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Impact of Chronic Condition Status and Severity on Dental Utilization for Iowa Medicaid-Enrolled Children

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Abstract

Background—Although Medicaid-enrolled children with a chronic condition (CC) may be less likely to use dental care because of factors related to their CC, dental utilization for this population is poorly understood.

Objective—To assess the relationship between CC status and CC severity, respectively, on dental utilization for Iowa Medicaid-enrolled children.

Research Design—Retrospective cohort study of Iowa Medicaid data (January 1, 2003 to December 31, 2006).

Subjects—Medicaid-enrolled children aged 3 to 14 (N = 71,115) years.

Measures—The 3M Corporation Clinical Risk Grouping methods were used to assess CC status (no/yes) and CC severity (episodic/life-long/malignancy/complex). The outcome variable was any dental utilization in 2006. Secondary outcomes included use of diagnostic, preventive, routine restorative, or complex restorative dental care.

Results—After adjusting for model covariates, Iowa Medicaid-enrolled children with a CC were significantly more likely to use each type of dental care except routine restorative care ($P = 0.86$) than those without a CC, although the differences in the odds were small (4%–6%). Compared with Medicaid-enrolled children with an episodic CC, children with a life-long CC were less likely to use routine restorative care ($P < 0.0001$), children with a malignancy were more likely to use complex restorative care ($P < 0.03$), and children with a complex CC were less likely to use each type of dental care except complex restorative care ($P = 0.97$).

Conclusions—There were differences in dental utilization for Iowa Medicaid-enrolled children by CC status and CC severity. Children with complex CCs were the least likely to use dental care.

Future research efforts should seek to understand why subgroups of Medicaid-enrolled children with a CC exhibit lower dental utilization.

Keywords

children with disabilities; dental care for disabled; dental care for chronically ill; dental utilization; Medicaid

Tooth decay is the most common childhood disease.¹ Untreated decay can lead to pain, infection, and in rare cases, sepsis-induced death. Other consequences include difficulties chewing food, school absenteeism, and low quality-of-life.^{2–6} Tooth decay is preventable by drinking fluoridated water, brushing with fluoridated toothpaste, limiting carbohydrate intake, and visiting the dentist for preventive treatments such as topical fluoride and sealants.^{7,8}

The American Academy of Pediatric Dentistry recommends 6-monthly dental visits.⁹ However, not all children use dental care regularly. In fact, dental care is the most common unmet need for children, including those with a chronic condition (CC).^{10,11}

Low-income children are disproportionately affected by poor oral health, partly because most do not use dental care.¹² Although Medicaid-enrolled children are more likely to use dental care than uninsured children,^{13,14} studies have identified barriers that affect Medicaid-enrolled children.^{15–18} Dental utilization is commonly defined as use of dental care during a 12-month period. Based on National Health and Nutrition Examination Survey (NHANES) data, dental utilization for Medicaid-enrolled children aged between 2 and 16 years ranged from 38.5%¹⁹ (1988–1994) to 62.4% (1999–2004).²⁰ Data from the Medical Expenditures Panel Survey (MEPS) suggest that 28.5% to 33% of Medicaid-enrolled children <18 years used dental care in 1996.²¹ Based on state Medicaid data, utilization for children ranged from 24.4% in New Hampshire to 54.7% in Iowa.^{22–25} Collectively, these estimates suggest that large proportions of Medicaid-enrolled children do not use care even though dental care is an entitlement under the federal Early and Periodic Screening, Diagnosis, and Treatment Program.

One in 5 Medicaid-enrolled children has a CC, defined as a mental, physical, or behavioral condition expected to last ≥ 12 months.²⁶ Medicaid-enrolled children with a CC typically face additional barriers to care. For example, dentists are unwilling to see these children because of insufficient financial reimbursement, especially for the effort required to treat patients with complex medical histories or behavior problems.²⁷ There is also a shortage of pediatric dentists trained to manage children with a CC.²⁸

Iowa Dental Medicaid is a traditional fee-for-service program that covers diagnostic, preventive, and restorative dental care.²⁹ Infants <1 year from households with incomes $\leq 200\%$ of the Federal Poverty Level as well as children aged 1 to 18 years $\leq 133\%$ Federal Poverty Level are eligible. Medicaid operates in all 99 counties and enrolls about 150,000 children each month.³⁰ Children are enrolled annually. All dentists with a valid Iowa dental license can participate. There were 2148 dentists in Iowa in 2008.³⁰ Forty percent of Iowa dentists (about 860 dentists) treat Medicaid or State Children's Health Insurance Program-enrolled (SCHIP) patients and 8% (about 172 Iowa general dentists) have practices with $\geq 25\%$ Medicaid or SCHIP patients.³¹

In this study, we tested the following hypotheses:

1. Children with a CC are less likely to use dental care than those without a CC;

2. Children with more severe CCs are less likely to use dental care than those with less severe CCs.

METHODS

Conceptual Framework

A sociocultural oral health disparities model proposed by Patrick et al was the conceptual framework for this study.³² We used this model because it focuses on the multilevel influences on oral health. The model of Patrick et al hypothesizes that policies and interventions focusing on these influences will reduce oral health disparities. Our study variables were organized under the following 5 domains:

- Ascribed factors (immutable individual-level descriptors: CC status; CC severity; age; race/ethnicity; gender; Medicaid eligibility group);
- Proximal factors (modifiable individual-level health behaviors/use of health services: previous primary medical care use; previous dental care use);
- Immediate factors (household-level mediating pathways between proximal and intermediate factors: whether there was another Medicaid-enrolled sibling/adult in the household);
- Intermediate factors (community-level social environment: rurality); and
- Distal factors (system-level organization and delivery of services: dental Health Professional Shortage Area [HPSA]).

Study Population

We focused on children aged 3 to 14 years enrolled in Iowa Medicaid for 11 to 12 months in 2005 and in 2006. We excluded 19,178 children who did not meet this criterion. Children <3 years were excluded because CCs are diagnosed after the third birthday³³ and dental utilization is low for this group,³⁴ suggesting heterogeneous determinants of utilization. Children aged 15 to 17 years were excluded because they exhibit utilization patterns that appear to be uniquely related to adolescence.³⁵ The final dataset contained 71,115 children.

Data

The University of Iowa Institutional Review Board approved this study. We analyzed Medicaid files from 2003 to 2006. Enrollment files contained date of birth; gender; race/ethnicity; Medicaid eligibility group; and zip/county code. Claims files contained medical diagnoses, inpatient, outpatient, pharmacy, and dental claims. Dental services were identified by Current Dental Terminology code and invalid Current Dental Terminology codes were removed (<0.01% of all claims).

Measures

Use of dental care was defined as the presence of a claim for such care. The outcome variables were use of any dental care in 2006; use of diagnostic care (eg, examinations; D0110–D0330); preventive care (eg, cleanings; topical fluoride; sealants; D1110–D1351; D4355); routine restorative care (eg, fillings; D2110–D2394); or complex restorative care (eg, pulp therapy; stainless steel crowns; extractions; D1510–D1550; D2930–D4342; D7110–D7140; D9420). Children who used multiple types of care were included in the rates for each type of care they used.

The main independent variables were CC status and CC severity, defined using the 3M Clinical Risk Grouping methods.³⁶ The 3M Clinical Risk Grouping methods classify

children into 9 core health status groups (CHSGs) based on medical diagnoses and relevant health service utilization.³⁷ We modified CHSG1 to differentiate non-medical care utilizers from healthy children. Furthermore, we used clinically validated methods to differentiate children with episodic CCs from children with lifelong CCs (originally categorized in CHSG3–CHSG7).³⁸ This resulted in 7 mutually exclusive, hierarchical condition-stable clinical groups (CG) (Table 1).

First, we compared dental utilization for children without a CC from CG1 to CG3 (nonmedical care utilizers; healthy; acute condition) and the remaining children with a CC in CG4 to CG7 (episodic CC; life-long CC; malignancy; complex CC). We then compared utilization across CG4 to CG7, with CG4 as the reference group.

Statistical Analyses

The χ^2 test or analysis of variance was used to test for inter-CG differences ($\alpha = 0.05$). Multiple variable logistic regression models were constructed to test our hypotheses. Variables from similar constructs were assessed for collinearity. The Medicaid eligibility program variable was excluded because of partial collinearity with CC status. We excluded race/ethnicity because many children had missing data (14.6%). Imputation methods were not used because of the uncertain reliability of this variable. The 2 immediate factors, having a Medicaid-enrolled sibling and/or adult, were proxies for household-level stress and very low household income, respectively. These 2 factors may be antagonistic to each other rather than being additive, whereby households with both a Medicaid-enrolled sibling and adult may act very differently than expected from having one of these but not both. Hence, an interaction term was included in the final models when significant ($\alpha = 0.05$). When a significant interaction occurred, we reported odds ratios and 95% confidence intervals for each of the 4 combinations of the Medicaid-enrolled sibling and adult factors. All data were analyzed using PASW 17.0.

RESULTS

Descriptive Data

A total of 25,933 children (36.6%) had a CC. Among children with a CC, 69.3% had an episodic CC (CG4); 28.2% life-long CC (CG5); 0.3% malignancy (CG6); and 2.2% complex CC (CG7) (Table 2).

Regarding previous dental use for children without a CC, rates for healthy and those with an acute condition were 54% and 59.1%, respectively. The rate was lowest for non-medical care utilizers (31%). Previous dental use was similar for children with a CC (52.9%–60.2%) and slightly lower for children with the most severe CCs (49%). Compared with children with less severe CCs (CG4–CG5), those with more severe CCs (CG6–CG7) were more likely to have used primary medical care in 2005 but less likely to have used dental care in 2005.

Dental Utilization in 2006

Table 3 summarizes dental utilization in 2006 (numbers in parentheses are utilization rates). Overall, 56.3% of children used any dental care in 2006. Approximately 50% used diagnostic or preventive care, 18.6% routine restorative care, and 8.9% complex restorative care. Among children without a CC, nonmedical care utilizers were the least likely to use each type of dental care in 2006. In fact, with the exception of routine restorative care, nonmedical care utilizers had the lowest utilization for each type of dental care. Among children with a CC, rates across dental care type for children from CG4 to CG6 were similar, and were lowest for children from CG7. Uniformly, larger proportions of children

who used primary medical care in 2005 used dental care in 2006, and those who previously used dental care had higher—sometimes much higher—rates of dental use in 2006 than those who did not previously use dental care.

Regression Models

Impact of CC Status for All Children—We hypothesized that Medicaid-enrolled children with a CC would be less likely to use dental care than those without a CC (Table 4). On the contrary, children with a CC were 1.07 times as likely to have used dental care in 2006 ($P < 0.0001$). They were also significantly more likely to use each type of care except routine restorative care.

Children aged 3 to 7 and 8 to 12 were more likely to use diagnostic, preventive, and complex restorative care but less likely to use routine restorative care than those aged 13 to 14 years. Those who used primary medical care in 2005 were significantly more likely to subsequently use each type of dental care except for complex restorative care and those who used dental care in 2005 were significantly more likely to use each type of dental care subsequently in 2006. Children with a Medicaid-enrolled sibling or adult were significantly more likely to use complex restorative care. Relative to metropolitan children, those in urban areas were less likely to use diagnostic, preventive, and routine restorative care, whereas rural children were less likely to use preventive care and more likely to use routine restorative care. Children in a dental HPSA were less likely to use each type of care.

Impact of CC Severity for Children With a CC—We hypothesized that Medicaid-enrolled children with more severe CCs would be less likely to use each type of dental care than those with less severe CCs (Table 5). With a few exceptions, the only consistently significant differences in dental care use by CC severity were for children with the most severe CCs. Except for complex restorative care, children with a complex CC were significantly less likely to use each type of dental care ($P < 0.0001$) than children with an episodic CC. There were no differences in dental utilization between children with an episodic CC (CG4) and those with a malignancy (CG6) except that children in CG6 were twice as likely to use complex restorative care. There were also no differences in utilization for children with an episodic (CG4) or life-long CC (CG5), except that the latter children had 12% lower odds of utilizing routine restorative dental care.

As in the previous model, younger children with a CC were significantly more likely to use diagnostic, preventive, and complex restorative care but significantly less likely to use routine restorative care. Similar to the results from Table 4, there were large odds ratios associated with previous primary medical care use and previous dental care use. The sibling variable was not significant for each type of care, whereas children with a Medicaid-enrolled adult were less likely to use any or preventive care and more likely to use complex restorative care. Children with a CC in a nonmetropolitan area were significantly less likely to use preventive care. There was no difference in dental utilization by dental HPSA, except for any dental care and preventive care, whereby children in a dental HPSA were less likely to use these types of care.

Interaction Term—In our CC status models (Table 4), the interaction between the 2 immediate factors (sibling/adult) was significant for each type of care except complex restorative care. Compared with children in the reference group (no enrolled sibling or adult), children with no enrolled sibling and an enrolled adult were more likely to use diagnostic and routine restorative care; children with an enrolled sibling and no enrolled adult were significantly more likely to use each type of care; and children with an enrolled sibling and an enrolled adult were more likely to use routine restorative care. In the CC

severity models (Table 5), the interaction term failed to reach statistical significance for each type of dental care except routine restorative care.

DISCUSSION

We adapted methods from the health services literature to identify Medicaid-enrolled children with a CC and to evaluate 2 relationships: first, between CC status and dental utilization, and a second, between CC severity and dental utilization.

CC Status

We hypothesized that Medicaid-enrolled children with a CC would be less likely to use each type of dental care than those without a CC. After adjusting for covariates, children with a CC were slightly more likely to use diagnostic, preventive, or complex restorative dental care and equally as likely to use routine restorative care as children without a CC.

There are 2 related explanations. Medicaid-enrolled children with a CC may have overcome barriers to care at a higher rate than those without a CC because of Iowa's unique dental care delivery system for children with a CC. For example, the University of Iowa's Center for Disabilities and Development, open since 1948, houses a dental clinic where many children with a CC can obtain comprehensive dental care from pediatric dentists and residents.³⁹ Such long-standing, specialty clinics can substantially improve access to dental care for children with a CC. Second, children with a CC in Iowa may generally be more likely to use all types of health care services, including dental, because of better integration into the health care system through clinics like the Center for Disabilities and Development.

Our finding of no difference in routine restorative care use by CC status is consistent with another study based on MEPS data.⁴⁰ This latter study found no difference in use of restorative care for children aged 2 to 17, of which 27% were Medicaid- or SCHIP-insured, by special needs status. Furthermore, Medicaid-enrolled children with a CC in our study were more likely to use preventive care, consistent with previous findings that higher proportions of children with a CC used preventive care.^{41,42} Children with a CC were also more likely to use complex restorative care (eg, pulp therapy, tooth extractions), suggesting greater severity of dental disease. These findings underscore the importance of preventive dental care as well as earlier diagnosis and treatment, especially for children with a CC. It is important to note that differences in utilization by CC status, even when statistically significant, may not be clinically meaningful if they reflect underlying differences between the 2 groups in dental need, which can manifest as increased use of complex restorative care.

CC Severity

We hypothesized that Medicaid-enrolled children with more severe CCs would be less likely to use each type of dental care than those with less severe CCs. As hypothesized, children with a complex CC (CG7) were significantly less likely to use each type of dental care, except complex restorative care, compared with children with an episodic CC (CG4). Compared with children in CG4, children with a malignancy, the second most severe CC group, were only more likely to use complex restorative care, whereas children with a life-long CC (CG5) were less likely to use routine restorative care. The odds ratios associated with use of each type of dental care appeared to increase, rather than decrease, by CC severity from CG4 to CG6 and then decreased for children in CG7. These results suggest a threshold effect rather than a direct relationship between CC severity and dental utilization.

There are 2 possible explanations. Children with a complex CC, which includes ventilator-dependent children and those in a persistent vegetative state, have other higher-priority health care needs or face end-of-life issues. These factors may lead to lower dental

utilization. This is consistent with a recent study reporting that lower proportions of children <18 years meeting >3 CSHCN Screener criteria had an annual dental visit than those meeting 1 criterion.⁴³ On the other hand, for children with a malignancy, the second most severe CC group, oncologists may reinforce the importance of dental care, which is necessary to ensure that severely decayed teeth are extracted (a type of complex restorative care) before chemotherapy or radiation and to monitor for mucositis following cancer treatment.⁴⁴

As for children from the less severe CC groups (CG4–CG5), there were generally no differences in utilization between these 2 groups, and they were collectively more likely to use each type of care than children without a CC (data not shown). These children have conditions that require monitoring but are not necessarily life-threatening. Integration into the health care system may make it more likely for these children to use dental care.

Other Factors Related to Dental Utilization (All Children)

Distal Factors—We examined 1 distal factor: dental HPSA. As expected, living in a dental HPSA was associated with lower utilization of each type of dental care in the first model (Table 4). In the second model (Table 5), children with a CC who lived in a dental HPSA were less likely to use preventive dental care but not less likely to use other types of care. The former finding is problematic given the importance of preventive care. The lack of relationship between the dental HPSA variable and the other types of dental care for children with a CC suggests that increasing the supply of dentists in HPSAs alone may not improve utilization.

Intermediate Factors—We examined the effect of one intermediate factor: rurality. As distinct from findings from other research,⁴⁵ we failed to detect consistent differences in dental utilization for children from rural and metropolitan areas, except for preventive care. Children in urban areas generally were less likely to use dental care than those living in metropolitan areas. One explanation is that metropolitan areas in Iowa have community health centers that serve high volumes of Medicaid enrollees, whereas children in rural areas may be seen by local dentists who treat economically vulnerable children based on an enhanced sense of social responsibility.⁴⁶ This leaves urban children relying on dentists who may limit the number of Medicaid patients seen, although this is an untested hypothesis. Future studies should identify reasons for differences by rurality in dental utilization for Medicaid-enrolled children.

Immediate Factors—We examined 2 immediate factors: whether there was a Medicaid-enrolled sibling or Medicaid-enrolled adult in the household. In the CC status model, the main effect of having a Medicaid-enrolled sibling was associated with increased use of complex restorative care, whereas in the CC severity model only children with a Medicaid-enrolled adult were more likely to use this type of care.

The interaction term was significant in the CC status models for each type of care except complex restorative care and failed to reach significance in the CC severity models except for routine restorative care. Consistent findings across both models that children from the 3 nonreference groups were significantly more likely to use routine restorative care suggest that preventive interventions should be targeted at households with multiple Medicaid enrollees.

Collectively, these results suggest that interventions might focus on households with at least 1 Medicaid-enrolled adult. Further research is needed on the main effects and interactive effects between immediate factors so that subgroups of Medicaid-enrolled children who would benefit most from household-level interventions can be identified.

Proximal Factors—We examined 2 proximal factors: previous dental care use and previous primary medical care use. In all models, previous dental care use was positively associated with subsequent dental use in 2006. Another study examined this relationship and found that Medicaid-enrolled children <6 years who used preventive care at an earlier age were significantly more likely to subsequently use preventive care.⁴⁷ As a sensitivity analysis, we ran our models without the variable and found that the adjusted odds ratios remained unchanged, suggesting that dental use in 2005 failed to confound the relationship between model covariates and dental use in 2006. Future work should examine dental utilization over time, especially for children with a CC, many of whom are long-term Medicaid enrollees.

We also detected a significant relationship between previous use of primary medical care and diagnostic, preventive, and routine restorative dental care use. These findings are consistent with previous studies.^{25,48} In the current study, however, children who used primary medical care were not more likely to use complex restorative care. Because the mechanisms are not well-understood, the relationship between medical and dental utilization warrants further investigation.

Study Limitations

There are several study limitations. First, we lacked child-level clinical data, which precluded an assessment of dental need. It is possible that differences in odds ratios for restorative care, especially for children with a CC, reflect heterogeneous dental need rather than unequal access to care. Underlying differences in risk for dental disease, which is related to dental need, may explain variations in utilization for all types of dental care, irrespective of CC status or CC severity. This limitation can be addressed in the future by measuring caries risk and collecting clinical oral health data. Second, we did not examine how other factors associated with CCs (eg, intellectual/developmental disability; behavior problems) are related to utilization. Third, we were unable to include behavioral factors such as knowledge, attitudes, and beliefs, which are important determinants of utilization. We addressed this limitation by including proxy measures such as primary medical care use, which is partially related to health care seeking behavior. Fourth, we dropped the race/ethnicity variable. In light of dental utilization disparities for minority children,⁴⁹ this issue requires additional investigation. Finally, our study was based on Medicaid-enrolled children in Iowa; our findings may not be generalizable to children in other states. Future studies should be conducted in other child populations so that direct comparisons can be made regarding the effect of CC status and severity on dental utilization.

CONCLUSIONS

All children, irrespective of their CC status, should use dental care regularly. Our results suggest that Medicaid-enrolled children with a CC were slightly more likely to use dental care and that children with the most severe CCs were the least likely to use care. However, nearly 50% of children in our study did not use any dental care in 2006, highlighting the larger problem that Medicaid-enrolled children face. Low dental utilization can lead to untreated tooth decay and deteriorations in overall health, which may have serious consequences for children with a CC, many of whom already have compromised systemic health. Future studies are needed to identify the factors associated with CCs that are critical barriers to dental utilization such as a cognitive deficit or physical impairment. This knowledge will lead to policies and interventions aimed at improving dental utilization for the most vulnerable Medicaid enrollees.

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References

1. US Department of Health and Human Services. Oral Health in America: A Report of the Surgeon General. Rockville, MD: US Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institute of Health; 2000.
2. Gift HC, Reisine ST, Larach DC. The social impact of dental problems and visits. *Am J Public Health*. 1992; 82:1663–1668. [PubMed: 1456343]
3. Filstrup SL, Briskie D, da Fonseca M, et al. Early childhood caries and quality of life: child and parent perspectives. *Pediatr Dent*. 2003; 25:431–440. [PubMed: 14649606]
4. Nuttall NM, Steele JG, Evans D, et al. The reported impact of oral condition on children in the United Kingdom, 2003. *Br Dent J*. 2006; 200:551–555. [PubMed: 16732242]
5. Patel RR, Tootla R, Inglehart MR. Does oral health affect self perceptions, parental ratings and video-based assessments of children's smiles? *Community Dent Oral Epidemiol*. 2007; 35:44–52. [PubMed: 17244137]
6. Casamassimo PS, Thikkurissy S, Edelstein BL, et al. Beyond the dmft: the human and economic cost of early childhood caries. *J Am Dent Assoc*. 2009; 140:650–657. [PubMed: 19491160]
7. Azarpazhooh A, Main PA. Pit and fissure sealants in the prevention of dental caries in children and adolescents: a systematic review. *J Can Dent Assoc*. 2008; 74:171–177. [PubMed: 18353204]
8. Azarpazhooh A, Main PA. Fluoride varnish in the prevention of dental caries in children and adolescents: a systematic review. *J Can Dent Assoc*. 2008; 74:73–79. [PubMed: 18298889]
9. American Academy of Pediatric Dentistry Clinical Affairs Committee, American Academy of Pediatric Dentistry Council on Clinical Affairs. Guideline on periodicity of examination, preventive dental services, anticipatory guidance, and oral treatment for children. *Pediatr Dent*. 2009; 30(suppl 7):112–118.
10. Newacheck P, McManus M, Fox H, et al. Access to health care for children with special health care needs. *Pediatrics*. 2000; 105:760–766. [PubMed: 10742317]
11. Lewis C, Robertson AS, Phelps S. Unmet dental care needs among children with special health care needs: implications for the medical home. *Pediatrics*. 2005; 116:e426–e431. [PubMed: 16140688]
12. Vargas CM, Crall JJ, Schneider DA. Sociodemographic distribution of pediatric dental caries: NHANES III, 1988–1994. *J Am Dent Assoc*. 1998; 129:1229–1238. [PubMed: 9766104]
13. Bloom B, Dey AN, Freeman G. Summary health statistics for US children: national health interview survey, 2005. *Vital Health Stat*. 2006; 231:1–84.
14. Dubay L, Kenney GM. Health care access and use among low-income children: who fares best? *Health Aff (Millwood)*. 2001; 20:112–121. [PubMed: 11194832]
15. Nainar SM. Dentists' ranking of Medicaid reimbursement rates as a measure of their pediatric Medicaid participation. *ASDC J Dent Child*. 2000; 67:422–424. 375–407. [PubMed: 11204067]
16. Mayer ML, Stearns SC, Norton EC, et al. The effects of Medicaid expansions and reimbursement increases on dentists' participation. *Inquiry*. 2000; 37:33–44. [PubMed: 10892356]
17. Al Agili D, Pass M, Bronstein J, et al. Medicaid participation by private dentists in Alabama. *Pediatr Dent*. 2007; 29:293–302. [PubMed: 17867394]
18. Iben P, Kanellis MJ, Warren J. Appointment-keeping behavior of Medicaid-enrolled pediatric dental patients in eastern Iowa. *Pediatr Dent*. 2000; 22:325–329. [PubMed: 10969442]
19. Fisher MA, Mascarenhas AK. Does Medicaid improve utilization of medical and dental services and health outcomes for Medicaid-eligible children in the United States? *Community Dent Oral Epidemiol*. 2007; 35:263–271. [PubMed: 17615013]

20. Fisher MA, Mascarenhas AK. A comparison of medical and dental outcomes for Medicaid-insured and uninsured Medicaid-eligible children: a US population-based study. *J Am Dent Assoc.* 2009; 140:1403–1412. [PubMed: 19884400]
21. Manski RJ, Edelstein BL, Moeller JF. The impact of insurance coverage on children's dental visits and expenditures, 1996. *J Am Dent Assoc.* 2001; 132:1137–1145. [PubMed: 11575023]
22. Chi D, Milgrom P. Preventive dental service utilization for Medicaid-enrolled children in New Hampshire: a comparison of care provided by pediatric dentists and general dentists. *J Health Care Poor Underserved.* 2009; 20:458–472. [PubMed: 19395842]
23. Taichman LS, Sohn W, Lim S, et al. Assessing patterns of restorative and preventive care among children enrolled in Medicaid, by type of dental care provider. *J Am Dent Assoc.* 2009; 140:886–894. [PubMed: 19571052]
24. Chi DL, Momany ET, Kuthy RA, et al. Preventive dental utilization for Medicaid-enrolled children in Iowa identified with an intellectual and/or developmental disability. *J Public Health Dent.* 2010; 70:35–44. [PubMed: 19694935]
25. Lee MA, Horan SA. Children's access to dental care in Connecticut's Medicaid managed care program. *Matern Child Health J.* 2001; 5:43–51. [PubMed: 11341719]
26. Muldoon J, Neff J, Gay J. Profiling the health service needs of populations using diagnosis-based classification systems. *J Ambul Care Manage.* 1997; 20:1–18. [PubMed: 10181610]
27. Milano M, Seybold SV. Dental care for special needs patients: a survey of Texas pediatric dentists. *ASDC J Dent Child.* 2002; 69:212–216. [PubMed: 12515070]
28. Davis MJ. American Academy of Pediatric Dentistry Task Force on Work Force Issues. Pediatric dentistry workforce issues: a task force white paper. *Pediatr Dent.* 2000; 22:331–335. [PubMed: 10969443]
29. Iowa Department of Human Services (IDPH). IDPH—Covering kids and families program—Medical coverage options. Available at: http://www.idph.state.ia.us/coveringkids/coverage_medicaid.asp
30. Kaiser State Health Facts. Available at: <http://www.statehealthfacts.org>
31. McQuistan MR, Kuthy RA, Daminano PC, et al. General dentists' referrals of 3- to 5-year-old children to pediatric dentists. *J Am Dent Assoc.* 2006; 137:653–660. [PubMed: 16739546]
32. Patrick D, Lee R, Nucci M, et al. Reducing oral health disparities: a focus on social and cultural determinants. *BMC Oral Health.* 2006; 6(suppl 1):S4. [PubMed: 16934121]
33. Pinto-Martin JA, Dunkle M, Earls M, et al. Developmental stages of developmental screening: steps to implementation of a successful program. *Am J Public Health.* 2005; 95:1928–1932. [PubMed: 16195523]
34. Kanellis MJ, Damiano PC, Momany ET. Utilization of dental services by Iowa Medicaid-enrolled children younger than 6 years old. *Pediatr Dent.* 1997; 19:310–314. [PubMed: 9260221]
35. Eklund SA, Pittman JL, Clark SJ. Michigan Medicaid's healthy kids dental program: an assessment of the first 12 months. *J Am Dent Assoc.* 2003; 134:1509–1515. [PubMed: 14664272]
36. 3M Clinical Risk Grouping Software (for Windows) [computer program]. Version 6.1. Wallingford, CT: 3M Health Information Systems; 2008.
37. Hughes JS, Averill RF, Eisenhandler J, et al. Clinical Risk Groups (CRGs): a classification system for risk-adjusted capitation-based payment and health care management. *Med Care.* 2004; 42:81–90. [PubMed: 14713742]
38. Neff, J.; Clifton, H.; Goldenberg, C., et al. Selecting children with long lasting chronic conditions for care coordination in a hospital affiliated community clinic. Presented at: 2009 Pediatric Academic Society Meeting; May, 2009; Baltimore, MD.
39. University of Iowa Healthcare. Center for Disabilities and Development website. Available at: <http://www.healthcare.uiowa.edu/cdd/index.asp>
40. Beil H, Mayer M, Rozier RG. Dental care utilization and expenditures in children with special health care needs. *J Am Dent Assoc.* 2009; 140:1147–1155. [PubMed: 19723949]
41. Kenney MK, Kogan MD, Crall JJ. Parental perceptions of dental/oral health among children with and without special health care needs. *Ambul Pediatr.* 2008; 8:312–320. [PubMed: 18922505]

42. Van Cleave J, Davis MM. Preventive care utilization among children with and without special health care needs: associations with unmet need. *Ambul Pediatr*. 2008; 8:305–311. [PubMed: 18922504]
43. Iida H, Lewis C, Zhou C, et al. Dental care needs, use and expenditures among US children with and without special health care needs. *J Am Dent Assoc*. 2010; 141:79–88. [PubMed: 20045826]
44. Hogan R. Implementation of an oral care protocol and its effects on oral mucositis. *J Pediatr Oncol Nurs*. 2009; 26:125–135. [PubMed: 19380885]
45. DeVoe JE, Krois L, Stenger R. Do children in rural areas still have different access to health care? Results from a statewide survey of Oregon's food stamp population. *J Rural Health*. 2009; 25:1–7. [PubMed: 19166555]
46. Dharamsi S, Pratt DD, MacEntee MI. How dentists account for social responsibility: economic imperatives and professional obligations. *J Dent Educ*. 2007; 71:1583–1592. [PubMed: 18096884]
47. Savage MF, Lee JY, Kotch JB, et al. Early preventive dental visits: effects on subsequent utilization and costs. *Pediatrics*. 2004; 114:e418–e423. [PubMed: 15466066]
48. Milgrom P, Mancl L, King B, et al. An explanatory model of the dental care utilization of low-income children. *Med Care*. 1998; 36:554–566. [PubMed: 9544595]
49. Dasanayake AP, Li Y, Chun N, et al. Challenges faced by minority children in obtaining dental care. *J Health Care Poor Underserved*. 2007; 18:779–789. [PubMed: 17982207]

TABLE 1

Description of 3M Clinical Risk Grouping (CRG) Core Health Status Groups, Examples of Medical Conditions From Each Core Health Status Group, and Condition-Stable Clinical Groups Used for Analyses

Core Health Status Group	Description of Core Health Status Group	Examples of Medical Conditions	Condition-Stable Clinical Groups	Description of Condition-Stable Clinical Groups
1	Healthy	Non-medical care utilizers; no acute condition; no chronic condition	1	Non-medical care utilizers
			2	Healthy (no acute condition or chronic condition)
2	Acute condition	Pneumonia	3	Acute condition
3	Single minor chronic condition	Migraine; attention deficit and hyperactivity disorder; minor bone/joint conditions	4	Episodic chronic condition
4	Minor chronic condition in multiple systems	Migraine and minor bone/joint condition		
5	Single moderate or dominant chronic condition	Single moderate: asthma; depression		
		Single dominant: diabetes type I; chromosomal abnormalities	5	Life-long chronic condition
6	Significant chronic condition in 2 systems	Diabetes type I and depression		
7	Dominant chronic condition in 3 or more systems	Heart, liver, and brain disorders		
8	Malignancy	Brain tumor	6	Malignancy
9	Catastrophic chronic condition	Cerebral palsy; cystic fibrosis; muscular dystrophy; quadriplegia; dependence of technology (dialysis or respirator); total parenteral nutrition	7	Complex chronic condition

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* $P < 0.0001$ for tests of significance across 7 groups.

TABLE 3

Numbers and Proportions of Iowa Medicaid-Enrolled Children Aged 3 to 14 With Use of Specified Type of Dental Care* in Calendar Year 2006 (N = 71,115)

Study Population N = 71,115					
Variable	Use of Any Dental Care n (%) [†]	Use of Diagnostic Dental Care n (%) [‡]	Use of Preventive Dental Care n (%) [‡]	Use of Routine Restorative Dental Care n (%) [‡]	Use of Complex Restorative Dental Care n (%) [‡]
Main independent variables					
Any chronic condition					
No (n = 45,122)	24,910 (55.2)	23,447 (52.0)	21,671 (48.0)	8351 (18.5)	3989 (8.8)
Yes (n = 25,993)	15,147 (58.3)	14,221 (54.7)	12,874 (49.5)	4877 (18.8)	2356 (9.1)
No chronic condition					
Clinical group 1: non-medical care utilizers (n = 828)	300 (36.2)	271 (32.7)	247 (29.8)	119 (14.4)	41 (5.0)
Clinical Group 2: Healthy (n = 37,847)	20,685 (54.7)	19,459 (51.4)	17,971 (47.5)	6990 (18.5)	3317 (8.8)
Clinical group 3: acute condition (n = 6447)	3925 (60.9)	3717 (57.7)	3453 (53.6)	1242 (19.3)	631 (9.8)
Chronic condition severity					
Clinical group 4: episodic chronic condition (n = 18,025)	10,521 (58.4)	9886 (54.8)	8988 (49.9)	3537 (19.6)	1629 (9.0)
Clinical group 5: life-long chronic condition (n = 7324)	4305 (58.8)	4045 (55.2)	3619 (49.4)	1269 (17.3)	670 (9.1)
Clinical group 6: malignancy (n = 85)	52 (61.2)	48 (56.5)	42 (49.4)	20 (23.5)	13 (15.3)
Clinical group 7: multisystem chronic condition (n = 559)	269 (48.1)	242 (43.3)	225 (40.3)	51 (9.1)	44 (7.9)
Ascribed factors					
Age (yr)					
3–7 (n = 33,060)	18,781 (56.8)	17,872 (54.1)	16,888 (51.1)	5966 (18.0)	3263 (9.9)
8–12 (n = 27,524)	15,741 (57.2)	14,733 (53.5)	13,936 (50.6)	5124 (18.6)	2581 (9.4)
13–14 (n = 10,531)	5535 (52.6)	5063 (48.1)	3721 (35.3)	2138 (20.3)	501 (4.8)
Gender					
Female (n = 34,169)	19,633 (57.5)	18,446 (54.0)	16,904 (49.5)	6453 (18.9)	3035 (8.9)
Male (n = 36,946)	20,424 (55.3)	19,222 (52.0)	17,641 (47.7)	6775 (18.3)	3310 (9.0)

Study Population N = 71,115					
Variable	Use of Any Dental Care n (%) [†]	Use of Diagnostic Dental Care n (%) [†]	Use of Preventive Dental Care n (%) [†]	Use of Routine Restorative Dental Care n (%) [†]	Use of Complex Restorative Dental Care n (%) [†]
Race/ethnicity					
White (n = 45,645)	26,546 (58.2)	24,963 (54.7)	22,742 (49.8)	8874 (19.4)	4213 (9.2)
Black (n = 7235)	3403 (47.0)	3219 (44.5)	2952 (40.8)	1092 (15.1)	456 (6.3)
Other (n = 7857)	4324 (55.0)	4067 (51.8)	3816 (48.6)	1517 (19.3)	777 (9.9)
Unknown or missing (n = 10,378)	5784 (55.7)	5419 (52.2)	5035 (48.5)	1745 (16.8)	899 (8.7)
Medicaid eligibility group					
Temporary Assistance to needy families (TANF) (n = 60,698)	34,548 (56.9)	32,598 (53.7)	29,906 (49.3)	11,709 (19.3)	5558 (9.2)
Supplemental Security Income (SSI) (n = 3123)	1548 (49.6)	1446 (46.3)	1288 (41.2)	503 (16.1)	261 (8.4)
Foster care (n = 5075)	2837 (55.9)	2607 (51.4)	2424 (47.8)	803 (15.8)	327 (6.4)
Institutionalization (n = 1579)	826 (52.3)	757 (47.9)	683 (43.3)	167 (10.6)	145 (9.2)
Home and community-based waiver (n = 640)	298 (46.6)	260 (40.6)	244 (38.1)	46 (7.2)	54 (8.4)
Proximal factors					
Child used primary medical care in 2005					
No (n = 12,618)	5998 (47.6)	5538 (43.9)	5069 (40.2)	2103 (16.7)	982 (7.8)
Yes (n = 58,497)	34,059 (58.2)	32,130 (54.9)	29,476 (50.4)	11,125 (19.0)	5363 (9.2)
Child used any dental care in 2005					
No (n = 31,195)	11,100 (35.6)	10,374 (33.3)	9062 (29.0)	3986 (12.8)	1981 (6.4)
Yes (n = 39,920)	28,957 (72.5)	27,294 (68.4)	25,483 (63.8)	9242 (23.2)	4364 (10.9)
Immediate factors					
At least one Medicaid-enrolled sibling in the household					
No (n = 16,330)	9170 (56.2)	8633 (52.9)	7812 (47.8)	2749 (16.8)	1339 (8.2)
Yes (n = 54,785)	30,887 (56.4)	29,035 (53.0)	26,733 (48.8)	10,479 (19.1)	5006 (9.1)
At least one Medicaid-enrolled adult in the household					
No (n = 28,496)	16,482 (57.8)	15,349 (53.9)	14,207 (49.9)	5254 (18.4)	2449 (8.6)
Yes (n = 42,619)	23,575 (55.3)	22,319 (52.4)	20,338 (47.7)	7974 (18.7)	3896 (9.1)
Intermediate factors					
Degree of rurality of child's county of residence					

n indicates the number of children in each cell and the numbers within parentheses indicate the proportion of children in the respective subgroup that utilized each type of dental care.

TABLE 4

Multiple Variable Logistic Regression Models for Dental Utilization for Iowa Medicaid-Enrolled Children Aged 3 to 14 in Calendar Year 2006 (N = 71,115)

Variable	Use of Any Dental Care			Use of Diagnostic Dental Care			Use of Preventive Dental Care			Use of Routine Restorative Dental Care			Use of Complex Restorative Dental Care		
	Odds Ratio	95% CI		Odds Ratio	95% CI		Odds Ratio	95% CI		Odds Ratio	95% CI		Odds Ratio	95% CI	
Main independent variable															
Chronic condition status*															
Yes	1.07	1.03, 1.11		1.06	1.02, 1.10		1.04	1.01, 1.07		1.00	0.96, 1.04		1.06	1.01, 1.12	
Ascribed factors															
Age (yr)															
3–7	1.25	1.19, 1.32		1.34	1.28, 1.40		2.13	2.03, 2.24		0.85	0.81, 0.90		2.21	2.01, 2.44	
8–12	1.17	1.12, 1.23		1.22	1.16, 1.28		1.94	1.84, 2.04		0.86	0.82, 0.91		2.03	1.84, 2.24	
13–14 [†]	ref	—		ref	—		ref	—		ref	—		ref	—	
Gender [‡]															
Female	1.07	1.03, 1.10		1.05	1.02, 1.09		1.04	1.01, 1.08		1.01	0.97, 1.05		0.98	0.93, 1.03	
Proximal factors															
Child used primary medical care in 2005*															
Yes	1.31	1.25, 1.36		1.33	1.27, 1.38		1.29	1.23, 1.34		1.10	1.04, 1.16		1.08	0.99, 1.16	
Child used any dental care in 2005*															
Yes	4.68	4.54, 4.84		4.26	4.13, 4.40		4.31	4.17, 4.45		2.03	1.95, 2.12		1.80	1.70, 1.90	
Immediate factors															
At least one Medicaid-enrolled sibling in the household*															
Yes	int	int		int	int		int	int		int	int		1.09	1.02, 1.17	
At least one Medicaid-enrolled adult in the household*															
Yes	int	int		int	int		int	int		int	int		1.03	0.98, 1.09	ns
Interaction between Medicaid-enrolled sibling and adult variables															
Sibling no/adult no [†]	ref	—		ref	—		ref	—		ref	—		ns	ns	
Sibling no/adult yes	1.04	0.97, 1.11		1.10	1.02, 1.17		1.00	0.93, 1.07		1.25	1.14, 1.35		1.03	0.98, 1.09	ns
Sibling yes/adult no	1.13	1.07, 1.19		1.12	1.06, 1.18		1.12	1.06, 1.18		1.33	1.24, 1.42		1.80	1.70, 1.90	

Variable	Use of Any Dental Care		Use of Diagnostic Dental Care		Use of Preventive Dental Care		Use of Routine Restorative Dental Care		Use of Complex Restorative Dental Care	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Sibling yes/adult yes	0.96	0.86, 1.06	0.91	0.90, 1.10	0.95	0.86, 1.06	1.26	1.11, 1.43		
Intermediate factors										
Degree of rurality of child's county of residence										
Metropolitan [†]	ref	—	ref	—	ref	—	ref	—	ref	—
Urban adjacent to metropolitan	0.90	0.86, 0.94	0.89	0.85, 0.93	0.86	0.83, 0.90	0.94	0.89, 0.99	0.99	0.92, 1.06
Urban non-adjacent to metropolitan	0.89	0.85, 0.93	0.89	0.85, 0.92	0.83	0.79, 0.86	0.94	0.89, 0.99	0.94	0.87, 1.01
Rural	1.06	0.99, 1.14	1.05	0.98, 1.13	0.92	0.86, 0.98	1.17	1.08, 1.27	1.06	0.95, 1.18
Distal factor										
Resides in a dental health professional shortage area *										
Yes	0.86	0.83, 0.89	0.89	0.86, 0.92	0.87	0.84, 0.91	0.93	0.89, 0.97	0.94	0.88, 0.99

* Reference group is no.

[†] Reference group.

[‡] Reference group is male.

ns indicates not included in model because interaction term failed to reach statistical significance at $\alpha = 0.05$; ref, reference group; int, significant interaction (refer to results for each combination of factor levels below); CI, confidence interval.

TABLE 5

Multiple Variable Logistic Regression Models for Dental Utilization for Iowa Medicaid-Enrolled Children With a Chronic Condition Aged 3 to 14 in Calendar Year 2006 (N = 25,993)

Variable	Use of Any Dental Care		Use of Diagnostic Dental Care		Use of Preventive Dental Care		Use of Routine Restorative Dental Care		Use of Complex Restorative Dental Care	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Main independent variable										
Chronic condition severity										
Clinical group 4: episodic chronic condition*	ref	—	ref	—	ref	—	ref	—	ref	—
Clinical group 5: life-long chronic condition	1.01	0.95, 1.07	1.02	0.96, 1.08	1.00	0.95, 1.07	0.88	0.82, 0.95	1.09	0.99, 1.20
Clinical group 6: malignancy	1.21	0.76, 1.94	1.14	0.72, 1.80	1.03	0.65, 1.63	1.39	0.84, 2.31	1.96	1.08, 3.57
Clinical group 7: complex chronic condition	0.70	0.58, 0.84	0.67	0.56, 0.81	0.73	0.60, 0.87	0.50	0.37, 0.67	0.99	0.72, 1.37
Ascribed factors										
Age (yr)										
3–7	1.17	1.09, 1.27	1.25	1.16, 1.35	2.00	1.85, 2.15	0.73	0.67, 0.80	2.03	1.76, 2.34
8–12	1.13	1.05, 1.21	1.15	1.07, 1.24	1.80	1.68, 1.94	0.79	0.73, 0.86	1.88	1.64, 2.16
13–14*	ref	—	ref	—	ref	—	ref	—	ref	—
Gender†										
Female	1.09	1.03, 1.15	1.09	1.04, 1.15	1.05	1.01, 1.11	1.01	0.94, 1.07	1.01	0.92, 1.10
Proximal factors										
Child used primary medical care in 2005‡	1.29	1.19, 1.40	1.30	1.19, 1.41	1.23	1.13, 1.34	1.13	1.02, 1.26	1.00	0.87, 1.15
Yes										
Child used any dental care in 2005‡	4.55	4.31, 4.80	4.16	3.95, 4.39	4.09	3.88, 4.32	1.94	1.81, 2.08	1.77	1.62, 1.95
Yes										
Immediate factors										
At least one Medicaid-enrolled sibling in the household‡	1.03	0.97, 1.10	1.01	0.96, 1.08	1.05	0.99, 1.12	int	int	1.06	0.96, 1.17
Yes										

Variable	Use of Any Dental Care		Use of Diagnostic Dental Care		Use of Preventive Dental Care		Use of Routine Restorative Dental Care		Use of Complex Restorative Dental Care	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
At least one Medicaid-enrolled adult in the household [‡]	0.92	0.87, 0.98	0.98	0.92, 1.03	0.91	0.86, 0.96	int	int	1.15	1.05, 1.26
Yes	ns	ns	ns	ns	ns	ns			ns	ns
Interaction between Medicaid-enrolled sibling and adult variables										
Sibling no/adult no [‡]							ref	—		
Sibling no/adult yes							1.33	1.18, 1.50		
Sibling yes/adult no							1.36	1.23, 1.50		
Sibling yes/adult yes							1.35	1.12, 1.62		
Intermediate factors										
Degree of rurality of child's county of residence										
Metropolitan [*]	ref	—	ref	—	ref	—	ref	—	ref	—
Urban adjacent to metropolitan	0.93	0.86, 1.01	0.94	0.87, 1.01	0.86	0.80, 0.92	0.93	0.85, 1.02	0.93	0.82, 1.05
Urban non-adjacent to metropolitan	0.92	0.86, 0.99	0.93	0.87, 0.99	0.83	0.78, 0.89	0.98	0.90, 1.06	0.94	0.84, 1.05
Rural	1.00	0.89, 1.13	1.00	0.89, 1.13	0.86	0.76, 0.96	1.10	0.96, 1.26	0.93	0.77, 1.13
Distal factor										
Resides in a dental health professional shortage area [‡]	0.93	0.87, 0.99	0.96	0.91, 1.02	0.94	0.89, 0.99	0.99	0.92, 1.06	0.97	0.88, 1.07
Yes										

* Reference group.

[‡] Reference group is male.

[‡] Reference group is no.

ns indicates not included in model because interaction term failed to reach statistical significance at $\alpha = 0.05$; ref, reference group; int, significant interaction (refer to results for each combination of factor levels below).