Unmet needs for dental care in children with special health care needs

Angelia M. Paschal [a,*], Jereme D. Wilroy [a], Suzanne R. Hawley [b]

[a] Department of Health Science, Box 870311, The University of Alabama, Tuscaloosa, AL 35487-0311, United States
[b] Department of Public Health Sciences, Wichita State University, 1845 Fairmount Box 43, Wichita, KS 67260-0043, United States

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ABSTRACT

Objective: The unmet need for dental care is one of the greatest public health problems facing U.S. children. This issue is particularly concerning for children with special health care needs (CSHCN), who experience higher prevalence of unmet dental care needs. The primary purpose of this study was to investigate regional differences in unmet dental care needs for CSHCN. Using the Social Ecological Model as a framework, additional variables were analyzed for regional differences. It was hypothesized that (H1) unmet dental care needs would be high in the CSHCN population, (H2) there would be regional differences in unmet dental care needs in CSHCN, and (H3) there would be differences in specific individual, interpersonal (family), community (state), and policy level factors by region. *Methods*: Data were obtained from the 2009–2010 National Survey of CSHCN. SPSS was used for data management and analysis. *Results*: Each of the study hypotheses was supported for the sample of 40,242 CSHCN. The West region was more likely to have more unmet needs for preventive and specialized dental care in CSHCN than the reference region (Northeast). The South region followed the West region in unmet dental care needs. Statistically significant differences in individual, interpersonal (family), community (state) and policy factors were found by region. *Conclusion*: Further research is recommended. Effective strategies that include policy to address unmet dental care needs at multiple levels of intervention are suggested.

Introduction

Oral health disparities continue to affect children with special health care needs (CSHCN) (Fulda et al., 2013). Unmet dental care needs represent one of these disparities and can be defined as needing dental treatment but receiving delayed care or no care at all (Fulda et al., 2013). Unmet dental care needs tend to be more prevalent in the CSHCN population compared to the general population of children (Lewis, 2009; Szilagyi et al., 2003).

CSHCN have chronic physical, developmental, behavioral, or emotional conditions which require health care and related services of a type or amount beyond that required by children in general (Mayer et al., 2004). About 14% of children in the U.S. are CSHCN (Fulda et al., 2013). Disparities in oral health care are particularly problematic in CSHCN (Fulda et al., 2013). A 2005 national study found that 78% of CSHCN had not received dental care in the past 12 months, and that among those who had, 10.4% did not receive all of the dental care they needed (Lewis et al., 2005).

Unmet dental care needs have been linked to adverse consequences in children (Dye et al., 2007). Mouth pain may develop when dental caries are left untreated. In turn, this might result in difficulty or inability to eating, weight loss, and decreased nutritional status (U.S. Department of Health and Human Services, 2010). Severe dental caries can cause tooth disfigurement which may impact children's smiling patterns, self-esteem, and social interactions and development (Albino et al., 2012; U.S. Department of Health and Human Services, 2000). While dental caries can largely be prevented, accessible dental care presents significant challenges to many CSHCN and economically disadvantaged families (Fisher and Mascarenhas, 2007; Fulda et al., 2013; Szilagyi et al., 2003).

The Social Ecological Model (SEM) provides a suitable framework to identify factors associated with oral health outcomes (Fisher-Owens et al., 2013; Sallis et al., 2008; Vichayanrat et al., 2012). The SEM suggests that a health behavior or problem is affected by multiple factors and at various levels (Sallis et al., 2008). The SEM considers the complex interplay between factors at the individual, interpersonal, organizational, community, and policy levels which influence a particular health behavior or problem. In the current study, factors at the individual, interpersonal (family), community (state), and policy levels were examined for regional differences.

Examining regional differences for unmet health care needs is a priority of the U.S. Department of Health and Human Services (USDHHS) (Singh et al., 2009; USDHHS, 2010). Significant gaps in health care

* Corresponding author. Tel.: +1 205 348 5708; fax: +1 205 348 7568.
E-mail addresses: apaschal@ches.ua.edu (A.M. Paschal), jdwilroy@crimson.ua.edu (J.D. Wilroy), Suzanne.Hawley@wichita.edu (S.R. Hawley).

services at the regional level may negatively affect the nation's efforts to prevent disease and reduce health disparities (Singh et al., 2009). Yet, a regional analysis can help identify such gaps and potential sources of inequity (Baiker et al., 2005; Singh et al., 2009). Regional level findings may have implications for program and policy planning and development, including multi-state interventions (Fulda et al., 2013). Findings may prompt national and regional decision-makers to develop equitable, effective health care interventions and policies (World Health Organization, 2008). Research suggests that health care policies which target large geographical areas are beneficial to reducing disparities (Baiker et al., 2005).

In a previous study, geographical differences in unmet health care needs, including preventive dental care, were investigated in CSHCN (Fulda et al., 2013). The findings indicated that the South region had a higher percentage of unmet preventive dental care needs than other regions. The current study is similar, but focused specifically on preventive and specialized dental care. The present study also builds onto the former research by examining community (state) and policy level factors. The current study used the 2009/10 National Survey—Children with Special Health Care Needs, whereas the former study used the data collected in 2005/06 (Fulda et al., 2013).

The primary purpose of this study was to investigate regional differences in unmet dental care needs for CSHCN. Using the Social Ecological Model as a framework, additional variables were analyzed for regional differences, which were selected due to their relationship with unmet dental care needs in previous research (Fulda et al., 2013; Lewis, 2009; Lewis et al., 2005; Van Cleave and Davis, 2006). It was hypothesized that: (1) unmet dental care needs would be high in the CSHCN population (Lewis, 2009; Lewis et al., 2005); (2) there would be regional differences in unmet dental care needs in CSHCN (Fulda et al., 2013); and (3) there would be differences in individual, interpersonal (family), community (state), and policy level factors by region (Edelstein and Chinn, 2009; Singh et al., 2009; Szilagyi et al., 2003; Yu and Singh, 2009).

Methods

The interview

Data from the National Survey—Children with Special Health Care Needs was used (USDHHS et al., 2011). This was a national telephone survey conducted for the third time in 2009–2010 (the dataset used for the current study). Independent random samples were taken in all 50 states and the District of Columbia, with at least 750 interviews conducted in each state with parents or guardians of CSHCN < 18 years old. The interviews lasted approximately 33 min and were conducted in English, Spanish, Mandarin, Cantonese, Vietnamese, and Korean. A range of topics were covered including the child's health and functional status, access to health care, access to community-based services, and others. Data analysis for the current study was approved by the Institutional Review Board at the University of Alabama.

Dependent variables

Two variables from the survey represented unmet dental care needs. Parents were asked, "During the past 12 months, was there any time when the child needed preventive dental care, such as check-ups and dental cleanings?" If the response was "yes," subsequently the parent was asked if the child received all preventive dental care that was needed (USDHHS et al., 2011). If the parent indicated "no," the response meant there was an "unmet need for preventive dental care."

The second dependent variable pertained to other types of dental care. Parents were asked whether their children needed "any other dental care or orthodontia" during the past 12 months. If the response was "yes," the parents were asked whether their children received all dental care needed (USDHHS et al., 2011). If the parent indicated "no," the response meant there was an "unmet need for specialized dental care".

Primary independent variable

The primary independent variable of interest was the geographic region of the child's household. The state of residence for each child was indicated in the survey dataset. States were divided into four regions: Midwest, Northeast, South, and West (U.S. Census Bureau, 2010). The geographic region with the lowest percent of respondents reporting that they did not receive all needed care was used as the reference group.

Individual level covariates

Potential individual level covariates included age, sex, ethnicity (Hispanic/Latino or not), race (white only, black only, multiracial, other), and percent of federal poverty level (FPL) (≤100, 101–200, 201–300, >300%). Additional covariates included health insurance status (continuous insurance coverage for the past 12 months) and time child was limited by condition in past 12 months (never, sometimes, usually/always). These variables were selected because of previous research on unmet dental care needs in CSHCN (Fulda et al., 2013; Lewis, 2009; Lewis et al., 2005; Van Cleave and Davis, 2006).

Interpersonal (family) level covariates

Covariates at the interpersonal (family) level included the relationship of the respondent to the CSHN (mother, other), number of children living in the household, and number of adults living in the household. These factors were included because of their inclusion in prior research on unmet dental care needs in CSHCN (Fulda et al., 2013).

Community (state) level covariates

Community (state) level data for the year 2010 were used in the analysis to be consistent with the 2009/10 survey data. Covariates included the following variables: percent population below poverty; percent children who were Medicaid enrollees; percent children who received dental treatment while enrolled in Medicaid; number of dentists per 10,000 population; number of physicians per 100,000 population; and percent population that lived in Dental Health Professional Shortage Areas (dental HPSA).

Policy level variables

Variables at the policy level included dental benefits covered by Medicaid (yes/no) and Medicaid co-payment (yes/no). In the U.S., children's dental treatment may be covered by private health insurance (personal- or employer-sponsored insurance), public health insurance (Medicaid or State Children's Health Insurance Program), or self-payment (Albino et al., 2012). Adherence to federal guidelines for Medicaid is required; yet, each state determines its program eligibility, rate of payment for services, type of dental coverage, and other factors (Albino et al., 2012).

Statistical analysis

SPSS 22.0 was used to conduct the analysis. Descriptive statistics were provided for covariates for each of the four geographic regions. Chi-square analysis and analysis of variance (ANOVA) were used as appropriate to determine differences in variables by geographic region for both the individual and family level factors (Table 1) and the

Table 1
Individual and interpersonal (family) level characteristics of CSHCN by region.

	All regions n = 40,242 (%)	Midwest n = 7104 (%)	Northeast n = 10,157 (%)	South n = 12,810 (%)	West n = 10,171 (%)	Overall p
Sex						0.65
Male	60.1	60.1	60.8	59.9	59.8	
Female	39.9	39.9	39.9	40.1	40.2	
Ethnicity						<0.01
Hispanic	11.1	6.6	10.4	8.7	18.7	
Other	88.9	93.4	89.6	91.3	81.3	
Race						<0.01
White only	75.6	82.2	82.0	69.3	73.7	
Black only	10.5	7.1	6.6	20.2	3.3	
Other	13.9	10.7	11.4	10.5	23.1	
Poverty level						<0.01
≤100% FPL	17.1	14.8	13.6	21.7	15.7	
101–200% FPL	19.2	20.0	16.6	19.3	20.2	
201–300% FPL	16.8	18.3	15.7	14.6	19.2	
≥300% FPL	46.9	47.0	54.1	44.4	45.0	
Relation to child						<0.01
Mother	75.0	77.1	76.1	73.3	74.6	
Other	25.0	22.9	23.9	26.7	25.4	
Insured past 12 months						<0.01
Yes	97.1	97.8	98.4	96.9	96.0	
No	2.9	2.2	1.6	1.3	4.0	
Time condition affected child						<0.01
Never	36.8	38.0	38.0	38.1	33.3	
Sometimes	40.6	40.9	40.1	39.5	42.2	
Usually/Always	22.6	21.2	21.9	22.4	24.5	
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	P
Age	10.2 (0.05)	10.3 (0.05)	10.4 (0.06)	10.0 (0.4)	10.2 (0.05)	<0.01
Total adults	2.1 (0.00)	2.1 (0.01)	2.1 (0.01)	2.1 (0.01)	2.2 (0.01)	<0.01
Total kids	2.1 (0.01)	2.2 (0.01)	2.0 (0.01)	2.0 (0.01)	2.2 (0.01)	<0.01

SD standard deviation, *p* p value, *FPL* federal poverty level.

community (state) and policy level variables (Table 2). Weighted percentages and standard errors of respondents that did not receive all needed care in the past 12 months for routine preventive dental care and for all other dental care in the past 12 months are represented in Table 3. Simple logistic and multiple logistic regression analyses were conducted with the geographic region as the main independent variable and the dental care service types (preventive or specialized dental care) as the dependent variables. All potential covariates were included in the multiple logistic regression models. Odds ratios and 95% confidence intervals are indicated. Results were considered statistically significant at the alpha 0.05 level.

Results

Individual level results

The sample included 40,242 CSHCN. The majority were male participants (60.1%), white (75.6%), at ≥300% of the federal poverty level (46.9%), and had health insurance (97.1%). The mean age was 10.2 years old. Of the sample, 7.4% had unmet needs for preventive dental care and 4.2% experienced unmet needs for specialized dental care. Regionally, the CSHCN composition was 31.8% South, 25.2% West, 25.2% Northeast, and 17.6% Midwest. Individual level differences were

Table 2
Community (state) and policy level characteristics by region.

	All regions n = 40,242 (%)	Midwest n = 7104 (%)	Northeast n = 10,157 (%)	South n = 12,810 (%)	West n = 10,171 (%)	p
Dental benefits covered by Medicaid						
Yes	94.0	100	100	82.4	100	<0.01
No	6.00	0.0	0.0	17.6	0.0	
Medicaid Copayment required						
Yes	37.6	50.0	22.1	36.0	38.7	<0.01
No	62.4	50.0	77.9	64.0	61.3	
	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Mean (SE)	Overall p
% population below poverty line	14.79 (0.02)	14.03 (0.02)	12.03 (0.02)	17.07 (0.03)	14.35 (0.03)	<0.01
% Children Medicaid enrollees	51.44 (0.00)	52.97 (0.00)	42.93 (0.00)	51.91 (0.00)	55.29 (0.00)	<0.01
% Children on Medicaid received dental treatment	23.67 (0.04)	17.12 (0.03)	23.11 (0.05)	25.40 (0.07)	27.82 (0.08)	<0.01
% of Population living in Dental HPSA	17.18 (0.06)	12.63 (0.06)	11.04 (0.07)	21.36 (0.13)	20.08 (0.09)	<0.01
Active physicians (per 100,000 population)	263 (0.49)	239 (0.23)	328 (0.43)	268 (1.31)	235 (0.35)	<0.01
Number of Dentists (per 10,000 population)	5.93 (0.01)	5.60 (0.01)	6.84 (0.01)	5.31 (0.01)	6.44 (0.01)	<0.01

Table 3
Percent CSHCN not receiving all needed preventive and specialized dental care.

	Needed care	Did not receive all needed care				
	%	All regions %	Midwest %	Northeast %	South %	West %
Preventive dental care	31.2	7.4	6.9	5.6[a]	8.0	**8.2**
Specialized dental care	27.6	4.2	3.6	3.5[a]	4.4	**5.1**

Bolded values represent the region with the highest percent of unmet need.
[a] Represents region with the lowest percent of unmet need.

significant by region with the exception of the child's sex, as indicated in Table 1.

Interpersonal (family) level results

Three interpersonal (family) level factors were investigated. About 75% of the survey respondents were mothers to the CSHCN. The mean number of adults in the home was two. Households had an average of two children, including the CSHCN. These differences were statistically significant by region as indicated in Table 1.

Community (state) level results

Community (state) level factors were analyzed. The poverty rate was 14.79% across all regions. Poverty rates were higher in the South (17.07%) and lower in the Northeast (12.03%).

Medicaid enrollment was 51.44% across all regions, with 23.67% who received dental treatment while enrolled in Medicaid. The West region had the highest enrollment (55.29%), and the Northeast had the lowest (42.93%). The West had the highest percent who received dental treatment while enrolled in Medicaid (27.82%), and the Midwest had the lowest (17.12%).

Across all regions, 17.18% of the population lived in dental HPSA. The South had the highest percent population living in dental HPSA (21.36%) and the Northeast had the lowest (11.04%).

The West had the lowest physicians per capita (235/100,000), whereas the Northeast has the highest (328/100,000). The South had the lowest dentists per capita (5.31/10,000), while the Northeast had the highest (6.84/10,000).

The results of the unadjusted analysis indicated that community (state) level differences were statistically significant by region. The distribution of these factors by region is provided in Table 2.

Policy level results

Two policy level factors were analyzed. Most states (94.0%) provided dental care benefits through their Medicaid programs. The South (82.4%) was the only region which did not have 100% of its states that did so. About 62.4% of the states across all regions required a Medicaid co-payment. Most required copayments were in the Midwest (50.0%) and the least were in the Northeast (22.1%) as indicated in Table 2.

Regional differences in unmet dental care needs

Among CSHCN in all regions, 7.4% had unmet preventive dental care needs and 4.2% had unmet specialized dental care needs. Unmet needs for preventive and specialized dental care were highest in the West (8.2% and 5.1%, respectively), followed by the South (8.0% and 4.4%, respectively) as shown in Table 3.

Table 4 provides the adjusted associations between regions and "unmet needs in preventive dental care," for which the individual and interpersonal (family) level covariates were controlled. The Northeast region was used as the reference group as it had the lowest percent of CSHCN who did not receive all of the preventive dental care needed in the past year. CSHCN in the West were 1.4 times more likely to have unmet needs compared to the Northeast (OR = 1.35; 95% CI [1.19–1.54]). The other regions were both 1.2 times more likely to have unmet needs compared to the Northeast: Midwest (OR = 1.21; 95% CI [1.05–1.38]); South (OR = 1.23; 95% CI [1.09–1.40]).

The West region was associated with higher odds of "other unmet dental care needs" in CSHCN than the Northeast which was the reference group. The West was 1.3 times more likely to experience unmet needs for specialized dental care (OR = 1.30; 95% CI [1.11–1.53]). Being in the Midwest region had no bearing (OR = 1) on unmet dental care needs in CSHCN (OR = 0.979; 95% CI [.95–1.30]). The South was 1.1 times more likely to have unmet needs for specialized dental care (OR = 1.11; 95% CI [0.95–1.30]).

Table 5 provides the adjusted associations between regions and "unmet needs in preventive dental care," for which the community (state) and policy level covariates were controlled. The Northeast region was the reference group as it had the lowest percent of CSHCN who did not receive all of the preventive dental care needed in the past year. CSHCN in the West and South were 1.5 times more likely to have unmet needs for preventive dental care compared to the Northeast: West (OR = 1.529; 95% CI [1.29–1.82]); South (OR = 1.523; 95% CI [1.28–1.81]), while the Midwest was not significant (OR = 1.081; 95% CI [.92–1.27]). CSHCN in the West were more likely to have unmet specialized dental care needs compared to the Northeast: West (OR = 1.4; 95% CI [1.11–1.72]).

Discussion

The primary purpose of this study was to investigate regional differences in unmet dental care needs for CSHCN. Using the Social Ecological Model as a framework, additional variables were analyzed for regional differences, which were selected due to their relationship with unmet dental care needs in previous research (Fulda et al., 2013; Lewis, 2009; Lewis et al., 2005; Van Cleave and Davis, 2006). It was hypothesized that unmet dental care needs would be high in CSHCN (Lewis, 2009; Lewis et al., 2005). This hypothesis was supported. Of the sample, 7.4% experienced unmet preventive dental care needs compared to 2.6% of the general population of children < 18 years old (USDHHS et al., 2011). The finding is comparable to the Fulda et al. (2013) study which found that 7.8% of CSHCN had unmet preventive dental care needs. According to prior research, dental care is a primary need in

Table 4
Multiple logistic regression for preventive and specialized dental care controlling for individual and interpersonal (family) level covariates.

	Midwest		Northeast		South		West	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Preventive dental care	1.206	(1.05–1.38)	–	–	1.233	(1.09–1.40)	1.350	(1.19–1.54)
Other dental care	0.979	(0.95–1.30)	–	–	1.109	(0.95–1.30)	1.301	(1.11–1.53)

Regression models control for age, number of adults in the household, number of children in the household, gender, race, ethnicity, poverty level, relationship of respondents to child, insurance coverage in the last year, and amount of time condition affects child.
For each analysis, Northeast was used as the reference group as it had the lowest percent of respondents reporting that they did not receive all needed care.
OR odds ratio, 95% CI 95% confidence interval.

Table 5
Multiple logistic regression for preventive and specialized dental care controlling for community (state) and policy level covariates.

	Midwest		Northeast		South		West	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Preventive dental care	1.081	(0.92–1.27)	–	–	1.523	(1.28–1.81)	1.529	(1.29–1.82)
Other dental care	0.871	(0.71–1.07)	–	–	1.174	(0.94–1.47)	1.384	(1.11–1.72)

Regression models control for poverty rate, children Medicaid enrollees, children with Medicaid who received dental treatment (2011), Medicaid payment per child enrollee, Active physicians per 100,000 population, number of Dentists per 10,000 population, population living in a Dental HPSA.
For each analysis, Northeast was used as the reference group as it had the lowest percent of respondents reporting that they did not receive all needed care.
OR odds ratio, *95% CI* 95% confidence interval.

CSHCN, being second only to their need for prescribed medication (Lewis et al., 2005).

It was hypothesized that there would be regional differences in unmet dental care needs in CSHCN. This hypothesis was also supported. The West region, followed by the South, had the highest percent of unmet preventive dental care needs in CSHCN (8.2% and 8.0%, respectively). The previous study on which the current study was compared also identified the same two regions as having the highest needs (8.3% for both regions) (Fulda et al., 2013). The former study used the 2005/06 National Survey—Children with Special Health Care Needs, while the current study used 2009/10 data (Fulda et al., 2013). Although both studies controlled for the same individual and interpersonal (family) level characteristics, the associations between region and unmet preventive dental care need remained significant only in the current study. CSHCN in the West were 1.4 times more likely, and CSHCN in the South and Midwest were both 1.2 times more likely to have an unmet need for preventive dental care than CSHCN in the Northeast. Although the highest percent of unmet specialized dental care needs were also identified in the West (5.1%) and South (4.4%) in the current study, the results were not significant after controlling for the individual and family level characteristics. The previous study did not examine unmet specialized dental care needs (Fulda et al., 2013). Research should continue to explore variations in regional patterns and investigate the underlying factors in greater depth (Baiker et al., 2005; Singh et al., 2009).

Further, it was hypothesized there would be differences in individual, interpersonal (family), community (state), and policy level factors by region. The hypothesis was supported. Differences were statistically significant by region for factors at each level of the Social Ecological Model (SEM) (Sallis et al., 2008).

At the individual and interpersonal levels of the SEM, all of the factors were significant by region among CSHCN, with the exception of the child's sex. One of the factors examined was the time the child was limited by the chronic condition in the past 12 months. The region with the highest unmet dental care needs in CSHN (West) also had the highest percent of children for whom their chronic conditions limited them "sometimes" or "usually/always." These findings have implications for comprehensive health care efforts for CSHCN. The results suggest there might be unmet chronic health care issues in this vulnerable population, which supports earlier research (Fulda et al., 2013; Lewis, 2009).

Poverty among CSHCN was highest in the two regions which also had greater likelihoods of unmet dental care needs in CSHCN (West and South). It is well documented that poverty is associated with disparities in oral health (Treadwell and Northridge, 2007; USDHHS, 2000). The study findings confirm this body of research.

Most of the CSHCN in the sample (97.1%) were insured. This supports former studies which indicated high insurance rates among CSHCN (Lewis, 2009; Szilagyi et al., 2003). Insurance coverage for dental treatment is a strong determinant of dental care use (Edelstein and Chinn, 2009; Liao et al., 2010). Yet, despite the insurance rates in the present sample, unmet needs for preventive and specialized dental services were found. The findings suggest that insurance may not be sufficient for meeting the oral health care needs of CSHCN and other factors at multiple levels should be explored.

Unmet dental care needs have been associated with racial and ethnic minorities, particularly blacks and Mexican-Americans (Edelstein and Chinn, 2009; Flores and Lin, 2013). In this study, the two regions with the highest likelihood of unmet dental care needs in CSHCN (West and South) also had the highest racial and ethnic minority populations: blacks (South), and Hispanics and "Others" (West).

At the community (state) and policy levels of the SEM, the factors analyzed were significant by region. The region with the highest unmet dental care needs (West) also had the highest Medicaid enrollment among children, and the highest utilization of dental services among those enrolled. The findings suggest that Medicaid is an important resource for CSHCN, though it may be not be sufficient in meeting all of their oral health needs.

The availability of dental services was also examined. Shortages of health care professionals have been associated with health disparities (Albino et al., 2012). The two regions with the highest rates of unmet dental care needs (West and South) also had the lowest physicians per capita (West), lowest dentists per capita (South), and the highest percent population living in a dental HPSA (South). These findings indicate potential workforce challenges which may affect access to health care among CSHCN.

It is worthy to note that the region with the lowest unmet dental care needs in CSHCN (Northeast) also had the lowest state-level poverty rate and lowest Medicaid enrollment (an indicator for low income). This region also had the lowest percent of its population living in a dental HPSA. It also had the highest dentists and physicians per capita. The findings suggest that stronger dental health infrastructure may be needed to address unmet needs in dental care across regions (Fulda et al., 2013).

The study is not without limitations. One pertains to the factors analyzed for regional differences. Some factors were not explored (e.g., parent health literacy). Yet, the factors selected expanded on former studies, contributed additional information to the literature, and improved understanding of the individual and contextual factors associated with dental care services in CSHCN (Fulda et al., 2013).

The study did not stratify the chronic conditions or illnesses of the CSHCN, which may be considered a limitation. Unmet dental care needs may be more prevalent in CSHCN with certain conditions than others. Future research is recommended to explore these possibilities and to implement appropriate public health efforts accordingly.

Regional differences were found in variables at the individual, interpersonal, community, and policy levels of the SEM. However, the exploratory study cannot conclude that these factors contributed to unmet dental care needs in CSHCN. Additional analyses (e.g., mediation analysis) are recommended.

The analysis of regional differences might be considered as a limitation by some but was of particular interest for the current study. Because of the growing need for services and programs for CSHCN, multiple levels of analysis (as the SEM suggests) are needed in research to inform needed multilevel interventions (Albino et al., 2012; Sallis et al., 2008).

The study findings indicated regional disparities in unmet dental care needs in CSHCN. The findings have implications for comprehensive

health care efforts at the state and regional levels, especially among CSHCN who are further marginalized (e.g., minority and poor). Policy implications exist for addressing shortages in dental and primary health care professionals across regions. The findings suggest efforts aimed at creating stronger, effective public oral health systems. Approaches that include broad, far-reaching policy interventions are needed (Albino et al., 2012). Strategies implemented at each level of the SEM should be considered.

Conflict of interest

The authors declare there is no conflict of interest.

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