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Access to and utilization of dental care services among children with special health care needs in the United States

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DISSERTATION

ACCESS TO AND UTILIZATION OF DENTAL CARE SERVICES AMONG CHILDREN WITH SPECIAL HEALTH CARE NEEDS IN THE UNITED STATES

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DEDICATION

I dedicate my dissertation work to my family and many friends. A special feeling of gratitude to my loving parents whose words of encouragement and push for tenacity ring in my ears. My patient spouse Amani, my beautiful daughter Kendah, my brothers Abdullah and Amro and my sisters Hana, Haifa, Hanouf, Hanadi, Hoton and Jana.

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ABSTRACT

Objective: To evaluate access and utilization of both preventive and other dental care services among Children with Special Health Care Needs (CSHCN) in the US in 2005 and 2009.

Methods: We analyzed data for 81,082 CSHCN from the National Survey of Children with Special Health Care Needs (NS-CSHCN) 2005 and 2009. The three main dependent variables were: access to and utilization of dental care, and health insurance status. The independent variables were: gender, age, race/ethnicity, type of insurance, number of criteria met on the screener tool, federal poverty level (FPL), family structure, language, family work life, financial burden and out-of-pocket expenses. Bivariate and multivariate weighted analyses were conducted to evaluate the study outcomes.

Results: We found that CSHCN had a high degree of access and utilization of the dental care system in the US. In 2005, 98.2% and 99.03% of CSHCN had “very good to good” access to preventive dental care and other dental care, respectively, and in 2009, the access was 98.1%

and 98.7% for both services, respectively. Further, in 2005, 92.9% and 90.4% “fully utilized” preventive dental care services and other dental care, respectively, while 91.9% and 84.7% of CSHCN “fully utilized” both services respectively in 2009. Barriers to access dental care were commonly seen among CSHCN of an older age (5-17 years old), other Non-Hispanics, those from low-income families, with complicated health conditions, living with single mothers, who were uninsured or publically insured, and having family out-of-pocket expenses of more than $250 for their health services. Low levels of utilization were found among non-Hispanic Blacks, Hispanics and other Non-Hispanics CSHCN, from low-income families, with complicated health conditions, who were uninsured or publically insured, having family out-of-pocket expenses of more than $250 for their health services and had other unmet specialist care needs. Hispanic CSHCN from low-income families were more likely to be uninsured. Family work life and family financial status were both significantly associated with access and utilization of dental care services in 2005 and 2009.

Conclusion: Although the results of this study show that, in 2005 and 2009, CSHCN accessed and utilized both preventive and other dental care services at a high level, disparities still exist among some CSHCN.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS

BLS	U.S. Bureau of Labor Statistics
CAHMI	Child and Adolescent Health Measurement Initiative
CSHCN	Children with Special Health Care Needs
DHHS	U.S. Department of Health and Human Services
DMFT	Decayed, Missing, and Filled Teeth
DS	Down syndrome
FPL	Federal Poverty Level
HRSA	U.S. Health Resources and Service Administration
IDD	Intellectual and/or developmental disability
MCBH	Maternal and Child Health Bureau
MEPS	Medical Expenditure Panel Surveys
MSA	Metropolitan Statistical Area
NCHS	CDC National Center for Health Statistics
NS-CSHCN	National Survey of Children with Special Health Care Needs
SCHIP	State Children's Health Insurance Program
SLAITS	State and Local Area Integrated Telephone Survey
WHO	World Health Organization

CHAPTER 1: INTRODUCTION

The U.S. Surgeon General's Report on the Oral Health in America 2000 focused on the importance of oral health for all people. It highlighted the importance of understanding the relationship between underlying medical conditions and oral health, and how this affects the access to dental care (U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000).

According to the 2009 National Survey of Children with Special Health Care Needs (NS-CSHCN), the US has 11.2 million children with special healthcare needs. The U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau (2010) has defined Children with Special Health Care Needs (CSHCN) as "...those who have or are at increased risk for a chronic physical, developmental, behavioral, or emotional condition and who also require health and related services of a type or amount beyond that required by children generally."

By law, all Children with Special Health Care Needs (CSHCN) in the US are covered for most healthcare services, including dental care. The literature, however, shows that many are still unable to access and utilize the dental care they need (Lewis, 2009; Kane, Mosca, Zotti, & Schwalberg, 2008). We conducted a preliminary analysis for CSHCN preventive dental care using the 2009 NS-CSHCN and confirmed the literature; the children continue to have problems accessing and utilizing dental care.

Many studies have evaluated the barriers faced by CSHCN in getting the dental care they need (Kenney, Kogan, & Crall, 2008; Szilagyi, 2012). Nevertheless, none of the studies evaluated the access and utilization using a series of cross-sectional studies, which would

have allowed them to examine the changes occurring during a specific period or the possible causes. In this thesis, I take a step back to see the whole picture of access and utilization among CSHCN. In addition, even though all the CSHCN are dentally covered, why does insurance status remain as a major factor preventing some CSHCN from getting the dental care they need?.

While the literature suggests that most parents of CSHCN are either unemployed or part-time employees due to their child's medical condition (Heck & Makuc, 2000; Busch & Barry, 2007; Kogan et al., 2008), the impact of the parental employment status on the access and utilization of dental care by CSHCN has not yet been investigated. This may be an interesting area of research, especially after the 2008 financial crisis, which had the greatest negative impact on employment rate over the past 40 years (Bureau of Labor Statistics, BLS, 2013).

By exploring the above questions, we may gain an understanding of the determinants of access and utilization of dental care, and explain the phenomenon of uninsured CSHCN and the effect of parental employment status on access and utilization of dental care among CSHCN.

CHAPTER 2: BACKGROUND AND LITERATURE REVIEW

Global Picture of CHSCN

In 2011, the World Health Organization (WHO, 2011) issued the first-ever report on the disabled population. The report touched on many aspects related to special healthcare populations including, but not limited to, general healthcare, rehabilitation, assistance and support, enabling environments, education, work and employment, and added future recommendations to improve the quality of life of the special healthcare population. According to the report, almost 20% of the estimated global population had some sort of disability. Further, between 110 and 190 million individuals face significant difficulties in their daily life activities. The report mentioned that only a few countries have a well-established system that can deal and respond to the needs of this special population. The report also revealed some of the barriers that individuals might encounter during their life, such as stigma and discrimination, lack of adequate healthcare and rehabilitation services, and inaccessible transport, buildings, and information and communication technologies. Therefore, the special needs population tends to have poorer health, lower educational accomplishments, fewer economic opportunities, and higher rates of poverty than people without special needs (WHO, 2011).

CSHCN in the United States

In the last decade, the term CSHCN has been substituting for a list of older terms that had been used to represent this special population, such as disabled and handicapped.

The new term represents a new understanding of the way we look at chronic impairment as a condition that affects one or more aspects of daily living, the CSHCN family's needs, and the access and utilization of other supportive services.

Based on the term's definition, in 2009, an estimated 11.2 million children were CSHCN, which represents nearly 15.1% of US children. Further, 23% of households with children include at least one child with a special healthcare need. These numbers have been gradually increasing since 2001. While no clear explanation is given for this trend, the numbers of CSHCN may be truly growing or their special need conditions may be more likely to be diagnosed than they were before (U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2010).

Dental Status of CSHCN in the United States

In 2000, the U.S. Surgeon General attracted public attention to dental care by issuing a report evaluating the dental status in the US. In the report, "Oral Health in America," dental disease was called a "silent epidemic". Although the US has one of the best oral healthcare systems in the world, many people still face big challenges in getting the basic dental care they need. This is an especially serious problem for vulnerable populations such as: children, minorities, special needs individuals, and older adults (U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000). In any case, population-based studies investigating utilization of dental care and the needs of CSHCN in the US have been lacking at the time the report was issued. Therefore, the report only briefly addressed the

oral health of people with disabilities. Since then, more researchers have begun to explore this field.

CSHCN may face higher risks of having oral diseases because of their medical conditions and attaining and keeping good oral health for this group can be especially challenging. While the best way of not getting a disease is through prevention, previous studies show that CSHCN tend to have low dental care utilization compared to their peers without special needs (Carroll et al., 1983).

Yu et al. (2002) studied 35,938 children younger than 18 years using the 1999 National Survey of America's Families to evaluate which factors determine their receiving the recommended well-child and dental visits. The authors found that nearly one-fourth of the children did not have the recommended number of well-child visits. Further, nearly half of them did not have the recommended number of dental visits. For children with poor health conditions, the author used logistic regression and found that they were among the groups that were least likely to meet the recommendations for well-child care (Yu et al., 2002).

Sanjay et al. (2014) evaluated the dental caries status of 310 CSHCN aged 6 to 20 years with hearing and vision problems. They found that the DMFT scores for males and females were 2.11 and 1.75, respectively. Further, CSHCN with vision problems had a higher mean DMFT compared to those with hearing problems, which were 2.16 and 1.80, respectively. In another study to evaluate the dental caries experience, oral hygiene status and dental treatment needs of 61 autistic patients aged 6-16 were compared to a matched control group. The autistic children had significantly higher carious, restored, and

missing teeth compared to the control group, with greater unmet restorative dental needs. Furthermore, the autistic children had poorer oral hygiene and more periodontal disease compared to non-autistic children (Jaber, 2011).

In a study of 80 autistic and non-autistic children aged 8 to 12 years, their periodontal status and orthodontic treatment needs were evaluated, after matching for gender and age (Luppanapornlarp, Leelataweewud, Putongkam, & Ketanont, 2010). The autistic children had a significantly poorer periodontal status than the non-autistic children. Further, the authors found that the autistic children had higher percentages of malocclusion compared to non-autistic children.

In contrast, however, other studies reported opposite findings, where CSHCN tended to receive more frequent dental care compared to children without special needs (Van Cleave & Davis, 2008; Houtrow, Kim, Chen, & Newacheck, 2007). Van Cleave and Davis (2008) conducted a cross-sectional study and analyzed data from 102,353 children aged 0 to 17 years from the National Survey of Children's Health to compare and evaluate the association of attending preventive medical and dental visits between CSHCN and children without SHCN. The authors found that CSHCN are more likely to attend a well-child visit and preventive dental visits, when compared to children without SHCN. Therefore, they tend to have fewer unmet medical and preventive dental needs than their peers without SHCN (Van Cleave & Davis, 2008).

Houtrow et al. (2007) compared 18,279 CSHCN with children without SCHN aged 3 to 17 years in terms of the preventive health services they receive, and identified predictors for the health services. The Medical Expenditure Panel Surveys (MEPS) of

2002 and 2003 were used. With regards to dental care, the authors found that caregivers of CSHCN were more likely to report receiving anticipatory guidance about dental checkups than were the caregivers of children without SHCN, 40.1% and 33.8%, respectively ($P<0.001$) (Houtrow et al., 2007). These different results could be explained by the changes that occurred in the healthcare system in general, and especially with regards to services targeting special needs children, which provided them with better access to preventive services.

Al Habashneh, Al-Jundi, Khader, and Nofel (2012) conducted a cross-sectional study to evaluate the oral health status, treatment needs, soft and hard tissue findings, and the barriers that prevent children with Down syndrome (DS) from attending a dental clinic. This study involved a total of 206 (103 with DS and 103 without DS) subjects of both sexes, with a mean age of 13.66 ± 1.47 years. The outcomes of interests were evaluated using the simplified oral hygiene index, and caries detection was achieved based on WHO caries recording criteria. The means and standard deviations of gingival index and probing pocket depth of children with DS were compared to those without DS and found to be 39.9 ± 9.1, 15.9 ± 8.0 and 2.27 ± 0.2, 1.81 ± 0.32, respectively. The DMFT was significantly lower among male children with DS compared to male children without DS: 2.82 and 4.07, respectively ($P = 0.034$). Parents of children with DS reported that the lack of awareness about their child's dental problem was the most common reason for not going to see a dentist. Nevertheless, parents of children without DS reported that the lack of awareness of the importance of dental visits was the most common reason.

Access of CHSCN to Dental Care

According to the results of the 2001 NS-CSHCN, dental care was the most often reported service that was not received by CSHCN (Waldman & Perlman, 2006). According to many healthcare services, dental care was most commonly reported as needed but not received care among CSHCN. Moreover, CSHCN from low-income families and uninsured CSHCN were less likely to receive the needed dental care. Although CSHCN from low-income families should be covered by public insurance, which in turn covers most dental care services, they were more likely to have unmet dental needs when compared to CSHCN with private insurance. Furthermore, 50% of the parents of uninsured CSHCN reported that their children were not able to obtain their needed dental care. This clearly highlights the presence of access dipartites to dental care among CSHCN (Waldman & Perlman, 2006).

Lewis (2009) conducted a cross-sectional study using the 2005 NS-CSHCN. The study included 46,953 children with and without SHCN to evaluate the prevalence of unmet dental care needs among CSHCN, and subgroup comparisons and a comparison with children without SHCN were made. The author showed that preventive dental care came as the second most needed health service among CSHCN, as reported by caregivers. Among all other healthcare services; however, dental care was the most needed but not received by CSHCN. This represents 8.9% of CSHCN, with 7.4% being unable to obtain their needed preventive dental care and 10.3% unable to get other needed dental care services (restorative and others) (Lewis, 2009).

We conducted a preliminary analysis of the 2009 NS-CSHCN and found an increase to almost 10% in the percentage of children who did not get their needed preventive dental care. Nevertheless, a decrease occurred in the percentage of CSHCN who were not able to get other dental care services, from 10.3% in the 2005 NS-CSHCN to 5.4% in the 2009 NS-CSHCN (U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau, 2006).

Barriers to Dental Care among CSHCN

Many barriers to dental care have been identified in previous studies, including: not having dental insurance, low family income, high treatment cost, dentist unwilling to treat the child, and the complexity of the child's medical condition.

Lewis (2009) found that the high cost of care and being uninsured were the most common reasons for being unable to obtain the needed dental care among CSHCN. In another study, Kane et al. (2008) examined the relationship between the amount of routine medical care and dental care services received among 2,092 CSHCN participants in the 2001 NS-CSHCN. The bivariate analysis indicated that mother's education, federal poverty level, health insurance type, and the ability to get needed routine medical care were strongly associated with having unmet dental care needs. In the multivariate analysis, federal poverty level and the ability to get the needed routine medical care remained as significant predictors of CSHCN receiving the needed dental care (Kane et al., 2008).

Nelson et al. (2011) conducted a cross-sectional study of 1,128 CSHCN to evaluate their oral health status, access to dental care, and barriers they faced to getting dental care, along with their oral health quality of life, while considering the type and severity of the CSHCN's medical condition. In the study, barriers were categorized as: 1) environmental (related to the healthcare system) and 2) non-environmental (related to the child and family). After controlling for other variables, the authors found that non-environmental barriers were not associated with having unmet needs. Nevertheless, three environmental barriers were found to be associated with unmet needs: 1) dentist's unwillingness to treat CSHCN, 2) parents could not find a dentist who would accept the child's insurance, and 3) the dental staff were concerned about treating the child (Nelson et al., 2011).

The child's enrollment status into dental insurance plays a major role in their access to dental care (Szilagyi, 2012). Newacheck, McManus, Fox, Hung, and Halfon (2000) conducted a cross-sectional study to evaluate the effect of health insurance on access and utilization of care services by CSHCN. The study used data from the 1994-1995 National Health Interview Survey on Disability, and involved 57,553 CSHCH who were younger than 18 years old. The majority of CSHCN (89%) were insured, with most of them covered under private insurance. The authors found that insured CSHCN, in general, were less likely to have unmet dental care needs compared to those who were uninsured (6.1% vs 23.9%, respectively).

The results from the 2005 NS-CSHCN showed that 21.1% of uninsured children had unmet preventive dental care needs (Child and Adolescent Health Measurement

Initiative, Data Resource Center for Child and Adolescent Health website, 2006). The Waldman and Perlman (2006) review found that insurance status and federal poverty level (FPL) play an important role in determining the amount of access and utilization of dental care services by CSHCN. They found that 16% of CSHCN from low-income families reported at least one needed, but not received, dental service. Furthermore, parents of 50% of uninsured CSHCN reported that their children were not able to obtain their needed dental care (Waldman & Perlman, 2006).

High dental care cost was also reported by CSHCN parents as being one of the major barriers to getting the dental care needed by CSHCN. Kenney, Kogan, and Crall (2008) conducted a cross-sectional study evaluating the dental status and access to preventive dental care services among CSHCN and compared them to children without SHCN, using the 2003 National Survey of Children's Health. The study involved a total of 17,001 children. The authors concluded that CSHCN tend to have a slightly higher access to dental care compared to children without SHCN. The study also showed that CSHCN encountered some barriers to accessing dental care, based on the parent's income level, parental education, and having insurance coverage (Kenney et al., 2008).

The reviewed literature also showed another significant barrier for CSHCN who are less likely to obtain needed dental care when they fail to obtain needed medical care (Kenney, Kogan, & Crall, 2008). In another study that evaluated dental care services for children with intellectual and/or developmental disability (IDD), children who had a primary care physician had 1.75-times greater odds of using a preventive dental care

system, compared to those who did not have one (Chi, Momany, Kuthy, Chalmers, & Damiano, 2010).

Inadequate training of pre-doctoral and postgraduate dental students can also affect the access of CSHCN to dental care. In 2004, Wolff, Waldman, Milano and Perlman (2004) conducted a cross-sectional study to evaluate how undergraduate dental students are prepared to treat people with mental retardation and whether or not the amount of preparation affects their willingness to see those patients. The study involved 295 undergraduate dental students from 5 dental schools. Interestingly, they found that almost half of the students had no clinical training in this field and two-thirds of them reported having little to no confidence in providing care to these cases (Wolff, Waldman, Milano, & Perlman, 2004).

Casamassimo, Seale and Ruehs (2004) conducted a cross-sectional study using data from the 2001 National Survey of General Dentists to examine their care of CSHCN. They found that only one out of ten general dentists sees CSHCN often or so often. Further, only 25% of them had practical experience in treating CSHCN during dental school. The survey also showed no difference in willingness to treat CSHCN between general practitioners who had postgraduate general dentistry training and those who did not (Casamassimo, Seale, & Ruehs, 2004). The lack of didactic and clinical components that target CSHCN in pre- and postdoctoral education curricula might explain why many dental students and dentists are unwilling treat CSHCN.

Uninsured CSHCN

By law, in the US all Children with Special Health Care Needs (CSHCN) are covered for most healthcare services, including dental care, under Medicaid, SCHIP, and additional benefits such as Title V. Despite this coverage, many parents reported that their CSHCN were uninsured in the 2009 NS-CSHCN.

Only one study in the reviewed literature investigated the case of uninsured CSHCN. Haley and Kenney (2007) explored possible factors that might prevent low-income CSHCN from being enrolled in public health insurance programs. The authors used the 2001 NS-CSHCN and included 968 low-income uninsured children. The 2001 NS-CSHCN was the only NS-CHSCN version that had a section about "Medicaid and SCHIP Knowledge and experience," which was not included in later versions of the NS-CSHCN in 2005 and 2009. The authors found that many of the parents of uninsured CSHCN were not fully aware of Medicaid and state children's health insurance programs. While the majority of parents had heard of these programs (93.5%), only about half of them thought that their CSHCN would be eligible (54.6%). Finally, the majority of the parents responded that they would have applied and enrolled their CSHCN if they had known they were eligible (Haley & Kenney, 2007). The reasons why these parents were uniformed about insurance eligibility needs to be studied since the literature shows that for both 2005 and 2009 NS-CSHCN, those CSHCN without health insurance had more unmet preventive dental needs compared to those with insurance (21.1% and 32%, respectively). Further investigation is needed to clarify the reasons for the uninsured CSHCN.

Parental Employment Status and CSHCN

The literature review revealed an association between parental employment status and having a child with special needs. In general, parents of CSHCN are less likely to be employed full-time. Heck and Makuc (2000) conducted a cross-sectional study using the 1994 National Health Interview Survey to evaluate parental employment status and health insurance coverage among CSHCN and those without SHCN. The study included 21,415 children aged 5 to 17 years, including 1,604 CSHCN. The relevant finding was that CSHCN are less likely to live with parents who are fully employed, compared to children without SHCN. Therefore, they are also less likely to have employer-sponsored health insurance (Heck & Makuc, 2000).

The literature also suggests that this association could be heavily related to the type of special need. Families of CSHCN with autism, asthma, or developmental disabilities were more likely to be part-time employees or to have stopped working, compared to the families with non-CSHCN or children with other special needs (Busch & Barry, 2007; Kogan et al., 2008; Parish, Seltzer, Greenberg, & Floyd, 2004).

The literature shows that children with a severe special need condition are more likely to affect their parents' employment status. Parents of these children are more likely to quit working or reduce their working hours, compared to parents with CSHCN with mild health conditions (Kuhlthau & Perrin, 2001; Looman, O'Conner-Von, Ferski, & Hildenbrand, 2009; Viner-Brown & Kim, 2005; Davidoff, 2004).

Employment Status Before and After the 2008 Great Recession

The great recession, which lasted from December 2007 to June 2009, had the greatest impact on employment rates since 1983. In December 2007, the US unemployment rate was 5.0%, and it subsequently increased to 9.3% in 2009 and 10% in 2010, the highest levels seen in the last 40 years (Bureau of Labor Statistics, BLS, 2013). Based on these numbers, we can assume that the unemployment rate also increased among CSHCN families. Nevertheless, we do not know whether or not employment status is related to access and utilization of dental care, and if it is related, how did the increased unemployment rate between 2007 and 2009 affect access and utilization of dental care among CSHCN.

Healthy People 2020 Oral Health Objectives

Four important objectives for oral health (OH) of CSHCN were addressed by Healthy People 2020:

- OH-1: Reduce the proportion of children and adolescents with dental caries experience in their primary or permanent teeth.
- OH–2: Reduce the proportion of children and adolescents with untreated dental decay.
- OH-7: Increase the proportion of children and adults who use the oral healthcare system each year.
- OH-8: Increase the proportion of low-income children and adolescents who received any preventive dental service during the past year.

The baseline and target percentages set by Healthy People 2020 are for all children, without specifying their health conditions. In this thesis, our results from the 2009 NS-CSHCN will work as a baseline for CSHCN for any future comparisons and improvements on these objectives. Our analyses that use the 2009 NS-CSHCN are restricted to addressing only OH-7 and OH-8, because they are applicable to the oral health variables measured in this dataset.

Gaps in Previous Studies

1. Previous studies have used "access" and "utilization" interchangeably, assuming that they carry the same meaning. In this study, we define the two terms separately to create a more accurate assessment of the dental needs among CSHCN.
2. Factors related to the utilization of dental care services among CSHCN have not been well studied.
3. No study has evaluated the association between access and utilization of dental care services among CSHCN and their parental employment status.
4. No study has evaluated the effect of the 2008 great recession on CSHCN family's employment and financial status and the association with CSHCN access and utilization of dental care services.
5. No study has thoroughly investigated the association between the demographic factors of CSHCN and their families, and the effect of being uninsured CSHCN.

Research Objectives and Questions

1. Evaluate access and utilization of dental services among CSHCN in 2005 and 2009.
2. Evaluate the association between family members' employment status and access and utilization of dental care services among CSHCN in 2005 and 2009.
3. Evaluate the association between family financial problems and access and utilization of dental care services among CSHCN in 2005 and 2009.
4. Identify demographic factors associated with CSHCN's low insurance enrollment despite their eligibility in 2009.

CHAPTER 3: METHODS

Data Sources

Data was obtained from the 2005/2006 and 2009/2010 National Surveys of Children with Special Health Care Needs (NS-CSHCN). The NS-CSHCN is a cross-sectional, quadrennial, random-digit-dialing survey directed towards parents or guardians who were most knowledgeable about their CSHCN's health and healthcare. NS-CSHCN is representative of all non-institutionalized CSHCN, aged 0 to 17 years, in the US and includes all states (Centers for Disease Control and Prevention, National Center for Health Statistics, State and Local Area Integrated Telephone, 2011).The surveys were sponsored by the U.S. Department of Health and Human Services (DHHS), the Maternal and Child Health Bureau (MCBH), and Health Resources and Service Administration (HRSA); and conducted by the CDC's National Center for Health Statistics (NCHS), State and Local Area Integrated Telephone Survey (SLAITS) program. The NS-CSHCN was administered in English, Spanish, Mandarin, Cantonese, Vietnamese, and Korean.

The survey was designed to provide information about CSHCN and their health-related circumstances. The parents or guardians were asked about their child's demographic information, household income relative to the federal poverty guidelines (FPG), their satisfaction with the services provided to their children, their child's health status, functional status, insurance status, dental health status, and access to dental care. (Centers for Disease Control and Prevention, National Center for Health Statistics, State and Local Area Integrated Telephone, 2011).

Study Population

- **Eligibility Criteria:** The CSHCN screener tool (Bethell et al., 2002) was used to determine whether or not the child was considered to have special healthcare needs. The screening tool used consequences-based criteria to screen for specific health conditions of CSHCN. The health conditions included in the tool are: (1) need or use of prescription medications; (2) an above routine use of services; (3) need or use of specialized therapies or services; (4) need or use of mental health counseling; and (5) a functional limitation. To be classified as CSHCN, all the following criteria must be met:
    a. The child currently experiences a specific consequence.
    b. The consequence is due to a medical or other health condition.
    c. The duration or expected duration of the condition is 12 months or longer. (CAHMI – Child and Adolescent Health Measurement Initiative, 2007)

  Only one CSHCN was randomly selected from each household.
- **2005/2006 NS-CSHCN:** 40,840 CSHCN met the eligibility criteria and were included in the study. A minimum of 750 CSHCN were achieved in each of the 50 states and the District of Colombia, with the exception of Alaska, which failed to meet this number.
- **2009/2010 NS-CSHCN:** 40,242 CSHCN met the eligibility criteria and entered the study. A minimum of 750 CSHCN per state were enrolled encompassing all states and the District of Colombia.

Institutional Review Board (IRB)

The Institutional Review Board of Boston Medical Center approved the use of NS-CSHCN under the exempt category (Protocol Number: H-31725).

Variables of Interest and Data Management

In this study, 14 independent and dependent variables were included. The three main dependent variables are: 1) access to dental care, 2) utilization of dental care, and 3) health insurance status. The independent variables of CSHCN at the child-level are: gender, age, race/ethnicity, type of insurance, number of criteria met with the screener tool. Family-level independent variables are: federal poverty level (FPL), family structure type, language spoken at home, family work life, family financial burden, and out-of-pocket expenses.

Dependent variables

1) **Access to both preventive and other dental care services**

- Access to health services means that the patient is able to properly use the personal health services to achieve the best health outcomes ("Access to Health Care in America," 1993). It requires three distinct steps:
    1. Gaining entry into the healthcare system.
    2. Accessing a healthcare location where needed services are provided.
    3. Finding a healthcare provider with whom the patient can communicate and trust.

- To evaluate the level of access for the participants in our study, each of the above three steps were measured using variables from NS-CSHCN datasets that reflect the meaning of each step.
- The first step was measured based on the insurance status of CSHCN (insured vs. uninsured). The second step was supposed to be evaluated based on the area of residence (inside vs. outside a metropolitan statistical area, MSA). Nevertheless, while exploring the datasets, we found that the MSA variable was only collected for 16 states where the population was at least 500,000 for both MSA and non-MSA status. Therefore, to avoid the large amount of missing data for the major study outcome, we replaced this variable with the question asking about the ability of the CSHCN to obtain a referral to specialty care, including dental care. The CSHCN is categorized as either "able" or "not able". The third step of "access" is measured based on the CSHCN's ability to get the needed dental care (no unmet vs. unmet dental services). Then, a combination of these variables provides four categories for the access outcome: 1) very good, 2) good, 3) fair, and 4) poor. "very good" access means that the CHSCN met all three criteria: is insured, able to obtain a referral to a specialty care, and had no unmet dental needs. The CHSCN with "good" access had two criteria and the CSHCN with fair access met only one of the three criteria. Finally, CSHCN with poor access had none of the three criteria, which means they are uninsured, unable to obtain a referral to a specialty care, and have unmet dental care needs. While running the bivariate analysis for this variable, we found very few frequencies in the "fair" and "poor" categories,

and “zero” frequencies in the “very good” access. These low or “zero” frequencies had negatively impacted the results of our bivariate analysis (chi-square test) and resulted in difficulty concluding the statistical significance of the “access” variable. Therefore, we decided to combine the “very good” and “good” access levels into a “very good to good”. Furthermore, we combined the “fair” and “poor” access levels into a “fair to poor”. This modification has resulted in the “access” variable with two levels: 1) very good to good, and 2) fair to poor. Access was measured separately for both preventive and other dental care services. The following Table 1 shows clearly the categorization process for the access variable.

Table 1: Categorization process of the “access” outcome.

Level of Access	Child insurance		Ability to obtain specialty referral		Dental services		Number of criteria met
	Insured	Non-Insured	Able	Not able	No Unmet	Unmet	
Very Good *	✓		✓		✓		3
Good **	✓		✓			✓	2
	✓			✓	✓		2
		✓	✓		✓		2
Fair ***	✓			✓		✓	1
		✓	✓			✓	1
		✓		✓	✓		1
Poor ****		✓		✓		✓	0

* Very good: CHSCN met all three criteria
** Good: CHSCN met only two of the three criteria
*** Fair: CSHCN met only one of the three criteria
**** Poor: CSHCN did not meet any of the three criteria

2) Utilization of both preventive and of other dental care services

- Utilization was measured by the amount of needed dental care services received by CSHCN. It was divided into two groups:
    1. CSHCN did not fully utilize dental care services to get the needed care.
    2. CSHCN fully utilized dental care services to get the needed care.
- This outcome measures the utilization of both preventive and other dental care services for both the 2005 and the 2009 NS-CSHCN.
- To assess utilization of preventive dental care in 2009, the NS-CSHCN added a new question that asked about the number of preventive dental visits that the CSHCN had during the last 12 months. Based on the answer, subsequent questions were asked:
    - During the past 12 months [since his/her birth], how many times did [S.C.] see a dentist for preventive dental care, such as check-ups and dental cleanings?
- If the number of visits was zero, the following question was asked:
    a. During the past 12 months [since his/her birth], was there any time when [S.C.] needed preventive dental care, such as check-ups and dental cleanings?
- But if the answer was one or more visits, the following question was asked:
    b. Did [S.C.] receive all the preventive dental care that [he/she] needed?
- Then, based on responses from questions "a" and "b," if the answer from question "a" was "yes," and from question "b" was "no," the CSHCN was categorized as:

    - CSHCN did not fully utilize preventive dental care services to get the needed care.

- Nevertheless, if the answer from question "b" was "yes," the CSHCN was categorized as:
    - CSHCN fully utilized preventive dental care services to get the needed care.
- However, the same sequence of questions as used for both 2005 and 2009 surveys to assess the utilization of other dental care services, and utilization of preventive and other dental care services for the 2005 NS-CSHCN. These questions were:
    1. During the past 12 months [since his/her birth], was there any time when the sampled child [S.C.] needed preventive dental care, such as check-ups and dental cleanings (OR Any other dental care or orthodontia)?
        - Yes.
        - No (Skip to question 2)
    2. Did [S.C.] receive all the preventive dental care (OR any other dental care or orthodontia) that [he/she] needed?
        - Yes
        - No
- The second question was asked for those who answered "yes" to the first question and the answer determines into which group the CSHCN would be categorized. If the answer was "no," the CSHCN was categorized as:

- CSHCN did not fully utilize dental care services to get the needed care.

However, if the answer was "yes," the CSHCN was categorized as:

- CSHCN fully utilized dental care services to get the needed care.

3) Insurance status

- For this outcome variable, the parents or guardians of the CSHCN were asked about the specific type of insurance that the child had at the time of the interview.
- The main goal of this outcome was to identify uninsured CSHCN. Therefore, regardless of the type of insurance, this variable was categorized only into two groups: insured and uninsured.

Independent Variables

All independent variables are categorical in nature. This subsection is divided into two parts. The first part explains each variable individually and the number of levels they contain as shown in Table 2. The second part explores the re-categorization process of these variables into different groups according to the dependent variable they test.

Re-categorization of independent variables:

Variables related to access to preventive and other dental care:

Variables that were assumed to be related to the access of CSHCN to dental care were categorized into three groups:

1. Home-related variables: Race/ethnicity, age, gender, parent's education, family structure type, federal poverty level (FPL), language spoken at home, medical condition (type and severity)
2. Intermediate variables: Type of the insurance
3. Dental clinic-related variables**:** Out-of-pocket cost of treatment

Variables related to utilization of preventive and other dental care:

- The Anderson Behavioral Model of Health Services is a conceptual model used to evaluate the factors that lead to the utilization of healthcare services (Rebhan, 2008). According to the model, health service utilization is determined by three dynamics:

1. Predisposing factors: Child's age, gender, race/ethnicity, and parent's education level, language spoken at home, medical condition (type and severity)
2. Enabling factors: FPL, insurance, out-of-pocket cost
3. Needs: Need for specialty care services (including dental care)

The model was applied in our study to evaluate what factors affect the utilization of dental care services among CSHCN.

Table 2: List and description of all independent variables included in the study.

Variable	***Explanation***	***Number of Levels***	***Levels***
Gender	----	2	Male
			Female
Age	The age of CSHCN was converted from continuous to categorical	3	0-4
			5-14
			15-17
Race/ethnicity	Race and ethnicity was combined into one variable	4	Non-Hispanic White
			Non-Hispanic Black
			Other Non-Hispanic
			Hispanic
Type of insurance	Type of insurance at the time of the interview	5	Private
			Public
			Both private and public
			Other comprehensive insurance
			Uninsured
Number of criteria met on the screener tool	These criteria are: (1) Need or use of prescription medications; (2) an above routine use of services; (3) need or use of specialized therapies or services; (4) need or use of mental health counseling (5) a functional limitation.	4	1
			2
			3
			4 or 5
Federal Poverty Level (FPL)	Households with income % of Federal Poverty Level (FPL) for family size	4	0-99% FPL
			100-199% FPL
			200-399% FPL
			400% or greater FPL
Family structure type	Family structure of CSHCN	4	Two parent biological/adopted
			Two parent stepfamily
			Single mother, no father present
			other
Language	Language spoken at home	2	English
			Other languages
Family work life	CSHCN affected the family work life	2	Affected
			Not affected
Family financial burden	CSHCN caused any financial problem for the family	2	Yes
			No
Out-of-pocket expenses	Expenses that families pay per year for child's medical expenses including dental care	4	Less than $250
			$250 - $500
			$501 - $1000
			More than $1000

Family financial and employment status

- Parents were asked three questions to determine the impact of caring for CSHCN on the parent's financial and employment situations. The three questions provided information on:

I. (Related to any financial problems)

  - Have [S.C.]'s health conditions caused financial problems for your family?

- The response for this survey item was YES or NO.

II. (Related to the family members' employment status)

  - Have you or other family members stopped working because of [S.C.]'s health conditions?
  - Have you or other family members cut down on the hours you work because of [S.C.]'s health conditions?

- For these two survey items, the response was YES or NO. For the purpose of our study, the responses for these two items were combined and categorized into two groups:

    1. If the family member stopped working *OR* a family member cut down working hours, then "Family work life" was categorized as "affected".
    2. If the family member had not stopped working AND no family member cut down working hours, then "Family work life" was categorized as "not affected".

Variables related to the CSHCN's low insurance enrollment.

The following variables were assumed to be related to the main outcome:

- Race/ethnicity
- Age
- Gender
- Family structure type
- Parents' education
- Income and FPL
- Language spoken at home

Statistical Analysis

General information

All analysis procedures were done using SAS version 9.2 with consideration of the complex sampling design of the survey. The survey weights and SAS survey procedures (Surveyproc, Surveylogistic) were used to obtain unbiased estimates and variance (Centers for Disease Control and Prevention, National Center for Health Statistics, State and Local Area Integrated Telephone, 2011):

- Weight: WEIGHTI
- Cluster: IDNUMR
- Strata: STATE and SAMPLE

In 2009 NS-CSHCN, data was collected via landline and cellphone. In 2005 NS-CSHCN; however, data was collected using landline only. Analyzing and comparing

these two datasets without considering the possible coverage bias in the 2005 survey could have prevented our analysis from fair comparisons of the two surveys, because of possible under- or over-estimation of the results from the 2005 NS-CSHCN sample population. Therefore, we combined the two datasets into a single SAS file and created a SAMPLE variable in the 2005 NS-CSHCN. We then compared the 2005 and 2009 datasets using some demographic variables to evaluate the possible effect that might have been caused by the SAMPLE variable. In any case, we found that the SAMPLE variable did not introduce any statically significant difference within the evaluated variables and the subject interviews using landline and cellphone were comparable.

Descriptive statistics

Descriptive statistics for the CSHCN populations in 2005 and 2009 were developed to describe the study population. Frequency distributions with weighted percentages of demographic variables included: gender, age category, race/ethnicity, FPL, number of criteria met on the screener tool, insurance status, insurance type, family structure type, language spoken at home, and parental education level. In addition, we evaluated the frequency distributions with weighted percentages for access levels to preventive and other dental care services in 2005 and 2009. We also examined the frequency distributions with weighted percentages for utilization levels of preventive and other dental care services in 2005 and 2009.

Bivariate analysis

The survey frequencies procedure in SAS 9.2 was used to run this analysis. This type of procedure is designed to account for the complex survey structure and sampling weight. The bivariate analyses were done to assess potential relationships between predetermined sets of predictors with the following outcomes: access to preventive dental care (in 2005, and 2009), access to other dental care (in 2005, and 2009) utilization of preventive dental care (in 2005, and 2009), utilization of other dental care (in 2005, and 2009), and insurance status in 2009 (the most recent information that we had available). Rao-Scott F adjusted Chi-square statistics was used in the bivariate analyses. This statistical analysis was found to best fit our dataset as it yields a more conservative interpretation, compared to Wald-Chi-squares statistics. The test was used with a consideration of the complex design and sampling weight of the survey.

The access outcome was evaluated using the following predictors: age, gender, race/ethnicity, type of insurance, number of criteria met on the screener tool, FPL, family structure type, language spoken at home, parental education, family work life, and family financial burden.

The following variables were included to examine the utilization outcome: age, gender, race/ethnicity, type of insurance, number of criteria met on the screener tool, FPL, out-of-pocket expenses, language spoken at home, parental education, family work life, and family financial burden.

Finally, the following predictors were included to evaluate the insurance status: gender, age, race/ethnicity, FPL, family structure type, language spoken at home, and parental education.

Multivariate analysis

The SAS survey logistic regression procedures (SurveyLogistic), incorporating the complex survey design and sampling weight, were used to conduct the multivariate analysis. We created one model for each of the nine outcome variables. Variables were included in the model for each outcome based on the statistical significance of the bivariate analysis. The outcome variables are: access to preventive dental care in 2005, access to preventive dental care in 2009, access to other dental care in 2005, access to other dental care in 2009, utilization of preventive dental care in 2005, utilization of preventive dental care in 2009, utilization of other dental care in 2005, utilization of other dental care in 2009, and insurance status in 2009. Odds ratios (OR) and 95% confidence intervals (CI) for the main study outcomes were calculated in each model.

CHAPTER 4: RESULTS

Descriptive Analyses

The study population was children with special healthcare needs (CSHCN) aged between 0-17 years. The study population had diverse racial backgrounds with different types of insurance coverage. Weighted descriptive analyses were done on the study population in 2005 and 2009. The total sample size of CSHCN was 40,723 and 40,242, in 2005 and 2009, respectively.

About 60% of the study sample were males and 64% were between 5 and 14 years old (Table 3). One fifth of the participants were 15-17 years old and around 15% were 0-4 years old. Of the subjects in 2005, 69% were Non-Hispanic Whites. In 2009, Non-Hispanic Whites constituted 10% less (59.3%) of the sample. The second most predominant race was Non-Hispanic Blacks, with a proportion of approximately 16% across the two surveys. The proportion of Hispanics increased from 11.8% in 2005 to 16.8% in 2009. The proportion of Non-Hispanic Others also increased from 2.9% in 2005 to 7.8% in 2009 (Table 3).

Table 3. Sample weighted distribution and descriptive statistics of socio-demographic and outcome variables for CSHCN in 2005 and 2009.

NS-CSHCN	**2005**		**2009**	
Number of CSHCN	**40723**		**40242**	
Gender				
	n	**%**	**n**	**%**
Male	24150	59.4	24139	59.3
Female	16498	40.6	16033	40.7
Age				
0 - 4	5471	16.1	5349	15.4
5 – 14	25820	63.0	26092	64.1
15 – 17	9432	20.9	8801	20.5
Race/ethnicity				
Non-Hispanic White	30694	69.1	27989	59.3
Non-Hispanic Black	4189	16.2	4010	16.1
Others Non-Hispanic	1532	2.9	3764	7.8
Hispanic	4016	11.8	4479	16.8
Type of insurance				
Private	25519	59.1	23315	50.7
Public	9779	28.0	11362	34.7
Both private and public	2932	7.3	2910	7.9
Other comprehensive insurance	967	2.1	1443	3.2
Uninsured	1437	3.5	1149	3.5
Number of criteria met on the screener tool				
1	22257	55.0	21059	51.6
2	8368	20.6	8252	20.5
3	5381	12.8	5550	13.8
4 or 5	4717	11.6	5381	14.1
Federal Poverty Level (FPL)				
0-99% FPL	6332	19.6	6899	22.2
100-199% FPL	8566	21.9	7722	21.9
200-399% FPL	13526	29.7	12572	28.5
400% or greater FPL	12299	28.8	13049	27.4

Table 3. Continued

NS-CSHCN	2005		2009	
Number of CSHCN	**40723**		**40242**	
Family structure type				
	n	%	n	%
Two parent biological/adopted	22512	55.0	25098	56.9
Two parent stepfamily	4151	9.9	3622	9.6
Single mother, no father present	10258	29.9	7803	25.7
Other	2154	5.2	3137	7.8
Language spoken at home				
English	39370	95.3	38346	93.3
Other	1326	4.7	1442	6.7
Parental Education				
Less than high school	1908	6.8	2094	10.9
High school graduate	6449	23.1	5895	20.1
More than high school	32284	70.1	31647	69.0
Outcome variables				
Utilization of preventive dental care				
Full utilization	31597	92.9	33684	91.9
No or partial utilization	2387	7.1	2959	8.1
Utilization of other dental care				
Full utilization	9381	90.4	9403	84.7
No or partial utilization	991	9.6	1698	15.3
Access to preventive dental care				
Very good to good	39784	98.2	39318	98.2
Fair to poor	724	1.8	743	1.8
Access to other dental care				
Very good to good	40100	99.03	39564	98.7
Fair to poor	394	0.97	510	1.3

Only a small percentage of the participants had no insurance of any kind (3.5% in 2005 and 2009). In 2005, about 60% and 30% of the subjects had private or public insurance, respectively. In 2009, however, fewer (50%) of the subjects had private insurance, while more (35%) of the subjects had public insurance. Around 10% of the

subjects consistently across 2005 and 2009 had either "other comprehensive insurance" or both private and public insurance (Table 3).

The percentage of subjects who met one criteria on the screener tool decreased from 55% in 2005 to 51.6% in 2009. Conversely, the proportion of subjects who met 4 or 5 criteria on the screener tool increased from 11.6% in 2005 to 14.1% in 2009. Those who met 2 or 3 criteria on the screener tool constituted about one-third of the subjects and remained unchanged from 2005 to 2009 (Table 3).

The distribution of subjects by FPL did not show a noticeable change from 2005 to 2009. About 20% of the participants reported an income of 0-99% of the FPL. Similarly, about 20% of the subjects reported an income of 100-199% of the FPL. About one-third of the subjects had income that was 200-399% of the FPL and one-third had income that was 400% or greater of the FPL. In regards to family structure, more than half of the subjects lived with two parents (biological or adopted) and one-fifth lived with two step-parents. In 2005, 29.9% of the participants lived with a single mother with no father present and this percentage decreased to 25.7% in 2009. Most of the subjects spoke English at home (95.3% in 2005 and 93.3% in 2009). About 70% of the parents reported having more than high school education. Parents with high school education represented 23.1% of the subjects in 2005 and 20.1% of the subjects in 2009. The proportion of parents with less than high school education increased from 6.8% in 2005 to 10.9% in 2009. (Table 3).

The distribution of subjects by the outcome variables is shown in table 3. In both 2005 and 2009 NS-CSHCN, the majority of CSHCN had fully utilized both preventive

and other dental care services. However, we noticed that CSHCN who partially utilized or didn't utilize other dental care service in 2009 (15.3%) were almost double that in 2005 (9.6%). For the access outcome variable in 2005 and 2009 NS-CSHCN, the vast majority of CSHCN reported having a "very good to good" access to both preventive and other dental service. (Table 3).

Bivariate Analyses

- **Insurance status of CSHCN in 2009:**

The insurance status of CSHCN was examined in bivariate analyses with the set of predictors, including: gender, age, race/ethnicity, FPL, family structure type, language spoken at home, and parental education (Table 4). Based on Rao-Scott F adjusted Chi-square statistics, no statistically significant difference was present in the proportions of males and females between the insured and uninsured CSHCN groups (p-value = 0.355). Age distribution also did not show a significant statistical difference between insured and uninsured groups.

Race/ethnicity showed a significant difference between the insured and the un-insured groups (p-value < 0.0001). In the insured group, Non-Hispanic Whites constituted 59.9%, compared to 43.3% in the uninsured group. In contrast, Hispanics were more represented in the insured group (16.2%), than the insured group (31.8%). The distribution of Non-Hispanic Blacks and Other Non-Hispanics was consistent across both insured and uninsured groups (Table 4).

Distribution of FPL and insurance status of CSHCN showed a noticeable trend. CSHCN who live above 400% FPL were most likely to be insured, while most of the those who live below 400% FPL were more likely to be uninsured (p-value < 0.0001) (Table 4).

In the bivariate analysis, the type of family structure was found to be associated with the insurance status of CSHCN. Insured CSHCN were more likely to have two biological/adopted parents, while uninsured CSHCN were more likely living with single mothers (p-value = 0.006). Of the CSHCN in the insured group, 57.1% lived in families with two biological/adopted parents and then 25.5% were living in a family structure of "single mother". In the uninsured group; however, CSHCN living in a family with two biological/adopted parents represented a lower proportion (48.9%), compared to the insured group, as a higher proportion of CSHCN were living with a single mother (33.0%). The language spoken in the household was not associated with the insurance status of CSHCN (p-value = 0.7) (Table 4).

Another significant association was observed between parental education and the insurance status of CSHCN. Among the uninsured CSHCN group, the proportion of parents with high school education or less was higher than the proportion in the insured group. By the same token, the proportion of parents with more than high school education was higher in the insured group compared to the proportion in the uninsured group (p-value < 0.0001) (Table 4).

Table 4. Bivariate analysis of CSHCN insurance status with socio-demographic variables in 2009.

Variables	**CSHCN Insurance status**		*p-value*†
	Insured (%)*	Uninsured (%)*	
Gender			
Male	23398 (59.3)	701 (58.6)	0.3550
Female	15567 (40.7)	448 (41.4)	
Age			
0 - 4	5234 (15.5)	111 (13.6)	0.7964
5 - 14	25281 (64.1)	773 (62.7)	
15 - 17	8520 (20.4)	265 (13.6)	
Race/ Ethnicity			
Non-Hispanic White	27305 (59.9)	653 (43.3)	<.0001
Non-Hispanic Black	3878 (16.1)	118 (16.8)	
Other Non-Hispanic	3637 (7.8)	121 (8.1)	
Hispanic	4215 (16.2)	257 (31.8)	
Federal Poverty Level (FPL)			
0-99% FPL	6567 (21.9)	315 (31.3)	<.0001
100-199% FPL	7314 (21.4)	394 (32.7)	
200-399% FPL	12206 (28.4)	351 (30.8)	
400% or greater FPL	12948 (28.2)	89 (5.2)	
Family structure type			
Two parent biological/adopted	24451 (57.1)	620 (48.9)	0.0068
Two parent stepfamily	3501 (9.6)	114 (9.3)	
Single mother, no father present	7498 (25.5)	296 (33.0)	
Other	3023 (7.8)	104 (8.8)	
Language spoken at home			
English	37303 (93.8)	996 (81.6)	0.7964
Other	1295 (6.2)	140 (18.4)	
Parental education			
Less than high school	1960 (10.7)	127 (20.3)	<.0001
High school graduate	5614 (19.8)	271 (25.3)	
More than high school	30880 (69.5)	371 (54.4)	

*Weighted column percentages.
† p-value for chi-square test.

- **Utilization Status of Dental Care**

CSHCN utilization of dental care was subdivided into "Utilization of Preventive Dental Care" and "Utilization of Other Dental Care". Our study included study populations from 2005 and 2009. The following section will discuss each utilization subdivision for 2005 and 2009.

CSHCN utilization of preventive dental care in 2005

The distribution of males and females was almost equal between the group of full utilizers and the group of partial or no utilizers, where males represented about 60% of each group. Thus, the difference in gender with regards to utilization of preventive dental care was not significant (p-value = 0.8188) (Table 5).

CSHCN aged 5-14 years constituted 69.2% of the full utilization group compared to only 62.3% of the partial or non-utilizers group. The partial or non-utilizer group had a higher proportion of CSHCN in the 15-17 years age group (28.7%), compared to the proportion in the same age group in the full utilization group (22.1%). This finding was statistically significant (p-value = 0.0002) (Table 5).

A closer look at the amount of utilization within each race/ethnicity revealed that Non-Hispanic Whites constituted the majority of full utilizers (72.1%). Non-Hispanic Whites also represented the majority of the partial utilization or non-utilization group but at a lower proportion (60.7%) than that observed in the full utilization group. The proportions of Non-Hispanic Blacks and Hispanics in the partial or non-utilization group

(20.0% and 16.5% respectively) were higher than that in the full utilization group (14.5%, 10.5% respectively). (p-value < 0.0001) (Table 5).

In regards to the number of criteria met on the screener tool, if the two categories of 3-criteria and 4 or 5-criteria on the screener tool were combined, a proportional trend can be observed based on the category of CSHCN utilization of dental care. An increase can be seen in the full utilization of preventive dental care as the number of criteria met decreased. (p-value < 0.0001) (Table 5).

The full utilization group had a higher proportion of parents with more than high school education (74.3%) compared to the proportion in the partial/no utilization group (60.4%), while the underutilization group had a higher proportion of parents with high school education or less (31% and 8.6%, respectively) compared to the full utilization group (20.3% and 5.4%, respectively). These findings were statistically significant (p-value < 0.0001) (Table 5).

Language spoken at home was found to be associated with the utilization of preventive dental care. Full utilizers were more likely to be CSHCN who speak English at home, while only 3.7% of the full utilizers speak a language other than English, compared to 5.8% of the partial or non-utilizers group. This finding was statistically significant (p-value = 0.01) (Table 5).

Based on the type of insurance, private insurance constitutes the highest proportion of CSHCN who fully utilize preventive dental care (64.5%), followed by public insurance (24.6%). Significant differences in the proportion of types of insurance were observed in the partial or non-utilization group where lower proportions of private

insurance and higher proportions of public and other types of insurance were reported. Private insurance constituted only 39.1% of the partial or non-utilization group but public insurance was reported by 38.1%. CSHCN who did not have any type of insurance represented only 2% of the full utilization group, compared to 11.8% of those in the partial or non-utilization group. CSHCN with private insurance were more likely to fully utilize preventive dental care services in 2005, and others with public, private and public, or other comprehensive insurance and uninsured accounted for most of those underutilizing the service. These findings were statistically significant (p-value < 0.0001) (Table 5).

In regard to the federal poverty level (FPL), two trends were observed from the category of CSHCN utilization of dental care. The first was a proportional trend, where an increase was seen in the full utilization of preventive dental care as the percentage above the FPL increased. The second was an inverse trend, noted in the group of "no or partial utilization" of preventive dental care. The inverse trend showed an increase in the no or partial utilization as the percentage above FPL decreased (below 200% FPL). These findings were statistically significant (p-value < 0.0001) (Table 5).

To further investigate CSHCN utilization of preventive dental care, the out-of-pocket expenses variable was examined. The proportion of CSHCN who pay less than $250 or $501-$1000 is higher among the underutilization group, compared to the full utilization group. The opposite was observed among CSHCN who pay $250-$500, where the proportion was higher among the fully utilization group compared to the underutilization group. The proportion of those who pay more than $1000 out-of-pocket

was consistent for both groups. This finding may be explained by the fact that subjects who did not have insurance paid more expenses out-of-pocket. These findings were statistically significant (p-value = 0.0008).

The ability to get specialty care services was associated with the amount of utilization of preventive dental care among CSHCN. About half of the full utilizers got all their needed care, compared to only 41.3% of the partial or non-utilizers. The proportion of partial or non-utilizers who had unmet specialist care needs (14.4%) was about seven times greater than the proportion of full utilizers who had unmet specialist care needs (2.0%). This finding was statistically significant (p-value < 0.0001) (Table 5).

Table 5: Bivariate analysis of CSHCN utilization of **preventive dental care services** with the Anderson model variables in **2005**.

Variables	**CSHCN Utilization of Preventive Dental Care in 2005**		*p-value*†
	Full utilization (%)*	No or partial utilization (%)*	
	31597	2387	
Predisposing Factors			
Gender			
Male	18638 (58.9)	1415 (58.5)	0.8188
Female	12899 (41.1)	968 (41.5)	
Age			
0 - 4	2261 (8.7)	186 (9.0)	0.0002
5 – 14	21610 (69.2)	1513 (62.3)	
15 – 17	7726 (22.1)	688 (28.7)	
Race/ Ethnicity			
Non-Hispanic White	24580 (72.1)	1597 (60.7)	<.0001
Non-Hispanic Black	2905 (14.5)	331 (20.0)	
Other Non-Hispanic	1139 (2.9)	91 (2.8)	
Hispanic	2773 (10.5)	340 (16.5)	
Number of criteria met on the screener tool			
1	17489 (72.1)	1041 (60.7)	<.0001
2	6461 (14.5)	504 (20.0)	
3	4143 (2.9)	398 (2.8)	
4 or 5	3504 (10.5)	444 (16.5)	
Parental education			
Less than high school	1165 (5.4)	160 (8.6)	<.0001
High school graduate	4403 (20.3)	503 (31.0)	
More than high school	25976 (74.3)	1719 (60.4)	
Language spoken at home			
English	30779 (96.3)	2278 (94.2)	0.0145
Other	801 (3.7)	108 (5.8)	
Enabling Factors			
Type of insurance			
Private	21283 (64.5)	976 (39.1)	<.0001
Public	6641 (24.6)	827 (38.1)	
Both private and public	2191 (6.9)	180 (8.4)	
Other comprehensive insurance	747 (2.0)	67 (2.6)	
Uninsured	675 (2.0)	330 (11.8)	

Table 5. Continued

Variables	**CSHCN Utilization of Preventive Dental Care in 2005**		*p-value*
	Full utilization (%)*	No or partial utilization (%)*	
	31597	2387	
Enabling Factors (cont.)			
Federal Poverty Level (FPL)			
0-99% FPL	879 (11.5)	305 (33.8)	<.0001
100-199% FPL	1548 (16.7)	313 (32.4)	
200-399% FPL	3261 (31.6)	268 (23.1)	
400% or greater FPL	3693 (40.2)	105 (10.7)	
Out-of-Pocket Expenses			
Less than $250	11358 (39.6)	916 (44.3)	0.0008
$250 - $500	8085 (25.7)	501 (19.6)	
$501 - $1000	4408 (13.6)	356 (14.8)	
More than $1000	7169 (21.0)	579 (21.3)	
Need Factors			
Need for specialty care services (including dental care)			
Did not need care	14597 (46.6)	1056 (44.3)	<.0001
Got all needed care	16303 (51.4)	974 (41.3)	
Unmet specialist care needs	597 (2.0)	347 (14.4)	
*Weighted column percentages. † p-value for chi-square test.			

CSHCN may affect the family work life and the family financial burden. Our bivariate analyses indicated that among the full utilization group, the proportion of families whose work life was affected was much lower (21.9%), compared to that among the partial/no utilization group (36.6%) (p-value < 0.0001). In addition, among the partial or non-utilization group, the proportion of those who had family financial burdens due to CSHCN was more than double (36.8%) the proportion with burdens in the full utilization group (16.2%) (p= 0.0001) (Table 6).

Table 6: Bivariate analysis of CSHCN utilization of **preventive dental care services** with family work life and financial burden in **2005**.

Variables	**CSHCN Utilization of Preventive Dental Care in 2005**		*p-value*†
	Full utilization (%)*	No or partial utilization (%)*	
	31597	2387	
Family work life**			
Not affected	24869 (78.1)	1502 (63.4)	<.0001
Affected	6484 (21.9)	865 (36.6)	
Family financial burden**			
No	26165 (83.8)	1399 (63.2)	<.0001
Yes	5161 (16.2)	968 (36.8)	

*Weighted column percentage
**due to CSHCN medical condition
† p-value for chi-square test.

CSHCN utilization of other dental care in 2005

The utilization of other dental care in 2005 was subdivided into "full utilization" and "no or partial utilization" (Table 7). In regard to the subjects' gender, males were less likely to fully utilize other dental services than females. A higher proportion of males had "no or partial utilization" of other dental care (60.9%) compared to the proportion of males in the full utilization group (55.5%). (p-value = 0.04).

CSHCN age 0-5 and 5-14 years were more likely to fully utilize other dental care services in 2005, while those age 15-17 years were more likely to not utilize or partially utilize this service. This finding was statistically significant (p-value = 0.0035) (Table 7).

In regard to race and ethnicity, Non-Hispanic Whites and Hispanics were more likely to fully utilize other dental care services in 2005 (78.3% and 15.3%, respectively).

Interestingly, Hispanics showed the second highest proportion in full utilization of other dental care. This finding differed from that of full utilization of preventive dental care, where Hispanics were among the lowest in utilizing preventive services. This suggests that Hispanics tend to have more treatment, rather than preventive care. Non-Hispanic Blacks and other Non-Hispanics were more likely to underutilize other dental services. The proportion of Non-Hispanic Blacks in the no or partial utilization group (21.6%) was more than double that of the full utilization group (9.1%). (p-value < 0.0001 (Table 7).

In regard to the number of criteria met on the screener tool, we found that in the insured group, the proportion of CSHCN who met one criteria on the screener tool was higher compared to that in the uninsured group. In contrast, the proportions of CSHCN who met two or more criteria on the screener tool were higher in the uninsured group compared to the insured group. This relationship demonstrates that the complexity of the CSHCN medical condition imposes a barrier to preventive dental care services utilization in 2005. These findings were statistically significant (p-value < 0.0001) (Table 7).

The parental education showed a statistically significant association with the utilization of other dental services in 2005 (p-value < 0.0001). CSHCN whose parents had high school education or less were more likely to not utilize or partially utilize preventive dental care service in 2005, while CSHCN living with parents with more than high school education were more likely to fully utilize the service. The proportion of CSHCN in the full utilization group living with parents with less than high school or with high school education (3.8% and 16.5%, respectively) was about half the proportion in the same categories in the no or partial utilization group (9.1% and 31.8%, respectively).

The proportion of CSHCN living with families where English was not the language spoken at home in the no or partial utilization group (4.7%) was twice the proportion of the same category in the full utilization group (2.2%). This finding was statistically significant (p-value = 0.0023) (Table 7).

Based on the type of insurance, CSHCN with private insurance constituted the highest proportion of CSHCN who fully utilize other dental care (72.8%) followed by public insurance (18.1%). An opposite finding was observed within the "no or partial utilization" of other dental care, where the highest proportion was found with public insurance (43.2%) followed by private insurance (36.3%). The proportion of uninsured CSHCN in the no or partial utilization group (13.6%) was about seven-times the proportion of the uninsured CSHCN in the full utilization group (1.8%). These findings were statistically significant (p-value < 0.0001) (Table 7).

In regard to FPL, two opposite trends were observed based on the category of CSHCN utilization of other dental care. Full utilizers of other dental services were more likely to be 200% or above FPL, while under-utilizers of these services were more likely to be under 200% of the FPL. These findings were statistically significant (p-value < 0.0001) (Table 7).

The out-of-pocket expenses variable was examined in relation to CSHCN utilization of other dental care. In the full utilization group, the proportion of CSHCN who pay less than $250 was much lower (29.9%) compared to the partial/no utilization group (42.8%). The proportion of CSHCN who reported paying more than $1000 was much higher in the full utilization group (30.1%) than in the no or partial utilization

group (21.6%). This finding will be further investigated when we control for insurance type and FPL as confounders in the relationship between out-of-pocket expenses and utilization of other dental services in 2005. These findings were statistically significant (p-value < 0.0001) (Table 7).

The ability to get specialty care services was found to be associated with the amount of utilization of other dental care among CSHCN. The proportion of CSHCN who received all needed specialist care were more likely to fully utilize other dental care service. Nevertheless, CSHCN who had unmet specialist care needs in the no or partial utilization group were proportionately six-times more frequent than in the full utilization group. (p-value < 0.0001) (Table 7).

Similar to our findings for the utilization of preventive dental care services in 2005, the bivariate analyses showed that CSHCN who under-utilized other dental care services were more likely to have family work affected, and to report family financial burdens due to their medical condition. (p-value < 0.0001) (Table 8).

Table 7: Bivariate analysis of CSHCN utilization of **other dental care services** with the Anderson model variables in **2005**.

Variables	**CSHCN Utilization of Other Dental Care in 2005**		*p-value*†
	Full utilization (%)*	No or partial utilization (%)*	
	9381	991	
Predisposing Factors			
Gender			
Male	5292 (55.5)	567 (60.9)	0.0453
Female	4065 (44.5)	422 (39.1)	
Age			
0 - 4	319 (4.4)	33 (3.8)	0.0035
5 - 14	6361 (69.7)	635 (60.9)	
15 - 17	2701 (25.9)	323 (35.2)	
Race/ ethnicity			
Non-Hispanic White	7742 (78.3)	651 (60.2)	<.0001
Non-Hispanic Black	560 (9.1)	140 (21.6)	
Other Non-Hispanic	316 (2.9)	40 (3.2)	
Hispanic	705 (15.3)	153 (9.4)	
Number of criteria met on the screener tool			
1	5112 (53.5)	405 (41.0)	<.0001
2	1994 (22.2)	223 (23.2)	
3	1294 (13.9)	183 (19.4)	
4 or 5	981 (10.4)	180 (16.4)	
Parental education			
Less than high school	241 (3.8)	64 (9.1)	<.0001
High school graduate	1050 (16.5)	223 (31.8)	
More than high school	8077 (79.7)	702 (59.1)	
Language spoken at home			
English	9219 (97.8)	942 (95.3)	0.0023
Other	157 (2.2)	48 (4.7)	
Enabling Factors			
Type of insurance			
Private	6873 (72.8)	384 (36.3)	<.0001
Public	1522 (18.1)	365 (43.2)	
Both private and public	562 (5.4)	75 (5.4)	
Other comprehensive insurance	225 (1.9)	22 (1.5)	
Uninsured	188 (1.8)	139 (13.6)	

Table 7. Continued

Variables	**CSHCN Utilization of Other Dental Care in 2005**		*p-value*†
	Full utilization n (%)*	No or partial utilization (%)*	
	9381	991	
Enabling Factors (cont.)			
Federal Poverty Level (FPL)			
0-99% FPL	879 (11.5)	305 (33.8)	<.0001
100-199% FPL	1548 (16.7)	313 (32.4)	
200-399% FPL	3261 (31.6)	268 (23.1)	
400% or greater FPL	3693 (40.2)	105 (10.7)	
Out-of-pocket expenses			
Less than $250	2552 (29.9)	372 (42.8)	<.0001
$250 - $500	2233 (23.9)	198 (21.3)	
$501 - $1000	1473 (16.1)	147 (14.3)	
More than $1000	2968 (30.1)	254 (21.6)	
Need Factors			
Need for specialty care services (including dental care)			
Did not need care	4025 (41.1)	417 (45.6)	<.0001
Got all needed care	5139 (56.6)	396 (40.4)	
Unmet specialist care needs	185 (2.3)	170 (14.0)	
*Weighted column percentages. † p-value for chi-square test.			

Table 8: Bivariate analysis of CSHCN utilization of **other dental care services** with family work life and financial burden in **2005**.

Variables	**CSHCN Utilization of Other Dental Care in 2005**		*p-value*†
	Full utilization (%)*	No or partial utilization (%)*	
	9381	991	
Family work life*			
Not affected	7436 (78.8)	621 (62.9)	<.0001
Affected	1887 (21.2)	356 (38.1)	
Family financial burden*			
No	7643 (82.2)	527 (57.0)	<.0001
Yes	1674 (17.8)	452 (43.0)	
*Weighted column percentage **due to CSHCN medical condition † p-value for chi-square test.			

CSHCN utilization of preventive dental care in 2009

The utilization of preventive dental care in 2009 was also investigated in this study. Similar to the 2005 population, CSHCN utilization of preventive dental care was divided into "full utilization" and "no or partial utilization". The difference in gender with utilization of preventive dental care was not significant (p-value = 0.5332) (Table 9).

The age category was associated with the amount of utilization of preventive dental care in 2009. In general, CSHCN age 5-14 years represented a slightly higher proportion in the full utilization group (69.1%), compared to the no or partial utilization group (62.3%). The age groups of 0-4 and 15-17 years showed higher proportions of no or partial utilization of preventive dental services, compared to the same age groups in the full utilization group in 2009. (p-value = 0.0001) (Table 9).

A closer look at the levels of utilization within each race/ethnicity revealed that similar to the utilization of preventive and other dental services in 2005, Non-Hispanic Whites were more likely to fully utilize preventive dental care services in 2009. In contrast, Hispanic and Non-Hispanic Blacks and other Non-Hispanics were more likely to underutilize the service. These findings were statistically significant (p-value < 0.0001) (Table 9).

In 2009, CSHCN who fully utilized preventive dental care services were more likely to be those who met one criteria on the screener tool, while under-utilizers of the service were CSHCN who met two criteria or more on the screener tool. These findings were statistically significant (p-value < 0.0001) (Table 9).

Parental education showed a proportional trend with the two-levels of CSHCN utilization of preventive dental care. Under-utilization of preventive dental care services in 2009 was more frequent in CSHCN with parents who had high school education or less, while CSHCN who fully utilized the service were more likely to have parents with more than high school education. (p-value < 0.0001) (Table 9).

Similar to the previously reported results for utilization of preventive and other dental service in 2005, language spoken at home was associated with the utilization of preventive dental care in 2009. The proportion of CSHCN who spoke a language other than English was higher in the underutilization group (9.7%), compared to the full utilization group (5.9%). (p-value < 0.0001) (Table 9).

Based on the type of insurance, the proportions of CSHCN who had private, both public and private, and other comprehensive insurance were higher among the "full utilization group," compared to the "no or partial utilization" group. Nevertheless, the proportion of uninsured CSHCN was nearly five times higher in the "no or partial utilization" group (12.5%), compared to the utilization group (2.4%). These findings were statistically significant (p-value < 0.0001) (Table 9).

In regards to FPL, two different trends were observed based on the level of CSHCN utilization of preventive dental care. The first trend was a progressive increase in the "full utilization" of preventive dental care as the percentage above the FPL increased. The second trend showed an inverse relationship between FPL categories and "no or partial utilization" of preventive dental care, where CSHCN who underutilized the

service were more likely to be living at an FPL of less than 200%. These findings were statistically significant (p-value < 0.0001) (Table 9).

Out-of-pocket expenses were associated with the amount of utilization of preventive dental care in 2009. The proportion of CSHCN who paid less than $250 out-of-pocket expense was higher in the “no or partial utilization” group, compared to the “full utilization” group. Nevertheless, the opposite was observed with the proportion of those paying more than $250 out-of-pocket expenses which were higher in the “full utilization” group, compared to the “no or partial utilization” group. These findings were statistically significant (p-value < 0.0185) (Table 9).

Table 9: Bivariate analysis of CSHCN utilization of **preventive dental care services** with the Anderson model variables in **2009**.

Variables	**CSHCN Utilization of Preventive Dental Care in 2009**		*p-value*†
	Full utilization (%)*	No or partial utilization (%)*	
	33684	2959	
Predisposing Factors			
Gender			
Male	20114 (59.1)	1792 (60.2)	0.5332
Female	13509 (40.9)	1156 (39.8)	
Age			
0 - 4	2745 (9.4)	340 (11.3)	0.0001
5 - 14	23264 (69.1)	1865 (62.3)	
15 - 17	7675 (21.5)	754 (26.4)	
Race/ ethnicity			
Non-Hispanic White	23923 (61.3)	1764 (47.8)	<.0001
Non-Hispanic Black	3118 (15.1)	449 (22.5)	
Other Non-Hispanic	3066 (7.6)	349 (10.2)	
Hispanic	3577 (16.0)	397 (19.5)	
Number of criteria met on the screener tool			
1	17867 (52.1)	1237 (43.1)	<.0001
2	6884 (20.5)	638 (21)	
3	4615 (13.9)	480 (15.4)	
4 or 5	4318 (13.5)	604 (20.5)	
Parental education			
Less than high school	1553 (9.9)	246 (15.6)	<.0001
High school graduate	4626 (18.9)	605 (26.0)	
More than high school	27036 (71.2)	2056 (58.4)	
Language spoken at home			
English	32259 (94.1)	2777 (90.3)	<.0001
Other	1068 (5.9)	147 (9.7)	
Enabling Factors			
Type of insurance			
Private	20544 (54.2)	1046 (30.0)	<.0001
Public	8859 (32.4)	1237 (47.4)	
Both private and public	2383 (7.8)	218 (7.5)	
Other comprehensive insurance	1189 (3.2)	114 (2.6)	
Uninsured	662 (2.4)	336 (12.5)	

Table 9. Continued

Variables	**CSHCN Utilization of Preventive Dental Care in 2009**		*p-value*†
	Full utilization (%)*	No or partial utilization (%)*	
	33684	2959	
Enabling Factors (cont.)			
Federal Poverty Level (FPL)			
0-99% FPL	5163 (20.1)	877 (35.0)	<.0001
100-199% FPL	6058 (20.7)	862 (28.5)	
200-399% FPL	10623 (28.6)	852 (27.8)	
400% or greater FPL	11840 (30.6)	368 (8.7)	
Out-of-pocket expenses			
Less than $250	12448 (43.2)	1271 (48.6)	0.0185
$250 - $500	7574 (21.6)	591 (20.5)	
$501 - $1000	4518 (12.2)	326 (10.4)	
More than $1000	8666 (23.0)	730 (20.5)	
Need Factors			
Need for specialty care services (including dental care)			
Did not need care	17444 (53.1)	1545 (51.9)	<.0001
Got all needed care	15239 (43.6)	1041 (34.0)	
Unmet specialist care needs	932 (3.3)	364 (14.1)	

*Weighted column percentages.
† p-value for chi-square test.

The ability to get specialty care services was associated with the amount of utilization of preventive dental care among CSHCN. We found that for the "no or partial utilization" group, the proportion of CSHCN who had unmet specialist care needs was much higher (14.1%) than the proportion among the "full utilization" group (3.3%). In addition, in the "full utilization" group, the proportion of CSHCN who did not need the care or received all needed care needs were higher (53.1% and 43.6%, respectively) than the proportions in the "no or partial utilization" group (51.9% and 34%, respectively). These findings were statistically significant (p-value < 0.0001 (Table 10).

The bivariate analyses also indicated that families of CSHCN who reported no effect on their family work life, and those who reported no financial burden were more prevalent in the "full utilization" group (77% and 80.4%, respectively), compared to the "no or partial utilization" group (63.6% and 61%, respectively). These findings were statistically significant (p-value < 0.0001) (Table 10).

Table 10: Bivariate analysis of CSHCN utilization of **preventive dental care services** with family work life and financial burden in **2009**.

Variables	**CSHCN Utilization of Preventive Dental Care in 2009**		*p-value*†
	Full utilization (%)*	No or partial utilization (%)*	
	33684	2959	
Family work life**			
Not affected	26390 (77.0)	1962 (63.6)	<.0001
Affected	7066 (23.0)	971 (36.4)	
Family financial burden**			
No	27229 (80.4)	1813 (61.0)	<.0001
Yes	6212 (19.6)	1119 (39.0)	

*Weighted column percentage.
**due to CSHCN medical condition.
† p-value for chi-square test.

CSHCN utilization of other dental care in 2009

The utilization of other dental care was also evaluated for 2009. Regarding the subjects' gender, no significant difference was seen in the gender distribution between those who fully utilized other dental care services and those who did not (p-value = 0.3481).

Similar to the 2005 results, in the "full utilization" group, the proportion of CSHCN age 4-15 years was higher (69.1%) than the proportion in the "no or partial

utilization" group (62.9%). The opposite was observed for the CSHCN age groups of 0-4 and 15-17 years, which were more likely to underutilize the service. (p-value = 0.0186) (Table 11). In 2009, Non-Hispanic Whites were more likely to be full utilizers of other dental care services compared to other races. Non-Hispanic Blacks, Other Non-Hispanics, and Hispanics constituted a higher proportion of the "no or partial utilization" group (19.1%, 8.5%, and 22.8%, respectively) compared to their proportions in the "full utilization" group (10.2%, 6.6%, and 13.6%, respectively). These findings were statistically significant (p-value < 0.0001) (Table 11).

Further evaluation of the amount of utilization distribution within each "number of criteria met" category showed that under utilizers were more to be CSHCN who met two or more criteria on the screener tool, while those who only met one criteria were more likely to fully utilize other dental services in 2009. These findings were statistically significant (p-value < 0.0001) (Table 11).

Like the results from the 2005 survey and after evaluating the data from each parental education category within the two levels of other dental care utilization in 2009, CSHCN who underutilized the service were more likely to have parents with high school education or less, while those who fully utilized the service were more likely to have parents with more than high school education. (p-value < 0.0001) (Table 11).

Again, similar to the results from the 2005 survey, language spoken at home was found to be associated with utilization of other dental care in 2009. We found that CSHCN who underutilized the service were more likely to be non-English speakers (10%) than were the full utilizers (3.8%). (p-value < 0.0001).

Based on the type of insurance, in the full utilization group, the proportion of CSHCN with private, both private/public, and other comprehensive insurance was higher (64.8%, 6.5%, and 3.4%, respectively) than that of the no or partial utilization group (34.8%, 4.4%, and 2.9%, respectively). The opposite was seen for CSHCN with public insurance and uninsured, where the proportions were higher (44.9% and 13.0%, respectively) in the no or partial utilization group, compared to the proportions in the full utilization group (23.3% and 2.1%, respectively). (p-value < 0.0001) (Table 11).

Regarding the FPL, we noted that CSHCN living above 200% FPL were more likely to fully utilize other dental service in 2009, while those living under 200% FPL were more likely to underutilized the service. These findings were statistically significant (p-value < 0.0001) (Table 11). Furthermore, the out-of-pocket expenses variable was examined in relation to CSHCN utilization of other dental care. We found that the proportion of those paying more than $250 out-of-pocket expenses in the "full utilization" group was higher than those in the "no or partial utilization" group. (p-value < 0.0001) (Table 11).

The ability to get specialty care services was significantly associated with the amount of utilization of other dental care among CSHCN. CSHCNs who underutilized other dental services had unmet specialist care needs, while those who fully utilized the service were able to receive the needed specialist care or they did not need it. These findings were statistically significant (p-value < 0.0001) (Table 11)

Table 11: Bivariate analysis of CSHCN utilization of **other dental care services** with the Anderson model variables in **2009**.

Variables	**CSHCN Utilization of Other Dental Care in 2009**		*p-value*†
	Full utilization (%)*	No or partial utilization (%)*	
	9403	1698	
Predisposing Factors			
Gender			
Male	5278 (56.2)	980 (53.9)	0.3481
Female	4105 (43.8)	715 (46.1)	
Age			
0 - 4	264 (3.6)	69 (4.2)	0.0186
5 - 14	6408 (69.1)	1101 (62.9)	
15 - 17	2731 (27.3)	528 (32.9)	
Race/ ethnicity			
Non-Hispanic White	7254 (69.6)	1004 (49.6)	<0.0001
Non-Hispanic Black	565 (10.2)	257 (19.1)	
Other Non-Hispanic	769 (6.6)	182 (8.5)	
Hispanic	815 (13.6)	255 (22.8)	
Number of criteria met on the screener tool			
1	5070 (52.8)	682 (41.7)	<0.0001
2	1944 (20.5)	393 (24.0)	
3	1299 (14.0)	290 (14.8)	
4 or 5	1090 (12.7)	333 (19.5)	
Parental education			
Less than high school	284 (5.8)	132 (14.7)	<0.0001
High school graduate	935 (14.0)	306 (22.7)	
More than high school	8129 (80.2)	1235 (62.6)	
Language spoken at home			
English	9140 (96.2)	1592 (90.0)	<0.0001
Other	191 (3.8)	93 (10.0)	
Enabling Factors			
Type of insurance			
Private	6602 (64.8)	664 (34.8)	<0.0001
Public	1711 (23.2)	684 (44.9)	
Both private and public	555 (6.5)	107 (4.4)	
Other comprehensive insurance	366 (3.4)	57 (2.9)	
Uninsured	158 (2.1)	184 (13.0)	

Table 11. Continued

Variables	**CSHCN Utilization of Other Dental Care in 2009**		*p-value*†
	Full utilization (%)*	No or partial utilization (%)*	
	9403	1698	
Enabling Factors (cont.)			
Federal Poverty Level (FPL)			
0-99% FPL	915 (12.9)	468 (32.1)	<0.0001
100-199% FPL	1287 (16.1)	528 (32.3)	
200-399% FPL	3096 (31.2)	509 (25.5)	
400% or greater FPL	4105 (39.8)	193 (10.1)	
Out-of-pocket expenses			
Less than $250	2440 (29.2)	607 (41.4)	<0.0001
$250 - $500	2035 (20.9)	347 (20.5)	
$501 - $1000	1395 (14.4)	227 (13.4)	
More than $1000	3416 (35.5)	490 (24.7)	
Need Factors			
Need for specialty care services (including dental care)			
Did not need care	4290 (46.2)	742 (43.5)	<0.0001
Got all needed care	4838 (50.9)	646 (37.8)	
Unmet specialist care needs	258 (2.9)	301 (18.7)	

*Weighted column percentages.
† p-value for chi-square test.

Our bivariate analyses indicate that, among the "full utilization" group, the proportion of CSHCN whose family work life was affected was less (21.7%) than in the "no or partial utilization" group (34.2%). In the "no or partial utilization" group; however, the proportion of those having some family financial burden due to CSHCN was more than double (43.1%) the proportion of those in the "full utilization" group (20.9%). These findings were statistically significant (p-value < 0.0001) (Table 12).

Table 12: Bivariate analysis of CSHCN utilization of **other dental care services** with family work life and financial burden in **2009**.

Variables	**CSHCN Utilization of Other Dental Care in 2009**		*p-value*†
	Full utilization (%)*	No or partial utilization (%)*	
	9403	1698	
Family work life**			
Not affected	7509 (78.3)	1126 (65.8)	<.0001
Affected	1843 (21.7)	562 (34.2)	
Family financial burden**			
No	7470 (79.1)	944 (56.9)	<.0001
Yes	1886 (20.9)	739 (43.1)	

*Weighted column percentage.
**due to CSHCN medical condition.
† p-value for chi-square test.

Access Status to Dental Care

CSHCN access to dental care was subdivided into two levels: "very good to good," and "fair to poor". Like the utilization section of this study, two populations were investigated for 2005 and 2009. Access status to dental care was examined in bivariate analyses with a set of predictors that included: age, gender, race/ethnicity, type of insurance, number of criteria met on the screener tool, FPL, family structure type, language spoken at home, parental education, family work life, and family financial burden.

CSHCN access to preventive dental care in 2005

The access to preventive dental care was subdivided into "very good to good" and "fair to poor". The differences in gender with regards to access to preventive dental care were not significant (p-value = 0.2603) (Table 13).

In the "very good to good" group, the proportion of CSHCN in the age categories of 0-4 and 4-15 years were higher than the proportion in the "fair to poor" group. The opposite was observed for CSHCN in the 15-17 age category, where a larger proportion was in the "fair to poor" group, compared to those in the "very good to good" group. This finding was statistically significant (p-value < 0.0001) (Table 13).

A closer look at access levels in race/ethnicity categories revealed that Non-Hispanic Whites and Non-Hispanic Blacks were more likely to have "very good to good" access to preventive dental care in 2005. In contrast, Hispanics were more likely to have fair to poor access, while other Non-Hispanics showed comparable proportions in the two levels of access. All of these findings were statistically significant (p-value < 0.0001) (Table 13).

Regarding the number of criteria met on the screener tool, for the "very good to good" access group, the proportion of CSHCN with one or two criteria met on the screener tool was higher than the proportion in the "fair to poor" group. Conversely, in the "fair to poor" access group, the proportion of CSHCN with three or more criteria met on the screener tool was relatively high compared to the "very good to good" group. This finding was statistically significant (p-value < 0.0001).

Regarding FPL, in the "very good to good" access group, the proportion of CSHCN living in FPL 200-399% or above 400% (29.0% and 29.2%, respectively) was higher than the proportions in the "fair to poor" group (19.0% and 7.4%, respectively). The opposite was observed for CSHCN living below 200%, where it was more likely to have "fair to poor" access than "very good to good" access. These findings were statistically significant (p-value < 0.0001) (Table 13).

The family structure type variable was examined in relation to CSHCN access to preventive dental care. In the "very good to good" access group, the proportion of CSHCN living with two parents (biological or adopted) (55.4%) was higher than those in the "fair to poor" group (32.7%). Nevertheless, in the "fair to poor" access group, the proportion of CSHCN living with two parents (step family or single mother) or single mother with no father present (14.2% and 47.8%, respectively) was much higher than in the "very good to good" group (9.9% and 29.5%, respectively). Finally, for both access groups, the proportion of CSHCN living with other family structure types was consistent (about 5%). These findings suggest that CSHCN access to preventive dental services may be influenced by the family structure type of CSHCN. These findings were statistically significant (p-value < 0.0001) (Table 13).

Parental education was examined in relation to CSHCN access to preventive dental care in 2005. In the "very good to good" access group, the proportion of CSHCN with parents with more than high school education (70.3%) was higher than those in the "fair to poor" group (58.8%). In the "fair to poor" access group; however, the proportion of CSHCN with parents with high school or less education was higher than the proportion

in the “very good to good” group. These findings were statistically significant (p-value < 0.0001) (Table 13).

Language spoken in the home was found to be associated with CSHCN access to preventive dental care in 2005. In the “very good to good” access group, the proportion of CSHCN who speak English at home (95.5%) was relatively high compared to the “fair to poor” group (86.4%). In contrast, in the “fair to poor” access group, the proportion of CSHCN who spoke other than English (13.6%) was almost three times the proportion in the “very good to good” group (4.5%). This finding was statistically significant (p-value < 0.0001) (Table 13).

In the “very good to good” group, the proportions of CSHCN with private, public, both private and public, or other comprehensives insurances were higher than those in the “fair to poor” group. In contrast, CSHCN with “fair to poor” access to preventive dental care were more likely to be uninsured (55.5%) than to have any other type of insurance (Table 13).

To further investigate CSHCN access to preventive dental care in 2005, the out-of-pocket expense variable was examined. The proportion of CSHCN who pay less than $250 or $250-$500 was found to be higher in the “very good to good” access group (42.7% and 24.6%, respectively), compared the “fair to poor” (36.9% and 16.2%, respectively) group. The opposite was observed for CSHCN who pay more than $500, where the proportion was higher in the “fair to poor” access group than in the “very good to good” group. This may be explained by subjects not having insurance pay out-of-pocket expenses. These findings were statistically significant (p-value < 0.0001).

Regarding the family work life, bivariate analyses showed that in the "fair to poor" access group, the proportion of those whose family work life was affected was much higher (55.3%) than in the "very good to good" (23.2%) access group (p-value < 0.0001) (Table 14). In regard to the family financial burdens, in the "very good" access group, the proportion of those who had no family financial burdens due to CSHCN (82.5%) was almost double that of the "fair to poor" access group (47.2%). In contrast, in the "fair to poor" access group, the proportion of those who had some family financial burden due to CSHCN (52.8%) was almost triple that of the "very good to good" access group (17.5%). These findings were statistically significant (p-value < 0.0001) (Table 14).

Table 13: Bivariate analysis of CSHCN access to **preventive dental care services** with variables from the three dynamics of the model in **2005**.

Variables	**Access of CSHCN to Preventive Dental Care in 2005**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	39784	724	
Home Factors			
Gender			
Male	23607 (59.4)	406 (56.0)	0.2603
Female	16103 (40.6)	318 (44.0)	
Age			
0 - 4	5387 (16.3)	58 (8.9)	<.0001
5 – 14	25232 (63.1)	447 (58.6)	
15 – 17	9165 (20.6)	58 (32.5)	
Race/ ethnicity			
Non-Hispanic White	30090 (69.3)	462 (59.2)	<.0001
Non-Hispanic Black	4078 (16.2)	79 (15.3)	
Other Non-Hispanic	1495 (2.9)	28 (3.0)	
Hispanic	3841 (11.6)	145 (22.5)	
Number of criteria met on the screener tool			
1	21862 (55.3)	279 (36.9)	<.0001
2	8193 (20.7)	134 (16.7)	
3	5195 (12.6)	152 (23.9)	
4 or 5	4534 (11.4)	159 (22.5)	
Federal Poverty Level (FPL)			
0-99% FPL	6023 (19.2)	242 (40.0)	<.0001
100-199% FPL	8245 (21.6)	265 (36.6)	
200-399% FPL	13318 (29.0)	155 (19.0)	
400% or greater FPL	12198 (29.2)	62 (7.4)	
Family structure type			
Two parent biological/adopted	22173 (55.4)	256 (32.7)	<.0001
Two parent stepfamily	4020 (9.9)	105 (14.2)	
Single mother, no father present	9901 (29.5)	299 (47.8)	
Other	2093 (5.2)	39 (5.3)	
Parental education			
Less than high school	1814 (6.7)	71 (13.4)	<.0001
High school graduate	6260 (23.0)	142 (27.8)	
More than high school	31636 (70.3)	508 (58.8)	

Table 13. Continued

Variables	**Access of CSHCN to Preventive Dental Care in 2005**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	39784	724	
Home Factors (cont.)			
Language spoken at home			
English	38528 (95.5)	644 (86.4)	<.0001
Other	1231 (4.5)	79 (13.6)	
Intermediate Factors			
Type of insurance			
Private	25352 (60.1)	109 (13.7)	<.0001
Public	9586 (28.1)	148 (23.6)	
Both private and public	2886 (7.3)	33 (6.2)	
Other comprehensive insurance	957 (2.0)	8 (1.0)	
Uninsured	1003 (2.5)	426 (55.5)	
Dental Clinic Factors			
Out-of-pocket expenses			
Less than $250	15267 (42.7)	219 (36.9)	<.0001
$250 - $500	9820 (24.6)	127 (16.2)	
$501 - $1000	5337 (12.9)	112 (15.5)	
More than $1000	8643 (19.8)	252 (31.4)	
*Weighted column percentages. † p-value for chi-square test.			

Table 14: Bivariate analysis of CSHCN access to **preventive dental care services** the family work life and family financial burden in **2005**.

Variables	**Access of CSHCN to Preventive Dental Care in 2005**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	39784	724	
Family work life**			
Not affected	30748 (76.8)	355 (44.7)	<.0001
Affected	8734 (23.2)	358 (55.3)	
Family financial burden**			
No	32440 (82.5)	310 (47.2)	<.0001
Yes	7003 (17.5)	410 (52.8)	
*Weighted column percentage. **due to CSHCN medical condition. † p-value for chi-square test.			

CSHCN access to other dental care in 2005

Like the access to preventive dental care, the access to other dental care in 2005 was subdivided into "very good to good," or "fair to poor". Differences due to gender with regards to access to other dental care was not significant (p-value = 0.6646) (Table 15).

The age group of 5-14 years constituted about two-thirds of each of the two access categories. In comparing the proportions, the age category 0-4 and 5-14 years in the access groups were higher in the "very good to good" group, compared to the "fair to poor" access group. However, the age category of 15-17 years constituted almost one-third of the "fair to poor" access group, which was higher than the proportion in the "very good to good" access group. This finding was statistically significant (p-value < 0.0001) (Table 15).

Regarding race and ethnicity, a closer look at the access levels in each race/ethnicity group revealed that Non-Hispanic Whites and Non-Hispanic Blacks were more likely to have "very good to good" access to other dental care in 2005. Other non-Hispanic CSHCN group had consistent proportions in all of the access levels. Hispanic CSHCN; however, were more likely to have "fair to poor" access to other dental care. These findings were statistically significant (p-value < 0.0001) (Table 15).

Regarding the number of criteria met on the screener tool, an inverse trend between access to other dental care and the number of criteria met was seen. For instance, in the "very good to good" access group, the proportions of CSHCN with one or two

criteria met on the screener tool was higher than in the "fair to poor" group. In contrast, in the "fair to poor" access group, the proportion of CSHCN with three or more criteria met on the screener tool was higher than in the "very good to good" group. (p-value < 0.0001) (Table 15).

Regarding FPL, in the "very good to good" access group, the proportions of CSHCN living in FPL 200-399% or above 400% were much higher than for those in the "fair to poor" group. The opposite was observed for CSHCN living below 200%, who were more likely to have "fair to poor" access than "very good to good" access. These findings were statistically significant (p-value < 0.0001) (Table 15).

The family structure type variable was examined in relation to CSHCN access to other dental care. In the "very good to good" access group, the proportion of CSHCN living with two parents (biological or adopted) was higher than for those in the "fair to poor" group. Nevertheless, in the "fair to poor" access group, the proportion of CSHCN living with a two-parent step-family, a single mother or other family structure type were higher than that in the "very good to good" group. These findings were statistically significant (p-value < 0.0001) (Table 15).

The parental education variable was examined in relation to CSHCN access to other dental care in 2005. In the "very good to good" access group, the proportion of CSHCN with parents with more than high school education (70.2%) was higher than for those in "fair to poor" group (58.8%). Nevertheless, in the "fair to poor" access group, the proportion of CSHCN with parents with high school education or with less than high

school education was higher than those in the "very good to good" group. These findings were statistically significant (p-value < 0.0001) (Table 15).

Similar to the access to preventive dental services, language spoken at home was associated with CSHCN access to other dental care in 2005. In the "fair to poor" access group, the proportion of CSHCN who spoke a language other than English at home (13.6%) was much higher than for those in the "very good to good" group (4.6%). This finding was statistically significant (p-value < 0.0001) (Table 15).

In the "very good to good" group, the proportions of CSHCN with private, public, both private and public insurance and other comprehensive insurance were higher than for those in the "fair to poor" group. In contrast, CSHCN with "fair to poor" access to other dental care were more likely to be uninsured (55.5%) than to have any other type of insurance. (p-value < 0.0001) (Table 15).

To further investigate CSHCN access to other dental care, the out-of-pocket expenses variable was examined. The proportion of CSHCN who pay less than $250 or $250-$500 was higher in the "very good to good" access group (42.8% and 24.4%, respectively), compared to the "fair to poor" (31.2% and 20.3%, respectively) group. The opposite was observed for CSHCN who pay more than $500, where the proportion was higher in the "fair to poor" access group, compared to the "very good to good" group. These findings were statistically significant (p-value = 0.0005) (Table 15).

Family work life and financial burdens were both examined against the access to other dental care in 2005. Both variables presented similar results as in the access to preventive dental care. In the "fair to poor" access group, the proportion of CSHCN

whose family work life was affected was much higher (53.8%) than for those in the "very good to good" (23.5%) access group (p-value < 0.0001). Furthermore, in the "very good to good" access group, the proportion of those who had no family financial burden due to CSHCN was almost double that in the "fair to poor" access group. In contrast, in the "fair to poor" access group, the proportion of those who had some family financial burden due to CSHCN was almost three-times that in the "very good to good" access group. These findings were statistically significant (p-value < 0.0001) (Table 16).

Table 15: Bivariate analysis of CSHCN access to **other dental care services** with variables from the three dynamics of the model in **2005**.

Variables	**Access of CSHCN to Other Dental Care in 2005**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	40100	394	
Home Factors			
Gender			
Male	23790 (59.4)	217 (56.0)	0.6646
Female	16237 (40.6)	175 (44.0)	
Age			
0 - 4	5434 (16.3)	20 (8.9)	<.0001
5 - 14	25420 (63.0)	250 (58.6)	
15 - 17	9246 (20.7)	124 (32.5)	
Race/ ethnicity			
Non-Hispanic White	30313 (69.2)	229 (59.2)	<.0001
Non-Hispanic Black	4107 (16.2)	53 (15.6)	
Other Non-Hispanic	1503 (2.9)	18 (3.0)	
Hispanic	3892 (11.7)	89 (22.2)	
Number of criteria met on the screener tool			
1	22003 (55.2)	142 (36.9)	<.0001
2	8229 (20.6)	88 (16.7)	
3	5270 (12.7)	77 (23.9)	
4 or 5	4598 (11.5)	87 (22.5)	
Federal Poverty Level (FPL)			
0-99% FPL	6119 (19.4)	142 (36.9)	<.0001
100-199% FPL	8368 (21.7)	143 (36.6)	
200-399% FPL	13394 (29.9)	79 (19.1)	
400% or greater FPL	12219 (29.0)	30 (7.4)	
Family structure type			
Two parent biological/adopted	22308 (55.3)	121 (32.6)	<.0001
Two parent stepfamily	4072 (9.9)	59 (14.2)	
Single mother, no father present	10015 (29.7)	170 (47.4)	
Other	2100 (5.1)	28 (5.8)	
Parental education			
Less than high school	1857 (6.8)	29 (13.8)	<.0001
High school graduate	6322 (23.0)	85 (27.4)	
More than high school	31845 (70.2)	279 (58.8)	

Table 15. Continued

Variables	**Access of CSHCN to Other Dental Care in 2005**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	40100	394	
Home Factors (cont.)			
Language spoken at home			
English	38814 (95.4)	344 (86.4)	<.0001
Other	1261 (4.6)	49 (13.6)	
Intermediate Factors			
Type of insurance			
Private	25400 (59.6)	49 (13.7)	<.0001
Public	9657 (28.1)	70 (23.6)	
Both private and public	2907 (7.4)	16 (6.2)	
Other comprehensive insurance	962 (2.0)	2 (1.0)	
Uninsured	1174 (2.9)	257 (55.5)	
Dental Clinic Factors			
Out-of-pocket expenses			
Less than $250	15381 (42.8)	114 (31.2)	0.0005
$250 - $500	9870 (24.4)	71 (20.3)	
$501 - $1000	5385 (12.9)	62 (16.3)	
More than $1000	8744 (19.9)	141 (32.2)	
*Weighted column percentages. † p-value for chi-square test.			

Table 16: Bivariate analysis of CSHCN access to **other dental care services** with the family work life and family financial burden in **2005**.

Variables	**Access of CSHCN to Other Dental Care in 2005**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	40100	394	
Family work life**			
Not affected	30898 (76.5)	194 (46.2)	<.0001
Affected	8902 (23.5)	196 (53.8)	
Family financial burden**			
No	32589 (82.3)	152 (40.6)	<.0001
Yes	7169 (17.7)	239 (59.4)	
*Weighted column percentage. **due to CSHCN medical condition. † p-value for chi-square test.			

CSHCN access to preventive dental care in 2009

Access to preventive dental care in 2009 was also subdivided into "very good to good" and "fair to poor" groups. Regarding the differences due to gender, we found that both genders had comparable proportions across both levels of access with non-significant p-value of 0. 7448 (Table 17).

In the "very good to good" group, the proportion of CSHCN in the 0-4 and 5-14 years age categories were higher, compared to that in the "fair to poor" group. Nevertheless, the proportion of CSHCN in the 15-17 years age category was higher for the "fair to poor" access group, compared to the proportions in the "very good to good" group. (p-value = 0.0053) (Table 17).

A closer look at access levels for each race/ethnicity revealed that Non-Hispanic Whites, Non-Hispanic Blacks, and Hispanics were more likely to have "very good to good" access to preventive dental care in 2005. In contrast, Other Non-Hispanics were more likely to have "fair to poor" access. All of these findings were statistically significant (p-value < 0.0001) (Table 17).

In regard to the number of criteria met on the screener tool, in the "very good to good" access group, the proportion of CSHCN with one criterion met on the screener tool was high, compared to that in the "fair to poor" group. On the other hand, in the "fair to poor" access group, the proportion of CSHCN with two or more criteria met on the screener tool was higher, compared to that of the "very good to good" group. (p-value < 0.0154).

In regard to FPL, two different trends were observed based on the level of CSHCN access to preventive dental care. Similar to the access of CSHCN to dental care in 2005, a progressive increase in the "fair to poor" access of preventive dental care, as the percentage above FPL decreased. For instance, CSHCN living below 200% were more likely to have "fair to poor" access rather than "very good to good" access. However, in the "very good to good" access group, the proportions of CSHCN living in FPL 200-399% or above 400% were much higher than in "fair to poor" group. These findings were statistically significant (p-value < 0.0001) (Table 17).

The family structure type variable was examined in relation to CSHCN access to preventive dental care in 2009. In the "very good to good" access group, the proportion of CSHCN living with two parents (biological or adopted) (57.4%) was higher than that of the "fair to poor" group (41%). Nevertheless, in the "fair to poor" access group, the proportions of CSHCN living with two-parent step-family, single mothers or other family structure type were higher than in the "very good to good" group. (p-value < 0.0001) (Table 17).

Parental education was examined in relation to CSHCN access to preventive dental care in 2009. In the "very good to good" access group, the proportion of CSHCN with parents with more than high school education (69.2%) was higher than those in the "fair to poor" group (58.7%). Nevertheless, in the "fair to poor" access group, the proportions of CSHCN with parents with a high school education or less were higher (22.8% and 18.5% respectively) than that of the "very good to good" group (19.9% and

10.9%, respectively). These findings were statistically significant (p-value = 0.0019) (Table 17).

Language spoken at home was examined against CSHCN access to preventive dental care in 2009. In the "very good to good" access group, the proportion of CSHCN who speak English at home (93.7%) was higher than that of the "fair to poor" group (81.6%). In contrast, in the "fair to poor" access group, the proportion of CSHCN who spoke a language other than English at home (18.4%) was much higher than that of the "very good to good" group (6.3%). (p-value < 0.0001) (Table 17).

In the "very good to good" group, the proportion of CSHCN with private, public, both private and public, and other comprehensive insurance were higher than that of the "fair to poor" group. In contrast, CSHCN with "fair to poor" access to preventive dental care were more likely to be uninsured (58.3%) than to have any other type of insurance (p-value < 0.0001) (Table 17).

The out-of-pocket expenses variable was examined and not found to be associated with access to preventive dental care in 2009 (p-value = 0.6149).

Family work life and financial burden were both examined against access to preventive dental care in 2009, and showed results that were similar to those for the 2005 analysis. In the "fair to poor" access group, the proportions of CSHCN whose family work life was affected or had some family financial burden due to CSHCN were two to three-times that of the "very good to good" access group. These findings were statistically significant (p-value < 0.0001) (Table 18).

Table 17: Bivariate analysis of CSHCN access to **preventive dental care services** with variables from the three dynamics of the model in **2009**.

Variables	**Access of CSHCN to Preventive Dental Care in 2009**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	39318	743	
Home Factors			
Gender			
Male	23558 (59.3)	458 (58.2)	0.7448
Female	15690 (40.7)	285 (41.8)	
Age			
0 - 4	5235 (15.6)	82 (10.2)	0.0053
5 – 14	25498 (64.1)	485 (62)	
15 – 17	8585 (20.3)	176 (27.8)	
Race/ ethnicity			
Non-Hispanic White	27485 (59.8)	401 (42.2)	<.0001
Non-Hispanic Black	3875 (16.0)	99 (11.6)	
Other Non-Hispanic	3655 (7.8)	93 (39.0)	
Hispanic	4303 (16.4)	150 (8.4)	
Number of criteria met on the screener tool			
1	20672 (51.9)	298 (41.2)	0.0154
2	8054 (20.5)	158 (24)	
3	5395 (13.7)	158 (16.8)	
4 or 5	5197 (13.9)	156 (18.0)	
Federal Poverty Level (FPL)			
0-99% FPL	6609 (21.8)	236 (38.7)	<.0001
100-199% FPL	7419 (21.5)	257 (33.3)	
200-399% FPL	12325 (28.6)	197 (24.7)	
400% or greater FPL	12965 (28.1)	52 (3.3)	
Family structure type			
Two parent biological/adopted	24690 (57.4)	336 (41.0)	<.0001
Two parent stepfamily	3523 (9.5)	78 (11.6)	
Single mother, no father present	7522 (25.4)	244 (39.0)	
Other	3019 (7.7)	76 (8.4)	
Parental education			
Less than high school	1995 (10.9)	82 (18.5)	0.0019
High school graduate	5707 (19.9)	158 (22.8)	
More than high school	31033 (69.2)	491 (58.7)	

Table 17. Continued

Variables	**Access of CSHCN to Preventive Dental Care in 2009**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	39318	743	
Home Factors			
Language spoken at home			
English	37530 (93.7)	656 (81.6)	<.0001
Other	1349 (6.3)	77 (18.4)	
Intermediate Factors			
Type of insurance			
Private	23173 (51.8)	107 (10.4)	<.0001
Public	11128 (34.9)	183 (26.5)	
Both private and public	2865 (8.0)	31 (3.9)	
Other comprehensive insurance	1425 (3.2)	10 (0.9)	
Uninsured	722 (2.1)	412 (58.3)	
Dental Clinic Factors			
Out-of-pocket expenses			
Less than $250	15098 (44.7)	231 (39.1)	0.6149
$250 - $500	8664 (21.4)	162 (22.7)	
$501 - $1000	5129 (11.8)	89 (12.7)	
More than $1000	9865 (22.1)	242 (25.5)	
*Weighted column percentages. † p-value for chi-square test.			

Table 18: Bivariate analysis of CSHCN access to **preventive dental care services** with the family work life and family financial burden in **2009**.

Variables	**Access of CSHCN to Preventive Dental Care in 2009**		*p-value*
	Very Good to Good (%)*	Fair to Poor (%)*	
	39318	743	
Family work life**			
Not affected	30380 (75.7)	423 (49.5)	<.0001
Affected	8652 (24.3)	313 (50.5)	
Family financial burden**			
No	31412 (79.5)	313 (42.0)	<.0001
Yes	7614 (20.5)	422 (58.0)	
*Weighted column percentage. **due to CSHCN medical condition. † p-value for chi-square test.			

CSHCN access to other dental care in 2009

Access to other dental care in 2009 was also subdivided into "very good to good," and "fair to poor". With regards to the effect of gender, in the "very good to good" access group, the proportion of male CSHCN (59.5%) was higher than that of the "fair to poor" group (50%). In contrast, the proportion of female (50.0%) was higher in the "fair to poor" group than that of the "very good to good" group (40.5%). This finding was statistically significant (p-value = 0.0198) (Table 19).

In the "very good to good" access group, the proportion of CSHCN within the 0-4 year age category was higher than that of the "fair to poor" group. The opposite was observed for CSHCN in the 15-17 years age category, where a higher proportion was in the "fair to poor" access group than in the "very good to good" group. Finally, in both access groups, the proportion of CSHCN within the 5-14 years age category was consistent. This finding was statistically significant (p-value < 0.0001) (Table 19).

A closer look at the access levels for each race/ethnicity revealed that only Non-Hispanic Whites were more likely to have "very good to good" access to other dental care in 2009. In contrast, Non-Hispanic Blacks, other Non-Hispanics, and Hispanics were more likely to have "fair to poor" access. (p-value < 0.0001) (Table 19).

By exploring the number of criteria met on the screener tool, in the "very good to good" access group, the proportion of CSHCN with one criterion met on the screener tool was higher than that in the "fair to poor" group. On the other hand, in the "fair to poor" access group, the proportion of CSHCN with two or more criteria met on the screener

tool was higher than that of the "very good to good" group. This finding was statistically significant (p-value = 0.0015) (Table 19).

In regard to FPL, among the "very good to good" access group, the proportions of CSHCN living in FPL 200-399% or above 400% were higher than that of the "fair to poor" group. The opposite was observed for CSHCN living below 200%, where it is more likely to have "fair to poor" access rather than "very good to good" access to other dental care services in 2009. (p-value < 0.0001) (Table 19).

The family structure type variable was examined in relation to CSHCN access to other dental care in 2009. In the "very good to good" access group, the proportion of CSHCN living with two parents (biological or adopted) (57.2%) was higher than that of the "fair to poor" group (41.7%). Nevertheless, in the "fair to poor" access group, the proportions of CSHCN living with a two-parent step-family, single mother, or other family structure type were higher than that of the "very good to good" group. (p-value = 0.0007) (Table 19).

Parental education was examined in relation to CSHCN access to other dental care in 2009. The results were comparable to those for access to preventive dental care. In the "very good to good" access group, the proportion of CSHCN with parents with more than high school education (69.3%) was higher that of the "fair to poor" group (60.9%). In the "fair to poor" access group; however, the proportions of CSHCN with parents with high school education or less than high school education (20.6% and 18.5% respectively) were higher than that of the "very good to good" group (19.9% and 10.8%, respectively). (p-value = 0.0135) (Table 19).

As seen from the access to preventive/other dental care in 2005 and the access to preventive dental care in 2009, the language spoken at home was significantly associated with CSHCN access to other dental care in 2009. In the "very good to good" access group, the proportion of CSHCN who speak English at home (93.7%) was higher than that of the "fair to poor" group (81.3%). In contrast, in the "fair to poor" access group, the proportion of CSHCN speaking other than English (18.7%) was much higher than that of the "very good to good" group (6.3%). (p-value < 0.0001) (Table 19).

With regards to insurance status, in the "very good to good" group, the proportions of CSHCN with private, public, both private and public, and other comprehensive insurance were higher than that of the "fair to poor" group. In contrast, CSHCN with "fair to poor" access to other dental care were more likely to be uninsured (58.9%) than to have any other type of insurance (Table 19).

Out-of-pocket expense was also evaluated against CSHCN access to other dental care in 2009. The proportion of CSHCN paying less than $250 was found to be higher in the "very good to good" access group (44.8%), when compared to the "fair to poor" group (31.6%). The opposite was seen for CSHCN paying more than $250, where the proportion was higher in the "fair to poor" access group than in the "very good to good" group. (p-value = 0.0073) (Table 19).

Family work life and financial burden were both examined in terms of access to other dental care. Both variables presented similar results like the access to preventive and other dental care in 2005, and the access to preventive dental care in 2009. In the "fair to poor" access group, both CSHCN with family work life being affected and family

with financial burdens due to the condition had much higher proportions than those of the "very good to good" group. Both of these findings were statistically significant (p-value < 0.0001) (Table 20).

Table 19: Bivariate analysis of CSHCN access to **other dental care services** with variables from the three dynamics of the model in **2009**.

Variables	**Access of CSHCN to Other Dental Care in 2009**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	39564	510	
Home Factors			
Gender			
Male	23732 (59.5)	293 (50.0)	0.0198
Female	15762 (40.5)	217 (50.0)	
Age			
0 - 4	5305 (15.7)	30 (5.7)	<.0001
5 - 14	25647 (64.0)	340 (63.5)	
15 - 17	8612 (20.3)	140 (30.8)	
Race/ ethnicity			
Non-Hispanic White	27635 (59.7)	257 (39.7)	<.0001
Non-Hispanic Black	3912 (16.1)	70 (19.1)	
Other Non-Hispanic	3682 (7.8)	64 (11.1)	
Hispanic	4335 (16.4)	121 (30.1)	
Number of criteria met on the screener tool			
1	20777 (51.9)	196 (37.2)	0.0015
2	8111 (20.5)	110 (25.7)	
3	5433 (13.7)	95 (15.8)	
4 or 5	5243 (13.9)	109 (21.3)	
Federal Poverty Level (FPL)			
0-99% FPL	6676 (21.9)	169 (37.2)	<.0001
100-199% FPL	7506 (21.5)	179 (36.6)	
200-399% FPL	12401 (28.7)	130 (21.7)	
400% or greater FPL	12981 (27.9)	32 (4.5)	
Family structure type			
Two parent biological/adopted	24816 (57.2)	214 (41.7)	0.0007
Two parent stepfamily	3538 (9.4)	72 (13.7)	
Single mother, no father present	7596 (25.6)	166 (35.8)	
Other	3053 (7.8)	48 (8.8)	
Parental education			
Less than high school	2009 (10.8)	60 (18.5)	0.0135
High school graduate	5765 (19.9)	98 (20.6)	
More than high school	31202 (69.3)	347 (60.9)	

Table 19. Continued

Variables	**Access of CSHCN to Other Dental Care in 2009**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	39564	510	
Home Factors			
Language spoken at home			
English	37762 (93.7)	438 (81.3)	<.0001
Other	1361 (6.3)	66 (18.7)	
Intermediate Factors			
Type of insurance			
Private	23211 (51.6)	70 (12.6)	<.0001
Public	11167 (34.8)	146 (25.1)	
Both private and public	2884 (8.0)	18 (2.3)	
Other comprehensive insurance	1433 (3.2)	5 (1.1)	
Uninsured	864 (2.4)	240 (58.9)	
Dental Clinic Factors			
Out-of-pocket expenses			
Less than $250	15191 (44.8)	141 (31.6)	0.0073
$250 - $500	8733 (21.4)	96 (22.2)	
$501 - $1000	5150 (11.8)	74 (14.6)	
More than $1000	9923 (22.0)	191 (31.6)	
*Weighted column percentages. † p-value for chi-square test.			

Table 20: Bivariate analysis of CSHCN access to **other dental care services** with the family work life and family financial burden in **2009**.

Variables	**Access of CSHCN to Other Dental Care in 2009**		*p-value*†
	Very Good to Good (%)*	Fair to Poor (%)*	
	39564	510	
Family work life**			
Not affected	30526 (75.5)	284 (50.0)	<.0001
Affected	8751 (24.5)	221 (50.0)	
Family financial burden**			
No	31540 (79.3)	192 (37.4)	<.0001
Yes	7733 (20.6)	310 (62.6)	
*Weighted column percentage **due to CSHCN medical condition. † p-value for chi-square test.			

Multivariate Analyses

We used the survey procedure analysis method (Proc Surveylogistic) to predict "no or partial utilization" of preventive dental care services in 2005 and 2009; "no or partial utilization" of other dental care services in 2005 and 2009; "fair to poor access" to preventive dental care services in 2005 and 2009; and "fair to poor access" to other dental care services in 2005 and 2009, and "uninsured" CSHCN in 2009 based on the variables that were significant in the bivariate analysis (p-value < 0.05).

Survey logistic models

- **Utilization of dental care services.**

CSHCN utilization of dental care was subdivided into "utilization of preventive dental care" and "utilization of other dental care". This analysis included study populations from 2005 and 2009. The following section describes each utilization subdivision model for the 2005 and 2009 datasets. A total of four logistic models were created to predict "no or partial utilization" of dental care services under each subdivision.

Predicting "no or partial utilization" of preventive dental care services in 2005

We used the survey procedure analysis approach to build a logistic regression model to predict no or partial utilization of preventive dental care services in 2005 (Table

21). We included predisposing factors (age, race/ethnicity, number of criteria met on the screener tool, parental education, language spoken at home), enabling factors (type of insurance, FPL, out-of-pocket expenses), and need factors (need for specialty care services). These predictors were included based on the significance of the bivariate analysis ($p < 0.05$). The global test was statistically significant with a p-value <0.0001. Statistical significance for these models were based on the 95% CI for the OR, and not on the p-value. With regards to predisposing factors, we found that age, parental education, and language spoken at home were not significant predictors for not or partially utilizing of preventive dental care services in 2005. Race/ethnicity demonstrated a statistically significant relationship for Hispanics, who had greater the odds of no or partial utilization of preventive dental care services, compared to Whites (OR=1.48). For the number of criteria met on the CSHCN screening tool, CSHCN with four or five criteria met was a predictor, having 1.44 the odds of no or partial utilization of preventive dental care services, compared to CSHCN who met only one criterion (Table 21).

Enabling factors demonstrated that having public insurance or both public and private insurance were not significant predictors in the model. Nevertheless, CSHCN with other comprehensive insurance or those who were uninsured had 1.82 and 4.43 times, respectively, the odds of no or partial utilization of preventive dental care services, compared to CSCHN who were privately insured. We examined FPL and found that it was a significant predictor in the model. In fact, we saw an interesting trend where CSHCN utilization of preventive care service was progressively more difficult as FPL decreased. CSHCN from families below 0-99% FPL, 100-199% FPL, or 200-399% FPL

had 5.29, 4.89, and 2.30-times, respectively, the odds of no or partial utilization of preventive dental care services, compared to CSCHN who lived with families with a FPL of 400% or greater. While examining out-of-pocket expenses for health services including dental care, we found that CSHCN whose families spent $501-$1000, or more than $1000 on their health services, were 1.53 or 1.37 times more likely, respectively, to not or partially utilize preventive dental care services, compared to CSHCN whose families spent less than $250, based on the 95% CI. (Table 21).

The only need factor included in the model as a predictor for no or partial utilization of preventive dental care services was CSHCN need for specialty care services including dental care. We found that CSHCN who had unmet specialist care needs had almost six-times the odds of no or partial utilization of preventive dental care services, compared to CSHCN who received all needed care. This relationship was statistically significant (Table 21).

The results from this model show that CSHCN who were not or partially utilizing preventive dental care services in 2005 were more likely to be Hispanic, from low-income families, with complicated health conditions, uninsured or having other comprehensive insurance, with unmet specialist care needs, and in families spending more than $501 on medical expenses including dental care (Table 21).

Table 21: Survey logistic regression model predicting "no or partial **utilization" of *preventive* dental care** in **2005.**

Variables	n	%	OR	95% CI		p-value
Predisposing Factors						
Age						
0 - 4	2443	8.7	ref	ref	ref	ref
5 - 14	23046	68.7	0.831	0.614	1.126	0.2323
15 - 17	8385	22.6	1.272	0.923	1.754	0.1420
Race/ ethnicity						
Non-Hispanic White	26177	71.2	ref	ref	ref	ref
Non-Hispanic Black	3236	14.9	1.162	0.919	1.470	0.2106
Other Non-Hispanic	1230	2.9	1.265	0.819	1.954	0.2896
Hispanic	3113	11	1.480	1.070	2.047	0.0179
Number of criteria met on the screener tool						
1	18530	54.5	ref	ref	ref	ref
2	6965	20.7	1.172	0.949	1.448	0.1403
3	4541	13.1	1.190	0.955	1.482	0.1209
4 or 5	3948	11.7	1.444	1.146	1.820	0.0018
Parental education						
Less than high school	1325	5.7	0.927	0.670	1.283	0.6469
High school graduate	4906	21.1	1.121	0.915	1.373	0.2706
More than high school	27695	73.2	ref	ref	ref	ref
Language spoken at home						
English	33057	96.2	ref	ref	ref	ref
Other	909	3.8	1.448	0.841	2.493	0.1819
Enabling Factors						
Type of insurance						
Private	22259	62.5	ref	ref	ref	ref
Public	7468	7	1.133	0.857	1.496	0.3806
Both private and public	2371	2.1	1.037	0.745	1.443	0.8307
Other comprehensive insurance	814	2.1	1.824	1.153	2.885	0.01024
Uninsured	1005	2.8	4.429	3.271	5.997	<.0001
Federal Poverty Level (FPL)						
0-99% FPL	4625	16.9	5.289	3.862	7.243	<.0001
100-199% FPL	6808	20.9	4.887	3.632	6.575	<.0001
200-399% FPL	11511	30.7	2.303	1.812	2.927	<.0001
400% or greater FPL	11040	31.5	ref	ref	ref	ref

Table 21. Continued

Variables	n	%	OR	95% CI		p-value
Enabling Factors (cont.)						
Out-of-pocket expenses						
Less than $250	12274	40.1	ref	ref	ref	ref
$250 - $500	8586	25.2	1.046	0.839	1.305	0.6882
$501 - $1000	4764	13.7	1.531	1.151	2.037	0.0034
More than $1000	7748	21	1.374	1.077	1.753	0.0106
Need Factors						
Need for specialty care services (including dental care)						
Did not need care	15653	46.4	1.148	0.966	1.365	0.1168
Got all needed care	17277	50.7	ref	ref	ref	ref
Unmet specialist care needs	944	2.9	5.902	4.428	7.867	<.0001

Predicting "no or partial utilization" of other dental care services in 2005

No or partial utilization of other dental care services in 2005 was also examined using the survey procedure analysis approach to build a logistic regression model (Table 22). We included predisposing factors (gender, age, race/ethnicity, number of criteria met on the screener tool, parental education, language spoken at home), enabling factors (type of insurance, FPL, out-of-pocket expenses), and need factors (need for specialty care services). These predictors were included based on the significance of the bivariate analysis ($p < 0.05$). The global test was statistically significant with a p-value <0.0001.

Table 22: Survey logistic regression model predicting "no or partial **utilization" of *other* dental care** in **2005.**

Variables	n	%	OR	95% CI		p-value
Predisposing Factors						
Gender						
Male	5859	56.1	ref	ref	ref	ref
Female	4487	43.9	0.786	0.617	1.001	0.0508
Age						
0 - 4	349	4.4	ref	ref	ref	ref
5 - 14	6970	68.8	1.043	0.468	2.327	0.9178
15 - 17	3010	26.8	1.829	0.804	4.162	0.1501
Race/ ethnicity						
Non-Hispanic White	8393	76.3	ref	ref	ref	ref
Non-Hispanic Black	700	10.4	1.798	1.248	2.589	0.0016
Other Non-Hispanic	356	3.2	1.641	0.748	3.600	0.2162
Hispanic	858	10.1	1.583	1.052	2.382	0.0276
Number of criteria met on the screener tool						
1	5517	52.1	ref	ref	ref	ref
2	2217	22.3	1.139	0.837	1.549	0.4081
3	1477	14.5	1.446	1.032	2.027	0.0323
4 or 5	1161	11.1	1.563	1.054	2.318	0.0265
Parental education						
Less than high school	305	4.4	1.130	0.654	1.952	0.6611
High school graduate	1273	18.1	1.325	0.968	1.813	0.0789
More than high school	8779	77.5	ref	ref	ref	ref
Language spoken at home						
English	10161	97.5	ref	ref	ref	ref
Other	205	2.5	1.528	0.701	3.331	0.2866
Enabling Factors						
Type of insurance						
Private	7257	68.9	ref	ref	ref	ref
Public	1887	20.8	1.912	1.237	2.954	0.0035
Both private and public	637	5.3	0.971	0.554	1.703	0.9187
Other comprehensive insurance	247	1.9	0.948	0.445	2.022	0.8905
Uninsured	327	3.1	5.682	3.523	9.165	<.0001

Table 22. Continued

Variables	n	%	OR	95% CI		p-value
Enabling Factors (cont.)						
Federal Poverty Level (FPL)						
0-99% FPL	1184	13.9	4.750	2.781	8.114	<.0001
100-199% FPL	1861	18.4	3.886	2.447	6.172	<.0001
200-399% FPL	3529	30.7	2.254	1.546	3.287	<.0001
400% or greater FPL	3798	37	ref	ref	ref	ref
Out-of-pocket expenses						
Less than $250	2924	31.3	ref	ref	ref	ref
$250 - $500	2431	23.6	1.286	0.894	1.851	0.1756
$501 - $1000	1620	15.9	1.346	0.881	2.056	0.1696
More than $1000	3222	29.2	1.222	0.843	1.772	0.2905
Need Factors						
Need for specialty care services (including dental care)						
Did not need care	4442	41.6	1.458	1.116	1.904	0.0056
Got all needed care	5532	54.8	ref	ref	ref	ref
Unmet specialist care needs	355	3.6	4.445	2.845	6.945	<.0001

In regards to the predisposing factors, we found that gender, age, parental education, and language spoken at home were not significant predictors for no or partial utilization of other dental care services in 2005. The significant relationships for race/ethnicity were for non-Hispanic Blacks and Hispanics who had 1.80 and 1.58, respectively, the odds of no or partial utilization of other dental care services, compared to Whites. Furthermore, the number of criteria met on the CSHCN screening tool was a significant predictor if the CSHCN met 3 or "4 or 5" criteria, where they had 1.45 and 1.56, respectively, the odds of no or partial utilization of other dental care services, compared to CSHCN only meeting one criterion (Table 22).

In terms of the enabling factors in the model, we found that having public insurance or being uninsured were significant predictors, and these groups had 1.91 and 5.68 times the odds, respectively, of no or partial utilization of other dental care services, compared to CSCHN with private insurance. FPL was also a significant predictor in the model. We found that CSHCN who lived with a family below 0-99% FPL, 100-199% FPL, or 200-399% FPL had 4.75, 3.89, and 2.25 times the odds, respectively, of no or partial utilization of other dental care services, compared to CSCHN who lived with a family with FPL of 400% or greater. Out-of-pocket expenses for health services including dental care was not a significant predictor for utilization of other dental care services (Table 22).

Needs factors also showed statistically significant relationships. We found that CSHCN who did not get the needed specialty care or had unmet specialist care needs had 1.46 and 4.45 times, respectively, the odds of no or partial utilization of preventive dental care services, compared to CSHCN who received all needed care. This relationship was statistically significant (Table 22).

The results from this model show that CSHCN who were not using or partially utilizing other dental care services in 2005 were more likely to be non-Hispanic Blacks or Hispanics, from low-income families, with a complicated health condition, uninsured or publically insured, with unmet specialist care needs or did not get the needed specialty care.

Predicting "no or partial utilization" of preventive dental care services in 2009

The survey procedure analysis approach was also used to build a logistic regression model to predict no or partial utilization of preventive dental care services in 2009 (Table 23). We included predisposing factors (age, race/ethnicity, number of criteria met on the screener tool, parental education, language spoken at home), enabling factors (type of insurance, FPL, out-of-pocket expenses), and need factors (need for specialty care services). These predictors were included based on the significance of the bivariate analysis ($p < 0.05$). The global test was statistically significant with a p- value <0.0001. As in the previous models, the level of significance for the independent variables was based on the 95% CI of the OR. In regard to predisposing factors, we found that parental education and language spoken at home were not significant predictors for no or partial utilization of preventive dental care services in 2009.

Age was a significant factor in this model, with the 5-14 years old age group having a 0.78 odds of not using or partially utilizing preventive dental care services, compared to the 0-4 year age group. This result indicates that CSHCN between the age of 4 and 15 years old are more likely to utilize preventive dental services in 2009, compared to other age groups. Race/ethnicity was significant for non-Hispanic Blacks and other non-Hispanics, who had 1.44 and 1.53 the odds, respectively, of no or partial utilization of preventive dental care services, compared to Whites. In addition, the number of criteria met on the CSHCN screening tool was a significant predictor for no or partial utilization of preventive dental care services in 2009 for CSHCN who met 3 or "4 or 5" of the

criteria. These CSHCN had 1.23 and 1.64, respectively, the odds of no or partial utilization of preventive dental care services, compared to CSHCN who met only one criterion (Table 23).

Regarding the enabling factors in the model, being publically insured or uninsured CSHCN were significant predictors of no or partial utilization of other dental care services, compared to CSCHN with private insurance (1.42 and 4.77 times the odds, respectively). FPL was also examined and found to be a significant predictor in the model. As CSHCN FPL increased, the odds of no or partial utilization of preventive dental care services in 2009 decreased (below 0-99% FPL OR=4.05, 100-199% FPL OR=3.56, 200-399% FPL OR= 2.99), compared to CSCHN who lived with a family with FPL of 400% or greater. Out-of-pocket expenses for health services including dental care was also a significant predictor, with families who pay $250-$500 or more than $1000 out-of-pocket expenses having 1.26 and 1.33, respectively, the odds of no or partial utilization of preventive dental care services, compared to families who pay less than $250 based on the 95% CI (Table 23).

In terms of need factors, we found that CSHCN who did not get the needed specialty care or had unmet specialist care needs had 1.18 and 3.26 times the odds, respectively, of no or partial utilization of preventive dental care services, compared to CSHCN who received all needed care. This relationship was statistically significant (Table 23).

Table 23: Survey logistic regression model predicting "no or partial **utilization" of *preventive* dental care** in **2009.**

Variables	n	%	OR	95% CI		p-value
Predisposing Factors						
Age						
0 - 4	3081	9.8	ref	ref	ref	ref
5 - 14	25077	68.4	0.777	0.621	0.971	0.0267
15 - 17	8407	21.8	1.118	0.867	1.442	0.3902
Race/ ethnicity						
Non-Hispanic White	25687	59.9	ref	ref	ref	ref
Non-Hispanic Black	3567	15.8	1.440	1.180	1.757	0.0003
Other Non-Hispanic	3415	7.9	1.528	1.147	2.036	0.0038
Hispanic	3974	16.4	1.059	0.820	1.368	0.6622
Number of criteria met on the screener tool						
1	19104	51.2	ref	ref	ref	ref
2	7522	20.5	1.191	0.981	1.446	0.0775
3	5095	14	1.225	1.001	1.498	0.0488
4 or 5	4922	14.3	1.643	1.306	2.067	<.0001
Parental education						
Less than high school	1799	10.4	1.011	0.775	1.319	0.9364
High school graduate	5231	19.6	1.066	0.883	1.285	0.5067
More than high school	29092	70	ref	ref	ref	ref
Language spoken at home						
English	35036	93.8	ref	ref	ref	ref
Other	1215	6.2	0.929	0.639	1.351	0.6999
Enabling Factors						
Type of insurance						
Private	21590	51.8	ref	ref	ref	ref
Public	10096	33.9	1.417	1.099	1.826	0.0071
Both private and public	2601	7.8	1.067	0.791	1.439	0.672
Other comprehensive insurance	1303	3.1	1.160	0.777	1.730	0.4674
Uninsured	998	3.4	4.766	3.512	6.468	<.0001
Federal Poverty Level (FPL)						
0-99% FPL	6040	21.5	4.048	2.971	5.515	<.0001
100-199% FPL	6920	21.5	3.559	2.706	4.681	<.0001
200-399% FPL	11475	28.5	2.996	2.356	3.809	<.0001
400% or greater FPL	12208	28.5	ref	ref	ref	ref

Table 23. Continued

Variables	n	%	OR	95% CI		p-value
Enabling Factors (cont.)						
Out-of-pocket expenses						
Less than $250	13719	43.7	ref	ref	ref	ref
$250 - $500	8165	21.5	1.255	1.006	1.565	0.0443
$501 - $1000	4844	12.1	1.191	0.916	1.548	0.1919
More than $1000	9396	22.7	1.328	1.060	1.665	0.0138
Need Factors						
Need for specialty care services (including dental care)						
Did not need care	18989	53	1.180	1.001	1.392	0.0490
Got all needed care	16280	42.6	ref	ref	ref	ref
Unmet specialist care needs	1296	4.4	3.256	2.496	4.246	<.0001

Overall, the results from this model show that CSHCN who were not using or partially utilizing preventive dental care services in 2009 were more likely to be Non-Hispanic Blacks or other Non-Hispanics, from low-income families, with a complicated health condition, uninsured or publically insured, from families who pay $250-$500 or more than $1000 for health services, with unmet specialist care needs or did not get the needed specialty care. In contrast, CSHCN between 5 and 14 years were less likely to not utilize or partially utilize preventive dental care services in 2009.

Predicting "no or partial utilization" of other dental care services in 2009

The survey procedure analysis approach was used to build a logistic regression model to predict having no or partial utilization of other dental care services in 2009 (Table 24). We included predisposing factors (gender, age, race/ethnicity, number of criteria met on the screener tool, parental education, language spoken at home), enabling

factors (type of insurance, FPL, out-of-pocket expenses), and need factors (need for specialty care services). These predictors were included based on the significance of the bivariate analysis ($p < 0.05$). The global test was statistically significant p-value <0.0001.

As with predicting no or partial utilization of preventive dental care services in 2009, we found that age, parental education, and language spoken at home were not significant predictors for no or partial utilization of other dental care services in that year. Race/ethnicity was significant for Hispanics, Non-Hispanic Blacks and other Non-Hispanics who had 1.48, 1.59 and 1.52 the odds, respectively, of no or partial utilization of other dental care services, compared to Whites. In addition, the number of criteria met on the CSHCN screening tool was only significant as a predictor if the CSHCN met two or "four or five" criteria where they had 1.46 and 1.68 the odds, respectively, of no or partial utilization of other dental care services, compared to if the CSHCN met only one criterion (Table 24).

Regarding the enabling factors in the model, having public insurance or comprehensive insurance was not a significant predictor in the model. However, CSHCN who had both private and public insurance or were uninsured were significant predictors with 0.55 and 3.92 times the odds, respectively, of no or partial utilization of other dental care services, compared to CSCHN with private insurance. This comparison clearly showed that CSHCN who had both public and private had a superior utilization of other dental care services in 2009 compared to those who only had private or other types of insurance. We further evaluated FPL and found that it was a significant predictor in the model. CSHCN who live with a family below 0-99% FPL, 100-199% FPL, and 200-

399% FPL have 5.34, 5.52, and 2.75 times, respectively, the odds of no or partial utilization of other dental care services, compared to CSCHN who live with a family with FPL of 400% or greater. The third enabling factor was out-of-pocket expenses for health services including dental care, which was found to not be significant as a predictor for no or partial utilization of other dental care services, based on the 95% CI (Table 24).

In regards to the need factors, our model showed that CSHCN with unmet specialist care needs have 4.24 times the odds of no or partial utilization of other dental care services, compared to CSHCN who received all needed care. This relationship was statistically significant (Table 24).

The results from this model show that CSHCN who did not use or partially utilize other dental care services in 2009 were more likely to be Hispanics, Non-Hispanic Blacks or Other Non-Hispanics (not including Whites), from low-income families, with a complicated health condition, uninsured, and with unmet specialist care needs. In contrast, CSHCN who had both private and public insurance were less likely to not utilize or partially utilize other dental care services in 2009.

Table 24: Survey logistic regression model predicting "no or partial **utilization" of *other* dental care** in **2009.**

Variables	n	%	OR	95% CI		p-value
Predisposing Factors						
Age						
0 - 4	332	3.7	ref	ref	ref	ref
5 - 14	7493	67.9	1.052	0.634	1.746	0.8443
15 - 17	3250	28.4	1.389	0.817	2.362	0.2249
Race/ ethnicity						
Non-Hispanic White	8258	65.5	ref	ref	ref	ref
Non-Hispanic Black	822	12	1.590	1.157	2.186	0.0043
Other Non-Hispanic	951	7.1	1.523	1.098	2.111	0.0117
Hispanic	1070	15.4	1.475	1.008	2.157	0.0454
Number of criteria met on the screener tool						
1	5752	50.5	ref	ref	ref	ref
2	2337	21.2	1.459	1.083	1.966	0.0130
3	1589	14.2	1.285	0.930	1.775	0.1281
4 or 5	1423	14.1	1.681	1.217	2.321	0.0016
Parental education						
Less than high school	380	7.5	1.184	0.780	1.797	0.4280
High school graduate	1241	15.8	1.118	0.839	1.491	0.4453
More than high school	9364	76.7	ref	ref	ref	ref
Language spoken at home						
English	10732	95	ref	ref	ref	ref
Other	284	5	0.983	0.562	1.717	0.9510
Enabling Factors						
Type of insurance						
Private	7266	58.7	ref	ref	ref	ref
Public	2395	27.6	1.104	0.768	1.588	0.5930
Both private and public	662	6	0.550	0.357	0.847	0.0067
Other comprehensive insurance	423	3.3	1.109	0.662	1.857	0.6954
Uninsured	342	4.3	3.924	2.426	6.348	<.0001
Federal Poverty Level (FPL)						
0-99% FPL	1383	16.8	5.343	3.260	8.757	<.0001
100-199% FPL	1815	19.4	5.523	3.638	8.386	<.0001
200-399% FPL	3605	30.1	2.752	1.947	3.889	<.0001
400% or greater FPL	4298	33.7	ref	ref	ref	ref

Table 24. Continued

Variables	n	%	OR	95% CI		p-value
Enabling Factors (cont.)						
Out-of-pocket expenses						
Less than $250	3047	31.6	ref	ref	ref	ref
$250 - $500	2382	20.8	1.090	0.810	1.465	0.5705
$501 - $1000	1622	14.2	1.206	0.843	1.725	0.3063
More than $1000	3906	33.4	0.879	0.635	1.218	0.4399
Need Factors						
Need for specialty care services (including dental care)						
Did not need care	5032	45.7	1.052	0.826	1.339	0.6833
Got all needed care	5484	48.3	ref	ref	ref	ref
Unmet specialist care	559	6	4.238	2.838	6.328	<.0001

Access to dental care services

CSHCN access to dental care was subdivided into "access to preventive dental care" and "access to other dental care". Our study included study populations from 2005 and 2009. The following section discusses each access subdivision for the model for the 2005 and 2009 datasets. A total of four logistic models were created to predict "fair to poor access" to dental care services under each subdivision.

Predicting "fair to poor access" to preventive dental care services in 2005

We used the survey procedure analysis approach to build a logistic regression model to predict having "fair to poor" access to preventive dental care services (Table 25). We included home-related factors (age, race/ethnicity, number of criteria met on the screener tool, FPL, family structure type, parental education, language spoken at home), intermediate factors (type of insurance) and dental clinic-related factors (out-of-pocket

expenses). These predictors were included based on the significance of the bivariate analysis ($p < 0.05$). The global test was statistically significant with p-value <0.0001. Statistical significance for these models is based on the 95% CI for the OR. With regards to home-related factors, we found that race, parental education and language spoken at home were not significant predictors for having "fair to poor" access to preventive dental care services in 2005.

Older CSHCN (15-17 years old) had 2.59 times the odds of having "fair to poor" access to preventive dental care in 2005, compared to younger CSHCN (0-4 years old). Another significant predictor was CSHCN who met three, or four/five criteria on the CSHCN screening tool with 2.67 and 3.65 times, respectively, the odds of having "fair to poor" access to preventive dental services, when compared to children who met only one criterion. CSHCN who lived with a family below 0-99% FPL, 100-199% FPL, and 200-399% FPL had 4.04, 3.34, and 1.84 times, respectively, the odds of having "fair to poor" access to preventive dental services, compared to CSCHN who lived with a family with FPL of 400% or greater. Family structure type showed that CSHCN living with "single mother, no father present" had 1.77 times the odds of having "fair to poor" access to preventive dental services care, compared to CSHCN who lived with "two parents (biological or adopted)". (Table 25)

In regard to the intermediate factors, we found that uninsured CSHCN or those who had public insurance had 6.3 and 1.76 times, respectively, the odds of having "fair to poor" access to preventive dental services, compared to CSCHN who had private insurance. (Table 25)

In regard to dental clinic-related factors, we found that CSHCN with a family spending more than $1000 for health services had 1.57 times the odds of having “fair to poor” access to preventive dental care services, compared to CSHCN in a family spending less than $250, based on their 95% CI (Table 25).

The results from this model show that CSHCN who had “fair to poor” access to preventive dental care in 2005 were more likely to be older adolescents (15-17 years), from low-income families, with a more complicated health condition, living with a single mother, uninsured or had public insurance and their family had out-of-pocket expenses of more than $1000 for health services.

Table 25: Survey logistic regression model predicting "fair to poor" **access to *preventive* dental care** services in **2005**.

Variables	n	%	OR	95% CI		p-value
Home Factors						
Age						
0 - 4	5445	16.1	ref	ref	ref	ref
5 - 14	25679	63	1.515	0.975	2.354	0.0647
15 - 17	9384	20.8	2.592	1.596	4.209	0.0001
Race/ ethnicity						
Non-Hispanic White	30552	69.1	ref	ref	ref	ref
Non-Hispanic Black	4157	16.2	0.742	0.486	1.134	0.1677
Other Non-Hispanic	1523	2.9	0.998	0.458	2.173	0.9962
Hispanic	3986	1.8	0.988	0.628	1.554	0.9588
Number of criteria met on the screener tool						
1	22141	55	ref	ref	ref	ref
2	8327	20.6	1.075	0.732	1.577	0.7133
3	4364	10.4	2.667	1.846	3.852	<.0001
4 or 5	3597	8.9	3.651	2.341	5.695	<.0001
Federal Poverty Level (FPL)						
0-99% FPL	6265	19.5	4.038	2.184	7.465	<.0001
100-199% FPL	8510	21.9	3.340	1.980	5.632	<.0001
200-399% FPL	13473	29.8	1.836	1.106	3.049	0.0189
400% or greater FPL	12260	28.8	ref	ref	ref	ref
Family structure type						
Two parent biological/adopted	22429	55.1	ref	ref	ref	ref
Two parent stepfamily	4125	9.9	1.407	0.950	2.082	0.0883
Single mother, no father present	10200	29.8	1.769	1.271	2.461	0.0007
Other	2132	5.2	1.157	0.516	2.591	0.7239
Parental education						
Less than high school	1885	6.8	0.801	0.497	1.289	0.3605
High school graduate	6402	23	0.747	0.515	1.083	0.1242
More than high school	32144	70.2	ref	ref	ref	ref
Language spoken at home						
English	39172	95.3	ref	ref	ref	ref
Other	1310	4.7	0.977	0.522	1.828	0.9413

Table 25. Continued

Variables	n	%	OR	95% CI		p-value
Intermediate factors						
Type of insurance						
Private	25461	59.2	ref	ref	ref	ref
Public	9734	28.1	1.760	1.077	2.877	0.0241
Both private and public	2919	7.3	2.005	0.994	4.043	0.0519
Other comprehensive insurance	965	1.9	1.720	0.636	4.655	0.2853
Uninsured	1429	3.5	6.382	4.376	9.308	<.0001
Dental Clinic Factors						
Out-of-pocket expenses						
Less than $250	15488	42.6	ref	ref	ref	ref
$250 - $500	9949	24.4	0.825	0.552	1.233	0.3491
$501 - $1000	5449	13	1.574	0.994	2.495	0.0533
More than $1000	8897	20	1.568	1.007	2.442	0.0463

Predicting "fair to poor" access to other dental care services in 2005

In this logistic regression model, we predicted having "fair to poor" access to other dental care services in 2005 (Table 26). We included home-related factors (age, race/ethnicity, number of criteria met on the screener tool, FPL, family structure type, parental education, language spoken at home), intermediate factors (type of insurance) and dental clinic-related factors (out-of-pocket expenses). These predictors were included based on the significance of the bivariate analysis ($p < 0.05$). The global test was statistically significant with p-value <0.0001. In regards to home-related factors, we found that race, family structure type, parental education and language were not significant predictors for "fair to poor" access to other dental care services in 2005.

In regard to CSHCN age, we found that older CSHCN within age categories of 5-14 and 15-17 years were more likely (OR 2.81 and 5.45) to have "fair to poor" access to

other dental care services in 2005, compared to younger CSHCN (0-4 years). This relationship was significant. CSHCN who met three, or four/five criteria on the CSHCN screening tool had 2.41 and 2.67 times, respectively, the odds of having "fair to poor" access to other dental care services, when compared to children who met only one criterion. These relationships were statistically significant. CSHCN who lived with a family living below 0-99% FPL, 100-199% FPL, and 200-399% FPL had 5.96, 5.02 and 2.05 times, respectively, the odds of having "fair to poor" access to other dental services, compared to CSCHN living with a family with a FPL of 400% or greater. (Table 26).

In regard to the intermediate factors, we found that uninsured CSHCN had 6.19 the odds of having "fair to poor" access to preventive dental services, compared to CSCHN who had private insurance. In contrast, CSHCN who had other comprehensive insurance were more likely to utilize other dental care services in 2009 compared to CSHCN who had private insurance (OR 0.20) (Table 26). In regards to dental clinic-related factors, we found that the out-of-pocket expenses for health services was not a significant predictor for "fair to poor" access to other dental care services in 2005. (Table 26).

The results from this model show that CSHCN with "fair to poor" access to other dental care in 2005 were more likely to be in age groups 5-14 or 15-17 years, from low-income families, with more complicated health conditions and uninsured. In contrast, CSHCN who had other comprehensive insurance were less likely to have fair to poor access to other dental care services in 2005.

Table 26: Survey logistic regression model predicting "fair to poor" **access to *other* dental care** services in **2005**.

Variables	n	%	OR	95% CI		p-value
Home Factors						
Age						
0 - 4	5454	16.1	ref	ref	ref	ref
5 - 14	25679	63	2.808	1.387	5.685	0.0041
15 - 17	9370	20.9	5.454	2.588	11.492	<.0001
Race/ ethnicity						
Non-Hispanic White	30542	69.1	ref	ref	ref	ref
Non-Hispanic Black	4160	16.2	1.388	0.806	2.391	0.2371
Other Non-Hispanic	1521	2.9	0.735	0.297	1.819	0.5056
Hispanic	3981	11.8	1.194	0.668	2.136	0.5493
Number of criteria met on the screener tool						
1	22145	55	ref	ref	ref	ref
2	8327	20.6	1.351	0.820	2.225	0.2378
3	5347	12.8	2.405	1.526	3.791	0.0002
4 or 5	4685	11.6	2.670	1.673	4.262	<.0001
Federal Poverty Level (FPL)						
0-99% FPL	6261	19.5	5.955	2.879	12.318	<.0001
100-199% FPL	8511	21.9	5.017	2.576	9.773	<.0001
200-399% FPL	13473	29.8	2.045	1.027	4.070	0.0417
400% or greater FPL	12249	28.8	ref	ref	ref	ref
Family structure type						
Two parent biological/adopted	22429	55	ref	ref	ref	ref
Two parent stepfamily	4131	10	1.506	0.875	2.592	0.1391
Single mother, no father present	10185	29.8	1.450	0.918	2.288	0.1108
Other	2128	5.2	0.632	0.283	1.410	0.2625
Parental education						
Less than high school	1886	6.8	0.548	0.284	1.057	0.0725
High school graduate	6407	23.1	0.717	0.471	1.092	0.1213
More than high school	32124	70.1	ref	ref	ref	ref
Language spoken at home						
English	39158	95.3	ref	ref	ref	ref
Other	1310	4.7	1.199	0.617	2.327	0.5925

Table 26. Continued

Variables	n	%	OR	95% CI		p-value
Intermediate Factors						
Type of insurance						
Private	25449	59.2	ref	ref	ref	ref
Public	9727	28.1	1.260	0.614	2.587	0.5292
Both private and public	2923	7.3	0.711	0.284	1.780	0.4667
Other comprehensive insurance	964	1.9	0.198	0.045	0.874	0.0325
Uninsured	1431	3.5	6.186	3.522	10.863	<.0001
Dental Clinic Factors						
Out-of-pocket expenses						
Less than $250	15495	42.6	ref	ref	ref	ref
$250 - $500	9941	24.4	1.087	0.620	1.905	0.7720
$501 - $1000	5447	13.0	1.736	0.953	3.163	0.0715
More than $1000	8885	20.0	1.626	0.985	2.683	0.0574

Predicting "fair to poor" access to preventive dental care services in 2009

We used the survey procedure analysis approach to build a logistic regression model to predict having "fair to poor" access to preventive dental care services in 2009 (Table 27). We included home-related factors (age, race/ethnicity, number of criteria met on the screener tool, FPL, family structure type, parental education, language spoken at home), intermediate factors (type of insurance) and dental clinic-related factors (out-of-pocket expenses). These predictors were included based on their significance in the bivariate analysis ($p < 0.05$). The global test was statistically significant with p-value <0.0001. Statistical significance for the variables in these models was based on the 95% CI for the OR. Regarding home-related factors, we found that family structure type and

language were not significant predictors for having "fair to poor" access to preventive dental care services in 2009.

CSHCN between 15-17 years of age had 2.04 times the odds of having "fair to poor" access to preventive dental care in 2009, compared to younger CSHCN (0-4 years). This relationship was statistically significant. In terms of race/ethnicity, other Non-Hispanics had 1.61 times the odds of having "fair to poor" access to preventive dental care, compared to Whites. In addition, CSHCN who met two, three, or four/five criteria on the CSHCN screening tool had 1.70, 1.80, and 2.32 times, respectively, the odds of having "fair to poor" access to preventive dental services, when compared to children who met only one criterion. These relationships were statistically significant and they demonstrate that the likeliness of having "fair to poor" access increases with the increasing number of CSHCN medical conditions. CSHCN living with a family below 0-99% FPL, 100-199% FPL, and 200-399% FPL have 6.93, 5.92, and 4.13 times, respectively, the odds of having "fair to poor" access to preventive dental services, compared to CSCHN living with a family with a FPL of 400% or greater. Thus, CSHCN are more likely to have "fair to poor" access when living with a low-income family. Interestingly, we found that CSHCN whom parent had a high school education were less likely to have "fair to poor" access to preventive dental care service in 2009, compared to those with more education (Table 27).

In regard to the intermediate factors, we found that uninsured CSHCN and those with public insurance had 8.6 and 1.8 the odds of having "fair to poor" access to preventive dental services, compared to CSCHN who had private insurance (Table 27).

The results from this model show that CSHCN who have "fair to poor" access to preventive dental care in 2009 were more likely to be from an older age group (15-17 years), other Non-Hispanics (not including Whites), from low-income families, with more complicated health conditions and uninsured or had public insurance. In contrast, CSHCN who had parental education of high school were less likely to have fair to poor access to other dental care services in 2009.

Table 27: Survey logistic regression model predicting "fair to poor" **access to *preventive* dental** care services in **2009.**

Variables	n	%	OR	95% CI		p-value
Home Factors						
Age						
0 - 4	5317	15.4	ref	ref	ref	ref
5 - 14	25983	64.1	1.393	0.875	2.217	0.1621
15 - 17	8761	20.5	2.035	1.196	3.462	0.0088
Race/ ethnicity						
Non-Hispanic White	27886	59.3	ref	ref	ref	ref
Non-Hispanic Black	3974	16.1	1.110	0.748	1.648	0.6047
Other Non-Hispanic	3748	7.9	1.611	1.030	2.520	0.0366
Hispanic	4453	16.7	0.926	0.593	1.446	0.7356
Number of criteria met on the screener tool						
1	20970	51.6	ref	ref	ref	ref
2	8212	20.6	1.696	1.164	2.472	0.0060
3	5526	13.8	1.803	1.215	2.675	0.0034
4 or 5	5353	14	2.316	1.520	3.528	<.0001
Federal Poverty Level (FPL)						
0-99% FPL	6845	22.2	6.934	3.554	13.530	<.0001
100-199% FPL	7676	21.8	5.918	3.284	10.666	<.0001
200-399% FPL	12523	28.6	4.125	2.373	7.170	<.0001
400% or greater FPL	13017	27.4	ref	ref	ref	ref
Family structure type						
Two parent biological/adopted	25026	56.9	ref	ref	ref	ref
Two parent stepfamily	3601	9.6	1.251	0.684	2.288	0.4673
Single mother, no father present	7766	25.7	1.312	0.941	1.828	0.1088
Other	3095	7.8	1.143	0.646	2.024	0.6464
Parental education						
Less than high school	2077	11.1	0.627	0.333	1.179	0.1476
High school graduate	5865	19.9	0.643	0.448	0.923	0.0166
More than high school	31524	69	ref	ref	ref	ref
Language spoken at home						
English	38186	93.3	ref	ref	ref	ref
Other	1426	6.7	1.733	0.944	3.184	0.0762

Table 27. Continued

Variables	n	%	OR	95% CI		p-value
Intermediate Factors						
Type of insurance						
Private	23280	50.8	ref	ref	ref	ref
Public	11311	34.7	1.764	1.059	2.938	0.0292
Both private and public	2896	7.9	1.271	0.699	2.312	0.4316
Other comprehensive insurance	1435	3.1	1.073	0.387	2.975	0.8917
Uninsured	1134	3.5	8.565	5.617	13.059	<.0001

Predicting "fair to poor" access to other dental care services in 2009

In this logistic regression model, we predicted having "fair to poor" access to other dental care services in 2009 (Table 28). We included home-related factors (gender, age, race/ethnicity, number of criteria met on the screener tool, FPL, family structure type, parental education, language spoken at home), intermediate factors (type of insurance) and dental clinic-related factors (out-of-pocket expenses). These predictors were included based on the significance in the bivariate analysis ($p < 0.05$). The global test was statistically significant with p-value <0.0001. The statistical significance of these models was based on the 95% CIs for the OR. In terms of home-related factors, we found that family structure type and language spoken at home were significant predictor for having "fair to poor" access to other dental care services in 2009.

In this model, gender was a significant predictor, with females having 1.81 times the odds of having "fair to poor" access to other dental care services compared to males. As with the previous model, older CSHCN within the age group 5-14 and 15-17 years

were more likely (OR 2.40 and 3.38) to have "fair to poor" access to other dental care services compared to younger CSHCN (0-4 years). This relationship was statistically significant. Regarding race/ethnicity, other Non-Hispanics had 2.01 times the odds of having "fair to poor" access to other dental care services compared to Whites. This relationship was statistically significant. CSHCN who met two, three, or four/five criteria on the CSHCN screening tool had 1.96, 1.71, and 2.87 times, respectively, the odds of having "fair to poor" access to other dental care services, when compared to children who met only one criterion. These relationships were statistically significant. CSHCN living in families below 0-99% FPL, 100-199% FPL, and 200-399% FPL had 6.51, 5.97, and 2.92 times, respectively, the odds of having "fair to poor" access to other dental services, compared to CSCHN living in families with FPL of 400% or greater. CSHCN whom parents had high school education were 40% less likely to have "fair to poor" access to other dental care services in 2009. (Table 28).

Further evaluation for 2009 predictors showed that uninsured CSHCN and those with public insurance had 5.37 and 2.15 times, respectably, the odds of having "fair to poor" access to other dental services, compared to CSHCN with private insurance.

When we look at the dental clinic-related factors, represented by the out-of-pocket expenses spent on health services including dental care, we found that CSHCN with families spending $250-$500, $501-$1000, or more than $1000 on their health services had 1.89, 2.45, and 2.88 times, respectively, the odds of having "fair to poor" access to other dental care services, compared to CSHCN with families spending less than $250

based on their 95% CI. This suggests that as the out-of-pocket spending increased, the likelihood of having “fair to poor” access increased (Table 28).

Finally, and to summarize this model, we suggest that CSHCN who had “fair to poor” access to other dental care in 2009 were more likely to be females, from an older age group (5-17 years), Other non-Hispanics (not including Whites or Blacks), from low-income families, with more complicated health conditions, uninsured or had a public insurance with their families having out-of-pocket expenses of more than $250 for health services. In contrast, CSHCN whom parents had a high school education were less likely to have “fair to poor” access to other dental care services in 2009.

Table 28: Survey logistic regression model predicting "fair to poor**" access to *other* dental** care services in **2009.**

Variables	n	%	OR	95% CI		p-value
Home Factors						
Gender						
Male	24025	59.3	ref	ref	ref	ref
Female	15979	40.7	1.814	1.243	2.647	0.0020
Age						
0 - 4	5335	15.5	ref	ref	ref	ref
5 - 14	25987	64	2.401	1.238	4.655	0.0095
15 - 17	8752	20.5	3.377	1.672	6.819	0.0007
Race/ ethnicity						
Non-Hispanic White	27892	59.3	ref	ref	ref	ref
Non-Hispanic Black	3982	16.2	1.503	0.931	2.428	0.0954
Other Non-Hispanic	3744	7.8	2.101	1.273	3.469	0.0037
Hispanic	4456	16.7	1.597	0.926	2.753	0.0921
Number of criteria met on the screener tool						
1	20973	51.6	ref	ref	ref	ref
2	8221	20.6	1.962	1.244	3.093	0.0037
3	5528	13.8	1.713	1.101	2.667	0.0171
4 or 5	5352	14	2.874	1.735	4.763	<.0001
Federal Poverty Level (FPL)						
0-99% FPL	6845	22.1	6.505	2.883	14.679	<.0001
100-199% FPL	7685	21.9	5.966	2.844	12.513	<.0001
200-399% FPL	12531	28.6	2.917	1.479	5.752	0.0020
400% or greater FPL	13013	27.4	ref	ref	ref	ref
Family structure type						
Two parent biological/adopted	25030	56.9	ref	ref	ref	ref
Two parent stepfamily	3610	9.6	1.419	0.852	2.365	0.1792
Single mother, no father present	7762	25.7	1.081	0.695	1.682	0.7303
Other	2010	7.8	1.199	0.588	2.445	0.6182
Parental education						
Less than high school	2069	10.9	0.821	0.417	1.618	0.5692
High school graduate	5863	19.9	0.595	0.377	0.939	0.0258
More than high school	31546	69.2	ref	ref	ref	ref

Table 28. Continued

Variables	n	%	OR	95% CI		p-value
Home Factors (cont.)						
Language spoken at home						
English	38200	93.4	ref	ref	ref	ref
Other	1427	6.6	1.300	0.636	2.659	0.4724
Intermediate factors						
Type of insurance						
Private	23281	50.8	ref	ref	ref	ref
Public	11313	34.7	2.151	1.174	3.939	0.0131
Both private and public	2902	8.0	0.675	0.304	1.496	0.3326
Other comprehensive insurance	1438	3.2	1.280	0.401	4.083	0.6770
Uninsured	1135	3.3	5.366	3.126	9.108	<.0001
Dental Clinic Factors						
Out-of-pocket expenses						
Less than $250	15332	44.5	ref	ref	ref	ref
$250 - $500	8829	21.5	1.890	1.090	3.275	0.0233
$501 - $1000	5224	11.9	2.452	1.287	4.671	0.0064
More than $1000	10114	22.1	2.882	1.759	4.721	<.0001

- **Insurance status of CSHCN in 2009**

Predicting "uninsured" CSHCN in 2009

In this logistic regression model, we predicted having "no insurance" in the 2009 dataset (Table 29). We included race/ethnicity, FPL, family structure type and parental education in the model. These predictors were included based on the significance in the bivariate analysis ($p < 0.05$). The global test was statistically significant with p-value <0.0001. The statistical significance of these models was based on the 95% CIs for the OR. We found that family structure type and parental education were not significant

predictors for having "no insurance" in 2009. In this model, race was a significant predictor, with Hispanics having 2.01 times the odds of having "no insurance" compared to Non-Hispanic Whites. CSHCN living in families below 0-99% FPL, 100-199% FPL, and 200-399% FPL had 5.65, 7.41, and 5.81 times, respectively, the odds of having "no insurance" compared to CSCHN living in families with FPL of 400% or greater (Table 29).

The results from this model show that Hispanics CSHCN from low-income families were more likely to have no insurance in 2009.

Table 29: Survey logistic regression model predicting "**uninsured**" CSHCN in **2009.**

Variables	n	%	OR	95% CI		p-value
Race/ ethnicity						
Non-Hispanic White	27958	59.3	ref	ref	ref	ref
Non-Hispanic Black	3996	16.1	1.069	0.742	1.539	0.7197
Other Non-Hispanic	3758	7.8	1.363	0.870	2.136	0.1761
Hispanic	4472	16.8	2.006	1.513	2.659	<.0001
Federal Poverty Level (FPL)						
0-99% FPL	6882	22.3	5.653	3.477	9.192	<.0001
100-199% FPL	7708	21.8	7.409	4.731	11.601	<.0001
200-399% FPL	12557	28.5	5.808	3.803	8.870	<.0001
400% or greater FPL	13037	27.4	ref	ref	ref	ref
Family structure type						
Two parent biological/adopted	25071	56.9	ref	ref	ref	ref
Two parent stepfamily	3615	9.6	0.872	0.629	1.209	0.4125
Single mother, no father present	7794	25.8	1.072	0.795	1.446	0.6477
Other	3127	7.7	0.982	0.655	1.473	0.9294
Parental education						
Less than high school	2087	11.1	1.406	0.929	2.128	0.1069
High school graduate	5885	19.9	1.074	0.792	1.456	0.6464
More than high school	31611	69.0	ref	ref	ref	ref

CHAPTER 5: DISCUSSION

One of the objectives of this study was to address the gaps in the levels of CSHCN dental care access and utilization. Specifically, this study introduced and differentiated between "access" and "utilization" of dental healthcare services as an approach to better understand the relationship between CSHCN and the dental healthcare system in the US. The study examined the amount of access and utilization of preventive and other dental care services in 2005 and 2009. No previous study has differentiated and individually examined these two approaches for CSHCN.

Generally, our results show that CSHCN had a high amount of access and utilization of the dental care system in the US. In 2005, 98.2% and 99.03% of CSHCN had "very good to good" access to preventive dental care and other dental care, respectively. In 2009, however, these percentages decreased slightly to 98.1% and 98.7% for the two service categories, respectively. Further, in 2005, 92.9% and 90.4% "fully utilized" preventive dental care services and other dental care, respectively. Nevertheless, 91.9% of CSHCN "fully utilized" preventive dental care services in 2009. For other dental care services, 84.7% "fully utilized" other dental care services with a drop of almost 6% from what was found in 2005. No study has evaluated the change in access and utilization of preventive and other dental care services following similar periods. Therefore, the present study may provide a baseline for comparison when future studies are conducted in the same research field. It is possible that the drop in utilization of dental care services from 2005 to 2009 is related to the minimal change that occurred in

the NS-CSHCN structure between both years. Furthermore, it could be also suggested that some CSHCN families had faced possible financial difficulties between 2005 and 2009, specifically after the 2008 financial recession, which resulted in lower utilization of dental care services in 2009. The latest assumption is supported by our results where we found that CSHCN from low income families were more likely to not or partially utilizing dental care services compared to CSCHN from families with high income. Overall, our findings are in agreement with the results of Van Cleave and Davis (2008) who evaluated the association between attending preventive medical and dental visits by CSHCN and by children without SHCN. They found that CSHCN are more likely to utilize medical and dental care services compared to those without SHCN. Our findings also agree with the results of Houtrow, Kim, Chen, and Newacheck (2007) who compared CSHCN and children without SCHN with regards to the number of received preventive health services, including dental care. They found that CSHCN reported receiving more dental care than did children without SHCN. Although these two studies had a Non-CSHCN comparison group, and our study did not, the high percentages we found for access and utilization are in agreement with the literature for the CSHCN group (Houtrow et al., 2007).

In general, our final regression models suggest that several common factors are related to access and utilization of dental care among CSHCN in the US in 2005 and 2009. These factors are race/ethnicity, income status, child's medical condition complexity, insurance status, need for healthcare services, out-of-pocket expenses, and CSHCN family structure.

Our results showed that Non-Hispanic White CSHCN have better access and are more likely to access both preventive and other dental care services in 2009, compared to other Non-Hispanics. Moreover, we found that Non-Hispanic White CSHCN were also more likely to utilize preventive and other dental care service in 2009 compared to Hispanics and other Non-Hispanics. In any case, this is inconsistent with the results of Kenney et al. (2008) who found that race/ethnicity was not a significant determent for receiving dental care among CSHCN. Their findings suggested that race/ethnicity was only a significant factor for receiving dental care among children without special healthcare needs and not those with special needs (Kenney et al., 2008). This difference may be attributed to the fact that our study used a new approach to define access and utilization of dental care services, based on the responses to multiple questions, while Kenney's study was more subjective and relied on the response to a single survey question. Since no previous study has used the same definitions for access and utilization as we used in our study, direct comparisons of our results to those in the literature could be problematic.

Our study suggests that older CSHCN (15-17 years) are less likely to access both preventive and other dental care services in 2005 and 2009 compared to younger age groups (0-4 years). However, our results did not detect that CSHCN between 5 and 14 years old were less likely to utilize dental care services in either 2005 or 2009. Although this is inconsistent with the study of Chi et al. (2010), they limited their study population exclusively to children with intellectual and/or developmental disabilities (IDD). They found that children from older age groups (8-12 and 13-17 years) were significantly more

likely to obtain dental care services than those from the youngest age group (3-7 years). Nevertheless, the inconsistent outcomes could be the result of our study being more representative of the CSHCN population since we did not specify medical conditions or diagnoses and included all CSHCN. The findings reported by Chi et al. (2010) might best be applied only to children with IDD.

CSHCN from low-income families tend to have problems getting the needed dental care, in contrast to those from high-income families. For example, 40% of CSHCN with "fair to poor" access to preventive dental care in 2005 lived below the 99% FPL. Further, 32.3% of CSHCN with no or partial utilization of other dental care services in 2009 lived below 99% the FPL. This result was clearly and strongly seen across both preventive and other dental care services in 2005 and 2009. For instance, our results showed that CSHCN who live below 200% FPL had three to six times the odds of having fair to poor access to preventive and other dental care in 2005 and 2009 compared to CSHCN who live above 400% FPL. Moreover, the same observation was seen for the utilization variable where CSHCN who live below 200% had three to five times the odd of not or partially utilizing preventive and other dental care services in 2005 and 2009. Our results were broadly consistent with what is presented in the literature (Nelson et al., 2011; Van Cleave & Davis, 2008; Kane et al., 2008). For instance, Nelson et al. (2011) found that as family income increases, CSHCN tend to face fewer barriers, compared to their peers living with families with lower income.

While the complexity of a child's medical condition was evident to play an important role in access and utilization of dental care service by the children, we found

that this variable had a greater impact on the access than the utilization in both 2005 and 2009. Children with severe medical conditions usually have difficulty getting their needed dental care services, compared to children with mild medical conditions. We used a standardized CSHCN screening tool to evaluate the number of special needs acquired by a child without specifying the medical condition. We then determined the severity of special need conditions using a 1-5 point scale. In our study, CSHCN meeting four/five criteria on the CSHCN screening tool had 2.32 the odds of having "fair to poor" access to preventive dental care services in 2009. This finding agrees with Nelson et al. (2011) who found that children with cerebral palsy and craniofacial disorders had more barriers to getting dental care, compared to the other three medical conditions that were examined in their study (cystic fibrosis, metabolic disorders, and hemophilia). Al Agili, Roseman, Pass, Thornton, and Chavers (2004) found that children with cerebral palsy tended to have more issues in accessing the dental care system, compared to children with cleft lip and palate. Nevertheless, patients with cleft lip and/or palate that were included in the study were from children's rehabilitation centers that likely had multidisciplinary teams, including a dentist to manage cleft lip and/or palate cases. This could explain why the parents of these children reported fewer problems with access.

Several studies of dental care access have found disparities in access and utilization of dental care associated with the insurance status of CSHCN (Van Cleave & Davis, 2008; Kenney et al., 2008; Waldman & Perlman, 2006). Our findings indicate that uninsured CSHCN had up to eight times the odds of having difficulties accessing and utilizing dental care services in 2005 and 2009. The same observation was evident, but at

a lower impact, for CSHCN who were publically insured. For instance, we found that the odds of no or partial utilization of preventive dental care in 2009 were 4.77 times greater among uninsured CSHCN compared to those with private insurance. However, publically insured CSHCN status was not consistently related to utilization (only for other dental care utilization in 2005, and preventive care in 2009).

Our results suggest that CSHCN who had unmet specialty care needs were much more likely to not or partially utilize the dental care system. For example, 63% of our CSHCN study sample who had unmet specialist needs were able to fully utilize preventive dental care services in 2005, compared to 94% of CSHCN who had received all their needed specialty care. Our findings are consistent with Chi et al. (2010) who found that children with IDD and who had a primary care physician had 1.75 times the odds of using the preventive dental care system, compared to those who did not have a primary care physician.

Newacheck et al. (2000) suggested that in addition to the known barriers to accessing dental care by CSHCN, new cultural barriers may be introduced in the near future, especially with increased levels of immigration to the US. Interestingly, we found that the language spoken at home was one of the barriers to accessing dental care services in our bivariate analysis. However, after controlling for confounding in Multivariate modelling, this relationship was no longer related. This suggests that other variables in the model, such as race or income could also explain this relationship, as evidenced by the race/ethnicity disparities that we found, with Hispanic CSHCN at a higher risk of no or partial utilization dental care compared to other race/ethnicities.

Our findings indicate that the out-of-pocket expenses for families for healthcare services of their CSHCN show somewhat inconsistent results, demonstrating significant associations with having problems accessing preventive dental services in 2005, and other preventive dental services in 2009. Moreover, they are more likely to not utilizing or partially utilize preventive dental services in both 2005 and 2009, compared to families who spend less expense on their charges healthcare services. However, other dental services utilization was not impacted by out of pocket expenditures. For example, we found that families with $1000 out-of-pocket expenses for their children's health services were more likely (OR 1.57) to have "fair to poor" access to preventive dental care in 2005, compared to families spending less than $250. We propose that these CSHCN were more likely to be uninsured or have insurance that did not cover their needed dental care. Consequently, our statistical analysis investigated the relationship between out-of-pocket expenses and insurance status. We found that 30% of the families with uninsured CSHCN had more than $1000 in expenses for their CSHCN healthcare services, and only 6% of the families of CSHCN with public insurance spent the same amount. In addition, 32% of the families of privately insured CSHCN also spent more than $1000 on their CSHCN healthcare services. These results indicate that besides the insurance type, the adequacy of the insurance and its benefits are also relevant.

Blackwell (2010) reported that children living in nuclear families are generally less likely to have difficulties accessing healthcare (including dental care) compared to non-nuclear families. Similarly, for the special needs population, our findings suggest that the CSHCN family structure is an important predictor for the access to dental care.

We found that CSHCN living with single mothers with no fathers were more likely to have problems accessing preventive dental care in 2005, compared to those living with two (biological or adopted) parents. For instance, we found that CSHCN living with single mothers had 1.77 times the odds of having "fair to poor" access to preventive dental care in 2005, compared to CSHCN living with two (biological or adopted) parents. This may be because caring for CSHCN is a demanding job and might be more complicated for single mothers without support. The extra responsibilities for the mother could lead to the ignoring of CSHCN preventive dental needs, and inducing them to attend to their child's dental needs when the child is really in need for other dental care services such as an emergency dental treatment (for pain or infection).

The relationship between parental employment status and family financial burden, with CSHCN access and utilization of dental care services were also evaluated in this study. In particular, the survey questions about parental employment work life and family financial burden in the NS-CSHCN 2005 and 2009 were directly related to CSHCN, demonstrating the effect of caring for CSHCN on the parents' working life and family financial status. One should keep in mind that any differences in these two measurements between the 2005 and 2009 surveys could have resulted from impacts of the 2008 financial recession. Our results indicate a statistically significant relationship between parental employment status and access and utilization of both preventive and other dental care services. Nevertheless, the amount of this impact was comparable from 2005 and 2009. Almost 50% of CSHCN in our study who had "fair to poor" access to dental care had parents who reported that their child's condition affected their work life, either by

limiting some working hours or preventing their working; and only 20% of the parents of CSHCN with "very good" access reported that their life had been affected because of caring for CSHCN. In terms of utilization of dental care services, our results suggest that 39% of CSHCN who had not utilized or partially utilized dental care services had parents who reported their child's condition affecting their work life. On the other hand, only 22% of the parents of CSHCN who fully utilized dental care services reported that their work life had been affected because of caring for CSHCN.

Furthermore, our findings show a significant relationship between family financial burden and access and utilization of both preventive and other dental care services. Nevertheless, the degree of the impact was equal for 2005 and 2009. In our study, nearly 62% of the families of CSHCN who had "fair to poor" access to dental care reported that they had financial issues due to caring for CSHCN. On the other hand, only 16% of the parents of CSHCN with "very good to good" access reported financial issues. In terms of dental care service utilization, our results suggest that for 40% of CSHCN who had no or partial utilization of dental care services, the children's condition affected their financial status. On the other hand, only 18.6% of the parents of CSHCN who fully utilized dental care services reported that their financial status was affected because of caring for CSHCN.

Finally, one of the objectives of this study was to evaluate the socio-demographic determinants (age, gender, race/ethnicity, language spoken at home, parents' education, FPL, and family structure) for having uninsured CSHCN. From the multivariate analysis, we concluded that Hispanic CSHCN from low-income families were more likely to be

uninsured. Identifying the demographic characteristics of uninsured CSHCN will help to elucidate those who are at risk of having poor access and utilization of dental care. Subsequently, we may be able to focus our efforts on the appropriate populations and introduce them to insurance program options and benefits for CSHCN.

In our study, access to both preventive and other dental care services in 2005 and 2009 was predicted using three levels of variables which are; home-related variables (race/ethnicity, age, gender, parent's education, family structure type, FPL, language spoken at home, medical condition), Intermediate variables (type of the insurance), dental clinic-related variables **(**out-of-pocket cost of treatment). These three levels of variables were used to assess our four access outcomes: access to preventive dental care service in 2005, access to other dental care service in 2005, access to preventive dental care service in 2009 and access to other dental care service in 2009. We assume a predictor to be consistent in disrupting the access to dental care services if it was significant for at least two out of the four access outcomes. On the other hand, utilization of both preventive and other dental care services in 2005 and 2009 were evaluated based on the Anderson Behavioral Model of Health Services which is a conceptual model used to evaluate the factors that lead to the utilization of healthcare services. The model assumed that health service utilization is determined by three dynamics: predisposing factors (Child's age, gender, race/ethnicity, parent's education level, language spoken at home, medical condition), enabling factors (FPL, insurance, out-of-pocket cost) and needs factors (need for specialty care services, including dental care). These factors were used to assess the

four utilization outcomes: utilization of preventive dental care service in 2005, utilization of other dental care service in 2005, utilization of preventive dental care service in 2009 and utilization of other dental care service in 2009. Similar to the access variables, we assume a factor to be consistent in impacting the utilization of dental care services if it was significant for at least two out of the four utilization outcomes.

After controlling for all confounding in our multivariate analysis, we found that other Non-Hispanics (not including Whites or Blacks), from low-income families, with a complicated health condition, uninsured or publically insured and from families who spent more than $1000 out-of-pocket expenses on healthcare services were less likely to access and utilize dental care services in 2005 and 2009. In addition, we found that CSHCN from non-Hispanics Blacks and other Non-Hispanics race/ethnicity, and those who had unmet specialist needs were also less likely to utilize dental services in 2005 and 2009. Moreover, we found age to be a consistent predictor only for accessing dental care services with older CSHCN (5-17 years old) being less likely to access preventive or other dental care services in 2005 and 2009.

Strengths

1. This study used the 2005 and 2009 NS-CHSCN which resulted in large and representative sample of 80,965 CSHCN, aged 0-17 years, in the US. This has allowed for a greater understanding of the level of access and utilization of dental services for CSHCN during the period.
2. This study is the first to define and evaluate “access” and “utilization” to accurately assess the dental needs status among CSHCN.

3. We used a well-known behavioral model to help understand the factors that determine the amount of dental care service utilization among CSHCN. To the best of our knowledge, this model has never before been used in the dental field.
4. This is the first study to evaluate the association between parental employment status and family financial burden with access and utilization of dental care services. The results suggest a strong association and promise more valuable results for future research.

Limitations

Study design

In cross-sectional studies, information is collected at the same time-point, and self-reporting is frequently used to obtain most of the information in these studies. In fact, respondents tend to provide subjective information based on their understanding or ability to answer the survey questions rather than the truth. Therefore, one should be cautious when interpreting the results and making conclusions based on such information. Moreover, cross sectional studies do not assess causal relationships since it is mainly based on a one time-point assessment, and is unable to determine temporal relationships.

Variable-related limitations

Our initial study plan was to use an MSA (metropolitan statistical area) variable in the analysis to determine the possible effect of geography on access and utilization of dental care services (Skinner, Slifkin, & Mayer, 2006). Later, we discovered that this

variable was only available for 16 states, where the population was at least 500,000 in both categories (MSA and non-MSA). Therefore, we decided not to use this variable, because of the large amount of missing data that would unduly affect our research plan.

Parental employment status and family financial burden variables were both evaluated based on the assumption that they were affected by CSHCN health condition. The surveyed parents were asked whether or not their employment or financial status had been affected by having a child with special needs. Therefore, our results and interpretations must be restricted to the structure and meaning of the survey questions for these two variables. Our study does not necessarily measure the impact of the true family financial burden and work situation with regards to CSHCN access and utilization of dental care services.

Comparability across both surveys

From the 2005 and 2009 NS-CSHCN, changes occurred in the questions covering the structure of need and utilization of dental care in regards to preventive care. In the 2009 NS-CSHCN, the item asking about 'number of preventive dental visits in past year' had been introduced in addition to the 2005 NS-CSHCN question 'did you need preventive dental care?' Therefore, if parents reported that their CSHCN received more than one preventive dental care visits, they did not have to respond to the second question: 'did you need preventive dental care?' The obvious assumption was that the CSHCN was truly in need of preventive dental care if he or she received more than one visit, which was used to compare the two datasets.

Implications and Future Directions

1. Identifying the main determinants of access and utilization of dental care services for CSHCN will help policy makers, public health advocates, and healthcare providers remove modifiable barriers (low-income, inadequate or no insurance coverage, inability to obtain specialist care) and facilitate better access and utilization of dental care.
2. By understanding why some CSHCN remain uninsured, despite their coverage by public insurance, the public health community should be able to focus on removing the relevant barriers and deliver needed insurance for uninsured CSHCN.
3. This study should help in raising awareness about the impact of parental employment status and family financial problems due to the CSHCN's health conditions in regards to their access and utilization of dental care. Financial assistance programs may be needed as a strategy for these families to resolve access and utilization problems in CSHCN.

CHAPTER 6: CONCLUSION

This study found that, in 2005 and 2009, children with special healthcare needs (CSHCN) accessed and utilized both preventive and other dental care services at a high level. A slight decrease in the levels of access and utilization was observed for both services from 2005 to 2009. However, disparities in access and utilization of preventive and other dental care services still exist among CSHCN. Several barriers to both preventive and other dental care services were consistently found in 2005 and 2009. In CSHCN, older children (15 years and older) and children from minority, low-income, and single-parent families are at a higher risk of having difficulties accessing and utilizing dental care services in the US. Children with complex medical conditions (special healthcare needs), who have higher healthcare needs and are not insured, even though they are entitled for insurance coverage, are at a particularly higher risk of having difficulties accessing or utilizing dental care services. Family unemployment issues and financial difficulties due to the health conditions of CSHCN are also barriers that hinder their access and utilization of dental care. Further, Hispanic CSHCN from low-income families are more vulnerable by being uninsured, which puts them at a high risk of not accessing or utilizing dental care services. Some of the barriers can be modified, which in turn, can reduce or eliminate the disparities. By using strategies that increase the interactions between medical and dental services, and by implementing programs and policies to eliminate the disparities, CSHCN can receive better access and more effective utilization of dental care.

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