical home access have been examined among CSHCN, who comprise 14% of all US children.^{9,10} However, geographic disparities in medical home access among CSHCN have not yet been examined. The purpose of this article is twofold: (1) to estimate the observed and adjusted prevalence and odds of not having access to a medical home among CSHCN across the 50 states and the District of Columbia and (2) to identify individual-level sociodemographic and state-level social and health policy determinants of medical home access among CSHCN.

METHODS

To analyze disparities in medical home access, we used the 2005–2006 National Survey of Children With Special Health Care Needs (NS-CSHCN), a nationally representative telephone survey of 40 723 CSHCN <18 years old.^{15–17} Substantive and methodologic details of the survey are described elsewhere.^{15,16}

Our analysis was based on 38 886 CSHCN for whom the composite medical home variable could be defined. Medical home was operationalized by using questions related to its 5 components: (1) having a usual place for sick/well care; (2) having a personal doctor or nurse; (3) experiencing no difficulty in obtaining needed referrals; (4) receipt of needed care coordination; and (5) the presence of family-centered care.^{9,10}

On the basis of previous research, we used child's age, gender, race/ethnicity, primary language spoken at home, household income/poverty levels, insurance coverage at the time of the survey, child's functional limitation, and state of residence as individual-level covariates.^{8–10} These covariates were measured as shown in Table 1.

Income/poverty status was missing for 9% of the households and was imputed by using a multiple-imputation technique.^{16,18} For all other covariates, there were very few missing responses, which were excluded from the multivariate analyses. The χ^2 statistic was used to test the overall association between each covariate and medical home access. Prevalence (%) estimates of medical home access were computed for all 50 states and the District of Columbia. Multivariate logistic regression was used to examine the association between selected individual-level sociodemographic factors and the binary outcome variables of overall medical home access and its 5 components. Adjusted prevalence estimates were predicted marginals de-

rived from the fitted logistic models. To account for the complex sample design of the survey, SUDAAN¹⁹ software was used to conduct multivariate logistic analyses and to determine crude and adjusted prevalence estimates.

A series of fixed-effects multilevel logistic models were also fitted by using SUDAAN software to estimate the effects of state-level social and health policy factors on the individual likelihood of not having access to a medical home or its 5 component outcomes after adjusting for individual-level covariates such as age, gender, race/ethnicity, language use, household poverty status, insurance coverage, and functional limitation.^{20–22} Considered as state-level factors were poverty rate, percentage immigrant or non-English-speaking population, Medicaid/State Children's Health Insurance Program (SCHIP) eligibility criteria, Medicaid expenditure per child, and several health care expenditure and infrastructure variables, including overall health expenditure and primary care physician supply rates.^{4,5,8,23–26} These variables have been indicated as factors that influence geographic disparities in health and health care.^{4,5,8,25,26} Because of high correlations among the area-level health care expenditure and supply variables, we constructed an index of health care expenditure and infrastructure by combining and factor-analyzing 4 variables: total number of physicians per capita; number of nurses per capita; number of pediatricians per child; and total health expenditure per capita, with factor loadings of 0.94, 0.89, 0.93, and 0.90, respectively. The health care infrastructure index (Cronbach's α , the reliability coefficient = 0.93) had a mean of 100 and an SD of 20, and the index scores ranged from a high of 207.66 for the District of Columbia to a low of 74.52 for Idaho.

TABLE 1 Crude Prevalence and Adjusted Odds and Prevalence of not Having Access to a Medical Home According to State and Selected Sociodemographic Characteristics: 2005–2006 NS-CSHCN (*N* = 38 886)

Covariate	Crude Prevalence		Unadjusted Odds Ratio		Adjusted Odds Ratio ^a		Adjusted Prevalence ^b	
	Weighted %	SE	OR	95% CI	OR	95% CI	%	SE
United States	52.86	0.43						
State of residence		^c						
Alaska	60.74	2.12	2.09	1.65–2.64	1.78	1.39–2.30	59.39	2.14
Alabama	50.00	2.24	1.35	1.06–1.71	1.16	0.90–1.50	49.70	2.22
Arkansas	49.80	2.20	1.34	1.06–1.69	1.16	0.91–1.47	49.56	2.05
Arizona	59.60	1.97	1.99	1.58–2.50	1.61	1.27–2.05	57.16	1.95
California	57.84	2.41	1.85	1.44–2.38	1.48	1.13–1.95	55.25	2.49
Colorado	51.82	2.10	1.45	1.15–1.83	1.33	1.04–1.70	52.73	2.06
Connecticut	51.51	2.07	1.43	1.14–1.80	1.42	1.12–1.81	54.30	1.99
Washington, DC	63.15	2.19	2.31	1.81–2.95	1.54	1.17–2.02	56.05	2.44
Delaware	51.95	2.14	1.46	1.15–1.84	1.45	1.13–1.85	54.70	2.05
Florida	58.07	2.18	1.87	1.47–2.37	1.53	1.19–1.97	55.97	2.15
Georgia	52.75	2.30	1.51	1.18–1.92	1.25	0.97–1.60	51.28	2.18
Hawaii	54.78	2.15	1.63	1.29–2.06	1.38	1.06–1.80	53.66	2.33
Iowa	42.58	2.01	1.00	Reference	1.00	Reference	46.25	1.96
Idaho	52.27	2.04	1.48	1.18–1.85	1.34	1.06–1.70	52.98	1.99
Illinois	54.92	2.21	1.64	1.30–2.08	1.51	1.17–1.94	55.61	2.14
Indiana	45.36	2.22	1.12	0.88–1.42	1.04	0.81–1.34	47.20	2.13
Kansas	44.69	2.12	1.09	0.86–1.37	1.05	0.82–1.35	47.44	2.10
Kentucky	52.68	2.14	1.50	1.19–1.89	1.38	1.08–1.75	53.55	2.02
Louisiana	50.40	2.57	1.37	1.06–1.77	1.12	0.86–1.46	48.80	2.43
Massachusetts	54.26	2.19	1.60	1.26–2.03	1.58	1.23–2.02	56.60	2.14
Maryland	54.43	2.20	1.61	1.27–2.04	1.47	1.14–1.88	54.97	2.12
Maine	48.30	2.00	1.26	1.01–1.58	1.20	0.95–1.52	50.42	1.93
Michigan	54.05	2.10	1.59	1.26–2.00	1.43	1.12–1.81	54.35	1.97
Minnesota	48.18	2.09	1.25	1.00–1.58	1.35	1.06–1.71	53.09	1.96
Missouri	48.19	2.00	1.25	1.00–1.57	1.19	0.94–1.51	50.25	1.93
Mississippi	55.04	2.15	1.65	1.31–2.09	1.31	1.02–1.68	52.42	2.12
Montana	54.07	2.11	1.59	1.26–2.00	1.34	1.05–1.70	52.89	2.04
North Carolina	53.48	2.04	1.55	1.23–1.95	1.41	1.11–1.79	54.12	1.93
North Dakota	48.83	2.08	1.29	1.02–1.62	1.28	1.01–1.62	51.85	1.93
Nebraska	45.78	2.10	1.14	0.90–1.43	1.16	0.91–1.48	49.66	2.05
New Hampshire	50.40	2.02	1.37	1.09–1.72	1.49	1.19–1.88	55.39	1.86
New Jersey	59.24	2.23	1.96	1.54–2.50	1.89	1.46–2.44	60.61	2.15
New Mexico	58.39	1.93	1.89	1.51–2.37	1.38	1.08–1.76	53.53	2.03
Nevada	58.77	2.17	1.92	1.51–2.44	1.57	1.22–2.02	56.52	2.12
New York	54.81	2.12	1.64	1.30–2.06	1.38	1.08–1.76	53.58	2.05
Ohio	44.38	2.07	1.08	0.85–1.35	0.98	0.77–1.25	45.75	2.08
Oklahoma	50.31	2.11	1.37	1.08–1.72	1.20	0.94–1.53	50.41	2.09
Oregon	52.62	2.06	1.50	1.19–1.88	1.29	1.02–1.65	52.14	2.01
Pennsylvania	54.17	2.17	1.59	1.26–2.02	1.45	1.14–1.86	54.80	2.09
Rhode Island	49.09	2.09	1.30	1.03–1.64	1.17	0.92–1.49	49.79	2.03
South Carolina	46.88	2.04	1.19	0.95–1.49	1.04	0.81–1.32	47.04	2.00
South Dakota	46.21	2.01	1.16	0.92–1.45	1.15	0.91–1.45	49.45	1.90
Tennessee	47.29	2.11	1.21	0.96–1.52	1.09	0.85–1.38	48.12	2.01
Texas	53.71	2.07	1.56	1.24–1.97	1.26	0.99–1.60	51.49	2.02
Utah	47.75	2.03	1.23	0.98–1.55	1.17	0.92–1.48	49.78	1.92
Virginia	56.08	2.08	1.72	1.37–2.17	1.62	1.27–2.05	57.16	1.96
Vermont	48.45	2.10	1.27	1.01–1.60	1.32	1.04–1.67	52.52	1.98
Washington	51.74	2.09	1.45	1.15–1.82	1.29	1.02–1.64	52.10	2.01
Wisconsin	45.37	2.07	1.12	0.89–1.41	1.04	0.82–1.33	47.21	1.99
West Virginia	49.53	2.11	1.32	1.05–1.67	1.21	0.95–1.54	50.63	2.02
Wyoming	50.87	2.04	1.40	1.11–1.75	1.32	1.05–1.67	52.61	1.90
Age, y		^c						
0–5	49.62	0.99	1.00	Reference	1.00	Reference	49.69	0.94
6–11	52.56	0.70	1.13	1.02–1.24	1.11	1.01–1.23	52.10	0.69
12–17	54.76	0.65	1.23	1.12–1.35	1.26	1.15–1.39	55.01	0.65
Gender		^c						
Male	53.33	0.57	1.05	0.98–1.12	1.02	0.94–1.09	52.96	0.56
Female	52.15	0.67	1.00	Reference	1.00	Reference	52.60	0.65

TABLE 1 Continued

Covariate	Crude Prevalence		Unadjusted Odds Ratio		Adjusted Odds Ratio ^a		Adjusted Prevalence ^b	
	Weighted %	SE	OR	95% CI	OR	95% CI	%	SE
Race/ethnicity		^c						
Hispanic	67.76	1.39	2.35	2.06–2.68	1.56	1.33–1.83	59.85	1.68
Non-Hispanic white	47.22	0.50	1.00	Reference	1.00	Reference	49.64	0.56
Non-Hispanic black	63.44	1.16	1.94	1.75–2.16	1.57	1.40–1.77	60.02	1.24
Other	56.64	1.64	1.46	1.27–1.67	1.31	1.12–1.52	55.85	1.70
Primary language spoken at home		^c						
English	51.68	0.44	1.00	Reference	1.00	Reference	52.24	0.45
Any other language	77.89	1.99	3.29	2.62–4.14	1.97	1.51–2.58	67.15	2.73
Household poverty status (ratio of family income to poverty threshold), %			^c					
<100	65.97	1.06	2.49	2.22–2.78	1.67	1.48–1.88	59.77	1.15
100–199	58.67	1.03	1.82	1.64–2.02	1.39	1.24–1.55	55.63	1.03
200–399	49.00	0.77	1.23	1.13–1.34	1.15	1.05–1.26	51.29	0.76
≥400	43.81	0.78	1.00	Reference	1.00	Reference	48.02	0.77
Insurance coverage at time of survey			^c					
Yes	52.11	0.44	1.00	Reference	1.00	Reference	52.35	0.44
No	73.50	1.91	2.55	2.10–3.10	1.98	1.61–2.43	67.27	2.10
Impact of condition on activity		^c						
Never affected	39.71	0.69	1.00	Reference	1.00	Reference	41.83	0.71
Somewhat/moderately	56.04	0.69	1.93	1.79–2.09	1.77	1.63–1.92	55.39	0.67
Usually/always/a great deal	68.77	0.87	3.34	3.03–3.69	2.90	2.62–3.21	66.58	0.90

OR indicates odds ratio; CI, confidence interval.

^a Adjusted by multivariate logistic regression for state of residence, age, gender, race/ethnicity, primary language spoken at home, household poverty status, insurance coverage at time of survey, and impact of condition on activity.

^b Derived from predicted marginals on the basis of the multivariate logistic regression.

^c The χ^2 test for the overall association between the covariate and medical home access was statistically significant at $P < .01$.

RESULTS

State Variation in Medical Home Access

Overall, 53% of CSHCN in the United States did not have access to a medical home. The observed prevalence varied greatly across the states, with 43% of CSHCN in Iowa and 63% of CSHCN in Washington, DC, not having a medical home (Table 1). The map of overall access shown as Fig 1 indicates relatively higher rates of medical home access in the midwestern states and lower access rates in the coastal states.

Multivariate adjustment for individual-level covariates reduced state disparities in access (Table 1). Compared with those in Iowa, CSHCN in a number of states had at least 50% higher adjusted odds of not having access to a medical home, including Alaska, Arizona, Washington, DC, Florida, Illinois, Massachusetts, New Jersey, Nevada, and Virginia. The adjusted prevalence

of CSHCN without a medical home varied from a low of 46% in Iowa and Ohio to a high of 59% in Alaska and 61% in New Jersey.

Although state patterns differed by individual medical home components, CSHCN in a number of western and southwestern states had relatively less access to a personal doctor or nurse, a usual source of care, referrals for specialty care, receipt of needed care coordination, and family-centered care (Fig 1). For example, 10% of the CSHCN in Alaska did not have access to a personal doctor or nurse compared with only 2% of the CSHCN in Rhode Island. Similarly, at least 28% of the CSHCN in California and Arizona had difficulty getting needed referrals for specialty care compared with 10% of the CSHCN in Rhode Island. The CSHCN in Alaska, Montana, North Dakota, Arizona, Oregon, Michigan, Arkansas, Oklahoma,

Florida, and Georgia had at least three-fold higher adjusted odds of not having access to a personal doctor or nurse than the CSHCN in Rhode Island. CSHCN in California, Arizona, Washington, DC, Pennsylvania, Delaware, Nevada, and Florida had at least 3 times higher adjusted odds of experiencing problems with needed referrals for specialty care than their Rhode Island counterparts (data not shown).

Although 40% of CSHCN nationally did not receive effective care coordination when needed, this percentage varied substantially according to state from a low of 32% in Indiana and 33% in Iowa to a high of 49% in Nevada and New Jersey. The CSHCN in Nevada, New Jersey, Alaska, Arizona, Washington, DC, Delaware, and Massachusetts had at least 50% higher adjusted odds of not receiving effective care coordination than CSHCN in Iowa. The percentage of CSHCN not receiving family-centered

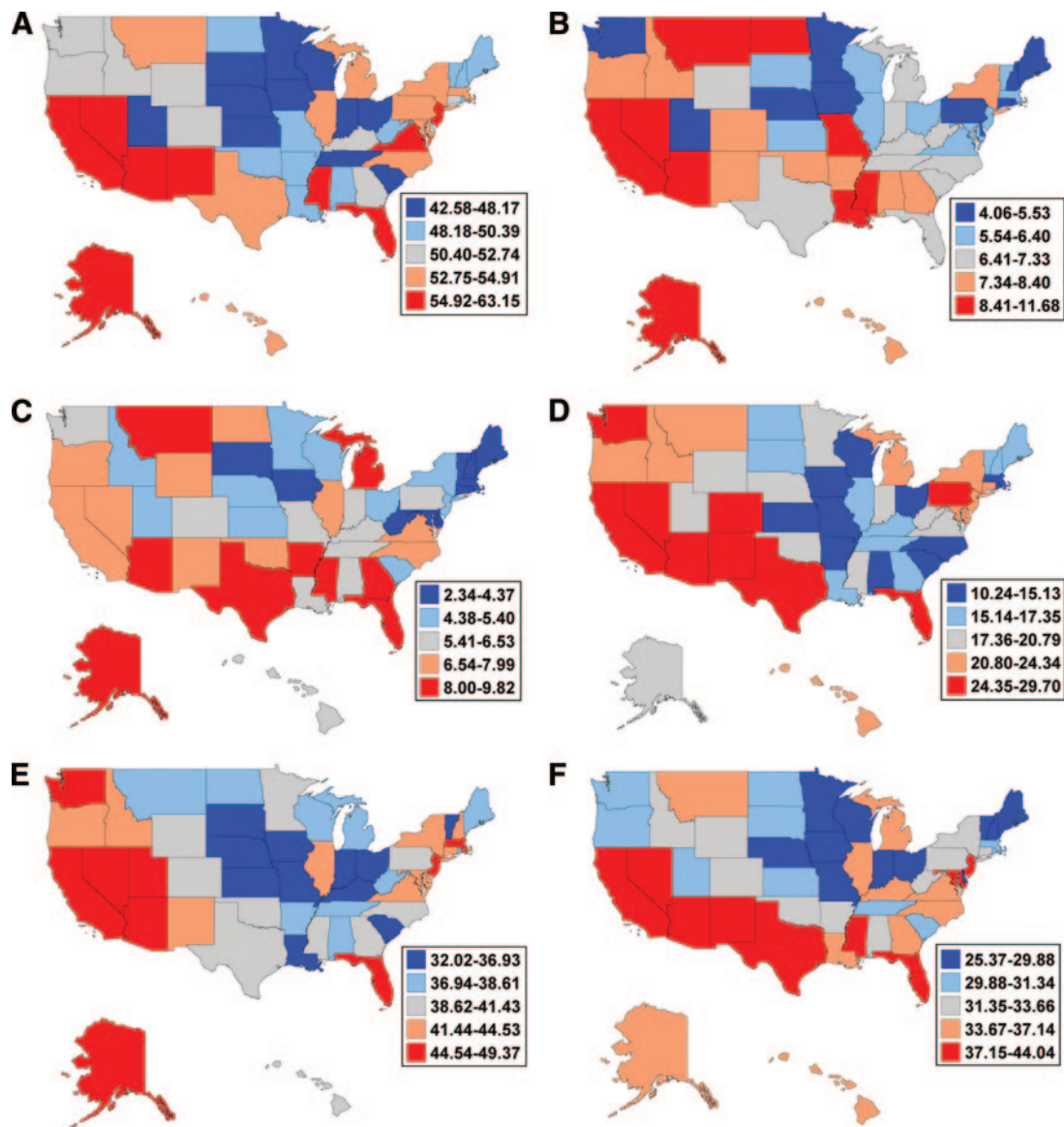


FIGURE 1

Prevalence of not having access to a medical home (A) and 5 component outcomes (B–F) among US CSHCN aged 0 to 17 years, 2005–2006. A, Lack of access to a medical home; B, no usual source of care; C, no personal doctor or nurse; D, problems with referrals when needed; E, not receiving effective care coordination; F, not receiving family-centered care.

care varied from 25% for Iowa to 44% for Washington, DC. CSHCN in California, Maryland, New Jersey, and Nevada had at least 55% higher adjusted odds of not receiving family-centered care than the CSHCN in Iowa.

In addition to geographic disparities, the substantial effects of other covariates listed in Table 1 are worth mentioning. CSHCN aged 12 to 17 years had 26% higher adjusted odds of not having a medical home than those aged 0 to 5 years. Hispanic and black CSHCN

had 56% and 57% higher odds, respectively, of not having access than their non-Hispanic white counterparts. CSHCN in non-English-speaking households had 97% higher odds of not having a medical home than those from English-speaking households. CSHCN who lived below the poverty threshold had 67% higher odds of not having a medical home than their most affluent counterparts. CSHCN whose condition greatly affected their activities had 190% higher odds of lacking access to

a medical home than those without activity limitation. CSHCN without health insurance had 98% higher odds of not having a medical home than those with health insurance.

State-Level Social and Health Policy Influences on Medical Home Access

Table 2 lists the results of a series of fixed-effects multilevel logistic models, which show the effects of various social and health policy factors on the

TABLE 2 Fixed-Effects Multilevel Logistic Models That Show Effects^a of State-Level Sociodemographic and Health Policy Variables on Individual Likelihood of Lack of Access to a Medical Home and 5 Component Outcomes Among US CSHCN, 2005–2006

Covariate	Lack of Access to a Medical Home		No Usual Source of Care		No Personal Doctor or Nurse		Problems With Needed Referrals		No Effective Care Coordination		No Family Centered Care	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Poverty rate (2005) ^b												
<10%	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference
10%–14.99%	0.87	0.79–0.96	0.91	0.74–1.13	1.31	1.05–1.62	0.97	0.79–1.19	0.86	0.77–0.96	0.85	0.77–0.95
≥15%	0.81	0.72–0.90	0.99	0.85–1.16	1.36	1.07–1.72	0.79	0.62–1.00	0.78	0.69–0.88	0.83	0.74–0.94
Foreign-born population (2005), % ^{b,c}	1.12	1.05–1.19	1.00	0.89–1.12	1.06	0.91–1.12	1.28	1.13–1.45	1.14	1.06–1.22	1.10	1.02–1.17
Non-English-speaking population (2005), % ^{b,c}	1.06	1.02–1.11	1.00	0.92–1.07	1.02	0.95–1.09	1.18	1.08–1.28	1.07	1.02–1.12	1.06	1.01–1.10
Health care expenditure and infrastructure index ^{b,d}	1.01	0.96–1.07	0.95	0.86–1.05	0.82	0.73–0.91	0.94	0.85–1.05	1.04	0.98–1.10	0.98	0.93–1.03
No. of doctors per capita (2004) ^{b,e}	1.08	1.03–1.14	0.96	0.87–1.06	0.81	0.73–0.91	1.04	0.94–1.14	1.09	1.03–1.15	1.02	0.97–1.07
No. of nurses per capita (2004) ^{b,f}	0.99	0.96–1.01	0.98	0.93–1.02	0.94	0.90–0.99	0.91	0.86–0.97	0.98	0.95–1.01	0.97	0.94–0.99
No. of pediatricians per child (2004) ^{b,g}	1.22	1.08–1.39	0.92	0.72–1.19	0.61	0.46–0.81	1.06	0.84–1.35	1.25	1.08–1.43	1.04	0.91–1.19
Health expenditure per capita (2004), \$ ^{b,h}	1.00	0.95–1.06	0.94	0.84–1.05	0.82	0.73–0.91	0.92	0.82–1.04	1.01	0.94–1.07	0.96	0.90–1.02
Medicaid expenditure per child (2004), \$ ^{b,h}	1.03	0.98–1.08	0.96	0.88–1.05	0.89	0.80–0.97	0.89	0.81–0.98	1.03	0.98–1.08	0.98	0.93–1.03
Medicaid/SCHIP upper eligibility limits (2005) ^b												
<200% of poverty rate	0.79	0.71–0.87	1.07	0.86–1.32	1.31	1.03–1.67	0.84	0.67–1.06	0.82	0.73–0.93	0.83	0.74–0.93
200%–249.99% of poverty rate	0.89	0.81–0.98	0.98	0.81–1.19	1.38	1.10–1.71	0.94	0.76–1.16	0.85	0.76–0.94	0.90	0.81–1.00
250%–299.99% of poverty rate	0.94	0.81–1.09	1.04	0.79–1.36	1.19	0.89–1.59	1.22	0.92–1.63	0.96	0.82–1.13	0.93	0.80–1.09
≥300% of poverty rate	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference	1.00	Reference

OR indicates odds ratio; CI, confidence interval.

^a Each state-level effect was adjusted by a fixed-effects logistic regression model for such individual-level covariates as age, gender, race/ethnicity, language spoken at home, household poverty status, insurance coverage, and impact of condition on activity.

^b State-level data from the 2005 American Community Survey, 2008 Statistical Abstract of the United States, and 2007 Area Resource File. The index of health care expenditure and infrastructure combines, using factor analysis 4 area-level variables: total number of physicians per capita; number of nurses per capita; number of pediatricians per child; and total health expenditure/capita.

^c Odds associated with a 10-percentage point increase in the immigrant or non-English-speaking population.

^d Odds associated with a 20-point increase in index scores.

^e Odds associated with each additional physician per 1000 population.

^f Odds associated with each additional nurse per 1000 population.

^g Odds associated with each additional pediatrician per 1000 children.

^h Odds associated with every \$1000 increase in expenditure per capita.

individual likelihood of lacking medical home access after controlling for individual-level covariates. Overall and most components of medical home access were inversely related to the size of the state's immigrant and non-English-speaking population. For example, a 10-percentage point increase in the state immigrant population was associated with a 12% increase in the odds of CSHCN not having a medical home, a 28% increase in the odds of experiencing problems with needed referrals for specialty care, a 14% increase in the odds of lacking care coordination, and a 10% increase in the odds of not receiving family-centered care.

The overall health care expenditure and infrastructure index and the variables that make up the index had a

substantial influence on access to a personal doctor/nurse by CSHCN, even after controlling for the individual-level factors. For example, a 20-point increase in the health care index score was associated with an 18% decrease in the odds of CSHCN not having access to a personal doctor/nurse. CSHCN in states with more physicians (all specialties), pediatricians, and nurses also had increased access to a personal physician/nurse. There was a 39% decrease in the odds of not having access to a personal doctor/nurse for each additional pediatrician per 1000 children, a 19% reduction in odds of no access for each additional physician per 1000 population, and a 6% reduction in odds for each additional nurse per 1000 population. The odds of not

having a personal doctor/nurse were reduced by 18% for every \$1000 increase in the overall health spending per capita and by 11% for every \$1000 increase in Medicaid expenditure per child. It is interesting to note that a lower nursing supply was associated with significantly higher likelihood of experiencing problems with needed referrals and family-centered care.

As expected, access to a personal doctor/nurse by CSHCN was significantly higher in states with lower poverty rates. However, the likelihood of not having access to a medical home was higher among CSHCN in states with lower poverty rates after adjusting for the individual-level covariates, including household poverty status. Lack of access to needed referrals, care coor-

dination, and family-centered care was also higher among CSHCN from states with lower poverty rates and higher Medicaid/SCHIP eligibility limits.

DISCUSSION

To our knowledge, this is the first study to document the extent of state disparities in medical home access among CSHCN in the United States and to determine if a set of individual-level sociodemographic variables and state-level health policy factors affect the likelihood of CSHCN having a medical home. We found substantial geographic disparities, with the overall medical home access rates being markedly lower in several western and northeastern states. At least 43% of CSHCN in each state did not have access to a medical home. More than one quarter of CSHCN in each state experienced problems with specialty care referrals, care coordination, and family-centered care. Moreover, 10% to 12% of CSHCN in Washington, DC, Louisiana, Arizona, Montana, and Nevada did not have a usual source of care. Approximately 9% to 10% of CSHCN in Alaska, Montana, Arizona, Washington, DC, Mississippi, Arkansas, and Michigan did not have a personal doctor or nurse.

What explains such marked geographic disparities in access among CSHCN? As might be expected, state differences in individual-level factors such as racial/ethnic composition, English-language use, socioeconomic status, and health insurance coverage accounted for a substantial portion of the state disparities in overall and most components of medical home access. State-level social and health policy factors such as immigrant population size, poverty rate, health care expenditure and infrastructure, and Medicaid/SCHIP eligibility criteria were also significant predictors of either overall or some specific components of medical home access among CSHCN

even after adjusting for individual-level covariates. These state-level health policy factors, therefore, are also expected to account for some of the state variations in medical home access rates.

States with higher poverty or deprivation levels may be significantly more constrained from a resource standpoint and/or in their organizational capacity to effectively deliver comprehensive primary care services to a majority of their population or households.⁵ Furthermore, states with a substantial immigrant population may experience significant barriers to providing accessible health care because of the cultural, linguistic, and health policy challenges that confront the immigrant population.^{27,28} Recent welfare reforms, including the 1996 Temporary Assistance for Needy Families (TANF) program and the Deficit Reduction Act (DRA) of 2005, which restrict or even exclude legal immigrants' access to public services and benefits, might adversely affect health services access and use among the immigrant population.^{29,30} It is important to note that states with higher immigrant or non-English-speaking populations experience significantly greater problems with such qualitative aspects of the medical home model as having access to needed referrals, care coordination, and family-centered care.

Increases in state health expenditure per capita, total physician supply, number of pediatricians and nurses per capita, and expanded Medicaid/SCHIP eligibility were positively associated with some aspects of medical home access, particularly access to a personal doctor/nurse. Increasing the supply of health care professionals such as nurses has an additional benefit in that it is associated with improved access to needed referrals and family-centered care among CSHCN. We found that overall access to medical homes, as well as access to spe-

cialty care referrals, care coordination, and family-centered care, was lower among CSHCN in states with lower poverty rates and higher Medicaid/SCHIP eligibility limits. This finding may indicate the need for the SCHIP and Medicaid programs to target CSHCN even in more affluent states to ensure increased access to comprehensive primary care services. The health policy variables, analyzed in our contextual analysis, clearly reflect the mechanisms and practices through which access by CSHCN to medical homes can be improved and geographic disparities in their health care access can be reduced.

Lower medical home access in more affluent states was unexpected. However, no significant association between state poverty level and medical home access was found at the bivariate level. The unexpected adjusted effect of area poverty may reflect state-level compositional differences in individual-level factors and/or the confounding influences of rural and immigrant population size in states. These area variables were not considered simultaneously because of multicollinearity. In addition, the unexpected adjusted effect of area poverty rate might reflect the limitation of area deprivation measured at the state level, as discussed below.

Some limitations of our study are worth mentioning. First, our study was a cross-sectional analysis in which we attempted to examine the association between individual-level sociodemographic and state-level health policy variables and the individual likelihood of medical home access among CSHCN. Although our state-level health policy variables temporally precede the survey measurement of access, a longitudinal design would be more appropriate for accurately estimating these effects. Second, the effects of some of the area-level factors, such as poverty

rate, health care expenditure, and health professional supply variables, may be underestimated because they were considered at the state level rather than at the county or local community level. This was because the geographic area in the public-use NS-CSHCN file could not be identified at a lower level than the state. Third, in our multilevel models, both individual- and state-level covariates were treated as fixed effects, which might have resulted in underestimating the SEs of state-level effects.^{31,32} Although intra-cluster correlations in the data are, to

some extent, accounted for by our use of SUDAAN software, which models complex sample design effects, a more general random-effects mixed multilevel model may be appropriate for testing whether individual-level effects are random (ie, they vary significantly across states) or whether state-level effects also vary randomly around an overall mean.⁵¹

CONCLUSIONS

The medical home is increasingly being recognized as the model of quality comprehensive health care not only

for CSHCN but for all children.^{11,33,34} One of the Healthy People 2010 objectives calls for access to comprehensive health care consistent with the medical home standard for all CSHCN.⁷ The wide disparities shown here in the overall access to a medical home and in its 5 component outcomes according to race/ethnicity, socioeconomic status, and state of residence, however, should represent major policy concerns, because they may adversely affect the nation's effort to reduce health, disease, and health care disparities among CSHCN.

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Pediatrics 2009;124;S352
DOI: 10.1542/peds.2009-1255E

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