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Preventive dental utilization for Medicaid-enrolled children in Iowa identified with intellectual and/or developmental disability

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Abstract

Objectives: To compare preventive dental utilization for children with intellectual and/or developmental disability (IDD) and those without IDD and to identify factors associated with dental utilization.

Methods: We analyzed Iowa Medicaid dental claims submitted during calendar year (CY) 2005 for a cohort of children ages 3-17 who were eligible for Medicaid for at least 11 months in CY 2005 ($n = 107{,}605$). A protocol for identifying IDD children was developed by a group of dentists and physicians with clinical experience in treating children with disabilities. Utilization rates were compared for the two groups. Crude and covariate-adjusted odds ratios were estimated using conditional logistic regression modeling.

Results: A significantly higher proportion of non-IDD children received preventive care than those identified as IDD (48.6 percent versus 46.1 percent; $P < 0.001$). However, the final model revealed no statistically significant difference between the two groups. Factors such as older age, not residing in a dental Health Professional Shortage Area, interaction with the medical system, and family characteristics increased one's likelihood of receiving preventive dental care.

Conclusion: Although IDD children face additional barriers to receiving dental care and may be at greater risk for dental disease, they utilize preventive dental services at the same rate as non-IDD children. Clinical and policy efforts should focus on ensuring that all Medicaid-enrolled children receive need-appropriate levels of preventive dental care.

Introduction

Healthy People 2010 highlights the importance of preventive dental care. This report suggests that efforts be made to increase the proportion of Medicaid-eligible children with an annual preventive dental visit from 20 percent to 57 percent (1). The emphasis on prevention-oriented dental care is based on the public health principle that preventing disease is less costly in the long-term and reduces the need for invasive future treatments. For example, preventive treatments such as pit and fissure sealants and fluoride varnish can reduce the prevalence of dental caries, particularly among high-risk children such as those on Medicaid (2-5). However, not all children have equal access to preventive dental care, prompting research on subgroups most likely to encounter barriers to

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care (6-10). A number of studies have examined dental care use among Medicaid-enrolled children (11-13). Fewer publications have assessed dental use for children with special needs (13-15) and no published study to date has evaluated preventive dental utilization by Medicaid-enrolled special needs children, particularly those with intellectual and/or developmental disability (IDD). Having a clearer understanding of preventive dental utilization for the IDD population is important because prevention-oriented care has the potential to reduce overall costs associated with more expensive restorative or emergency dental care (16,17).

Estimates on the prevalence of IDD among children must be interpreted cautiously as standard definitions of IDD do not exist. Depending on the criteria used, estimates range from 1.2 percent (18) to 17 percent (19) of the general pediatric population.

Previous research suggests that mentally retarded (MR) children are at increased risk for developing gingivitis and dental caries (20). A publication from Sweden reported that severely MR children had a higher prevalence of gingivitis and pathological periodontal pockets than controls (21). A 2002 publication based on data collected in Chile reported that 37 percent of MR children aged 4-17 had defective enamel (22). Collectively, these studies suggest that MR children are at increased risk for oral health problems.

Numerous barriers to care have been identified for IDD children. An analysis of 1997 National Health Interview Survey data of developmentally disabled (DD) children aged 2-17 examined unmet dental needs and cost-related barriers to care (14). The authors found that DD children and non-DD children were equally as likely to have seen a dentist in the past 6 months (53 percent versus 51 percent, respectively). However, children with Down syndrome comprised the group with the highest proportion (22 percent) who failed to receive dental treatment because of cost compared with children with non-syndromic MR (10 percent), autism (10 percent), attention deficit disorder (9 percent), or cerebral palsy (6 percent). Parents of DD children from the lowest income bracket were nearly twice as likely to identify cost as a barrier to dental care than parents of non-DD children at the same income level.

Barriers to dental care exist even for those families receiving case management services. A 2005 study of DD children aged 4-17 ($n = 102$) whose families used case management services found that only 17 percent received dental care (15). These families identified many reasons for not having accessed dental care including lack of information, no dental insurance, and no financial resources to pay for treatment (15).

Finally, a shortage of dentists who are comfortable treating children, particularly those with a disability, is another well-documented barrier to care (23-25). A 2004 survey administered to dental students ($n = 312$) found that one-half of students reported no clinical experience treating MR patients and about 75 percent felt "not at all" or only "a little" prepared to treat MR patients (23). Lack of clinical exposure during dental school might make dentists-in-training less likely to treat IDD children, which would make it difficult for parents of these children to find appropriate dental providers.

In this study, we developed a case finding definition of IDD that was operationalized using Medicaid administrative enrollment and claims data. We tested the hypothesis that Medicaid-enrolled IDD children were less likely to have received preventive dental care than those without IDD. We also hypothesized that other factors in addition to IDD status were associated with preventive dental care utilization. This study is important as a first step in evaluating the degree to which access to preventive dental care is a problem for IDD children.

Methods

Data

Iowa Medicaid administrative enrollment, medical claims, and dental claims files were obtained under an agreement with the Iowa Department of Human Services. All recipient-level data were de-identified to ensure patient confidentiality. This study was approved by the University of Iowa Institutional Review Board.

Enrollment files

The Medicaid enrollment files included the child's unique identification number, gender, age, race/ethnicity, county code, zip code, and the program through which the child became Medicaid-eligible. These files also included information on whether the child received Targeted Case Management services for the mentally retarded, lived in an Institutional Care Facility for the Mentally Retarded or state facility for the mentally retarded, or participated in the Home and Community-Based Services Waiver Program for the Mentally Retarded.

Study population

We limited our analysis to children aged 3-17. Children under 3 were excluded because IDD is typically diagnosed after the third birthday. We analyzed a cohort of children enrolled in Medicaid for $\geq$11 months in 2005. The 11-month enrollment criterion is based on methods developed by the National Committee for Quality Assurance. The final dataset included 107,605 Medicaid-enrolled children.

Study definition of IDD

The primary independent variable in our study was the child's IDD status. A case finding protocol for identifying IDD children was developed a priori by a group of dentists and physicians with clinical experience in treating children with disabilities and Medicaid program staff members from the Iowa Medicaid administrative office (Table 1) (26).

To make use of the richness of the available dataset, we adopted a combination of diagnosis-based and additional criteria in defining IDD. A list of IDD diagnoses was generated based on medical conditions that met the following criteria: a) associated with a cognitive deficiency or impairment; b) developmental etiology and not an acquired condition; and c) expected to last a lifetime. We looked through each child's medical claim files from 2005 to identify these IDD diagnoses by International Classification of Diseases, Ninth Revision, Clinical Modification codes. To account for potential inconsistencies in the coding of diagnoses, we created a "look back period" (2001-2004) to identify additional Medicaid-enrollees from our 2005 cohort with an IDD diagnosis that was not coded in 2005. While somewhat arbitrary, we believed that 4 years were sufficient to identify children with missing IDD diagnoses in CY 2005. Finally, to maximize the likelihood of identifying children with IDD, we developed four additional criteria to case find children without an IDD diagnosis who might otherwise be considered IDD. This included institutionalized children (criterion 2), those enrolled in a program designed specifically for children with mental retardation (criteria 3 and 4), or children without a formal diagnosis who may display clinical signs of IDD as noted by a physician (criterion 5).

Model covariates

We also examined the following variables as potential model covariates:

- Gender
- Age
- Race/ethnicity
- Program through which the child became Medicaid-eligible (e.g., Temporary Assistance to Needy Families, Supplemental Security Income, Foster Care, Waiver Program, other)
- Degree of urbanization of county of residence based on 2003 US Department of Agriculture Rural-Urban Continuum Codes (http://www.ers.usda.gov/Data/RuralUrbanContinuumCodes)
- Whether the child's zip code or county of residence was identified as a dental Health Professional Shortage Area (HPSA)
- Number of children or adults enrolled in Medicaid in the household
- Whether the child had any primary care physician or ambulatory care visits in 2005

As additional proxy measures for IDD diagnosis severity, we examined the total number of unique antibiotic prescriptions and total number of unique non-antibiotic prescriptions received by the child in 2005. These measures were originally based on the assumption that children with a greater number of prescription medications would have

Table 1 Case Finding Criteria Applied to Administrative Data to Identify Children with Intellectual and/or Developmental Disability (IDD) Enrolled in the Iowa Medicaid Program in Calendar Year 2005 (*N* = 4,385)

IDD case finding criteria			*N* = 4,385* *n* (%)
1. Any child with a medical diagnosis by International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes indicating IDD between 2001 and 2005			3,564 (81.3)
IDD diagnosis	ICD-9-CM Medical Diagnostic Code	*n* = 3,564	
Autism	299, 299.01, 299.10, 299.8, 299.81, 299.9	965	
Mental retardation	317, 317.1, 318.00, 318.1, 318.2, 319	914	
Cerebral palsy	343, 343.1, 343.2, 343.4, 343.8, 343.9	878	
Spina bifida	741, 741.01, 741.02, 741.03, 741.9, 741.91, 741.93	81	
Down syndrome	758.00, 758.1, 758.2, 758.3, 758.31, 758.32, 758.33, 758.39, 758.4, 758.5, 758.6, 758.7, 758.8, 758.81, 758.89, 758.9	598	
Tuberous sclerosis; Bourneville's disease	759.5	40	
Fragile X syndrome	759.83	41	
Fetal alcohol syndrome	760.71	112	
No IDD diagnosis from above	n/a	756	
2. Any child institutionalized in an Intermediate Care Facility for the Mentally Retarded or a State Facility for the Mentally Retarded for at least 1 month in 2005			233 (5.3)
3. Any child enrolled in the Home and Community-Based Services Waiver Program for the Mentally Retarded, 1915c			2,131 (48.6)
4. Any child who received Targeted Case Management services for the Mentally Retarded			2,450 (55.9)
5. Any child with a Mental Retardation or Developmental Disability Exception Indicator and not a Chronic Mental Illness Indicator			2,411 (55.0)

* Nonmutually exclusive groups (e.g., a child could have been included in multiple IDD case finding groups).

more severe medical conditions than those without no or fewer prescriptions. However, it was not clear from the regression analyses whether these proxy measures were valid IDD severity measures. For this reason, we omitted these variables from the final regression model.

Outcome variable

The primary dependent variable was whether a child received any preventive dental care in 2005. Our preventive care measure was based on a pre-specified list of Current Dental Terminology 2005 procedure codes (D1110, D1120, D1201, D1203, D1204, D1205, D1330, D1351, D4341, D4342, D4355, and D4910). Scaling and root planing codes were included because children presenting with heavy subgingival calculus without evidence of periodontal disease are sometimes coded as having received a "scaling and root planing" procedure. In these instances, the goal of the dental procedure is prophylactic as opposed to therapeutic.

Study hypotheses

We tested the following hypotheses:

- a lower proportion of IDD children enrolled in Medicaid received preventive dental care in 2005 compared with those without IDD;
- IDD children were less likely to have received preventive dental care than non-IDD children; and
- other factors included in the final model will also be associated with increased likelihood of receiving preventive dental care.

Statistical analyses

Prior to testing our study hypotheses, we determined the proportion of children with any dental visit or any preventive dental care among all Medicaid-enrolled children and the proportion receiving preventive care among those with a dental visit. We generated descriptive statistics of the overall study population. *t*-Tests (equal variances assumed) were used to identify differences in means and chi-square tests were used to compare proportions ($\alpha = 0.05$). Crude and covariate-adjusted odds ratios were estimated using conditional logistic regression modeling with 95 percent confidence intervals. We constructed our final multivariate logistic regression model by including all variables that we believed were conceptually relevant a priori in characterizing the relationship between IDD status and preventive dental utilization. When appropriate, continuous variables (e.g., age) were converted to categorical variables. All data were analyzed with SPSS 16.0 for Windows (Chicago, IL, USA).

Results

Descriptive statistics

A total of 4,385 children from our 2005 cohort were identified as IDD (4.2 percent) and the remaining 103,220 children were classified as non-IDD. Table 2 summarizes how the two groups compare on the independent variables. While the mean age of children was 9.4 ± 4.3 years, IDD children had a significantly greater mean age than those without IDD (10.7 ± 4.2 versus 9.3 ± 4.3 years, respectively; $P < 0.0001$). Approximately 48 percent of the population was female. A majority of children were White (64.7 percent), 14.9 percent had missing or unreported race data, 9.9 percent were Black, and 4.2 percent were Hispanic. Most non-IDD children gained Medicaid eligibility through Temporary Assistance to Needy Families (TANF; 89.1 percent), while IDD children became Medicaid-eligible mostly through the Waiver program (50.3 percent). About 55 percent of children lived in a metropolitan county, 39.4 percent in an urban county, and 6.1 percent in a rural county. There was no significant difference in the degree of urbanization of the child's county of residence between the two groups ($P = 0.284$). Finally, two-thirds of children lived in a dental HPSA, with a significantly higher proportion of non-IDD children living in a dental HPSA than those with IDD (66.5 percent versus 58 percent, respectively; $P < 0.0001$).

Significantly higher proportions of non-IDD children had at least one additional child under age 18 who was also enrolled in Medicaid within the household (77.1 percent versus 25.5 percent, respectively; $P < 0.001$) or a Medicaid-enrolled adult in the household (60.2 percent versus 21.3 percent, respectively; $P < 0.001$). Higher proportions of IDD children had a primary care physician visit, an antibiotic prescription, and a non-antibiotic prescription.

Utilization rates

Of all Medicaid-enrolled children, 54.7 percent had a dental visit and 48.5 percent received preventive dental care. Among children with a dental visit, 88.7 percent received preventive care. Table 3 summarizes differences between children who received preventive care and those who did not. A total of 52,238 children received preventive dental care in 2005. A significantly higher proportion of non-IDD children received preventive care than those identified as IDD (48.6 percent versus 46.1 percent; $P < 0.001$).

Logistic regression model

In the unadjusted regression model, IDD children were 9.7 percent less likely to have received preventive dental care than non-IDD children (95 percent CI: 0.85-0.96; $P < 0.001$). In

Table 2 Demographic and Other Characteristics of Children Identified with Intellectual and/or Developmental Disability (IDD), without IDD, and Total Study Population of Iowa Medicaid-Enrolled Children Ages 3 to 17 Years in Calendar Year 2005 and Significance Testing Results Between IDD and non-IDD Children via Chi Square Analyses ($N = 107,605$)

Measure	IDD children ($N = 4,385$) n (%)	Non-IDD children ($N = 103,220$) n (%)	Total study population ($N = 10,7605$) n (%)	Significance between IDD and non-IDD ($\alpha = 0.05$)
Gender				
• Male	2,744 (62.6)	52,815 (51.2)	55,559 (51.6)	$P < 0.0001$
Age group				
• 3-7 years	1,168 (26.6)	41,442 (40.1)	42,610 (39.6)	$P < 0.0001$
• 8-12 years	1,503 (34.3)	32,949 (31.9)	34,452 (32.0)	–
• 13-17 years	1,714 (39.1)	28,829 (27.9)	30,543 (28.4)	–
Race/ethnicity				
• White	3,203 (73.0)	66,378 (64.3)	69,581 (64.7)	$P < 0.0001$
• Black	161 (3.7)	10,462 (10.1)	10,623 (9.9)	–
• Hispanic	49 (1.1)	4,517 (4.4)	4,566 (4.2)	–
• Other	127 (2.9)	6,659 (6.5)	6,786 (6.3)	–
• Unreported or unknown	845 (19.3)	15,204 (14.7)	16,049 (14.9)	–
Medicaid eligibility category				
• Temporary Assistance to Needy Families	428 (9.8)	91,960 (89.1)	92,388 (85.9)	$P < 0.0001$
• Supplementary Security Income	924 (21.1)	3,502 (3.4)	4,426 (4.1)	–
• Foster care	428 (9.8)	7,406 (7.2)	7,834 (7.3)	–
• Waiver program	2,204 (50.3)	11 (<0.1)	2,215 (2.1)	–
• Other	401 (9.1)	341 (0.3)	742 (0.7)	–
Resides in a dental Health Professional Shortage Area				
• Yes	2,545 (58.0)	68,690 (66.5)	71,235 (66.2)	$P < 0.0001$
Degree of urbanization of county of residence				
• Metropolitan	2,420 (55.2)	56,221 (54.5)	58,641 (54.5)	$P = 0.284$
• Urban adjacent to metropolitan	880 (20.1)	20,358 (19.7)	21,283 (19.7)	–
• Urban non-adjacent to metropolitan	812 (18.5)	20,343 (19.7)	21,155 (19.7)	–
• Rural	273 (6.2)	6,298 (6.1)	6,571 (6.1)	–
Any additional Medicaid-enrolled children in the household				
• Yes	1,120 (25.5)	79,629 (77.1)	80,749 (75.0)	$P < 0.0001$
Any Medicaid-enrolled adults in the household				
• Yes	933 (21.3)	62,133 (60.2)	63,066 (58.6)	$P < 0.0001$
Child had a primary care physician visit in 2005				
• Yes	3,848 (87.8)	83,800 (81.2)	87,648 (81.5)	$P < 0.0001$
Child received a prescription for antibiotics in 2005				
• Yes	2,878 (65.6)	59,034 (57.2)	61,912 (57.5)	$P < 0.0001$
Child received a non-antibiotic prescription in 2005				
• Yes	3,742 (85.3)	69,392 (67.2)	73,134 (68.0)	$P < 0.0001$

the final model, we did not include race or ethnicity because nearly 20 percent of children had missing or unreported race information. The uncertain reliability of the race/ethnicity variable precluded us from implementing data imputation methods for this variable. The effects of age did not change dependent upon variable construction, so age was modeled as categorical. After adjusting for the remaining covariates, IDD status was no longer significant. Table 4 displays the final logistic regression model with covariates and corresponding odds ratios, 95 percent confidence intervals, and P-values.

Children aged 8-12 and 13-17 were significantly more likely to have received preventive dental care than those aged 3-7. Children who lived in a dental HPSA were significantly less likely to have received preventive care as were those children who lived in nonmetropolitan counties. Children with any ambulatory care medical visit were 75 percent more likely to have received preventive dental care (OR: 1.75; 95% CI: 1.69-1.81; $P < 0.0001$). Finally, while having another child from the same household enrolled in Medicaid increased a child's odds of having a preventive dental visit, the reverse was true for having an additional Medicaid-enrolled adult.

Discussion

This study is the first known publication in which a priori diagnosis- and non-diagnosis-based criteria were applied to administrative data to assess preventive dental utilization for

Table 3 A Comparison of Demographic and Other Characteristics of Iowa Medicaid-Enrolled Children Ages 3 to 17 in Calendar Year 2005 Who Received Preventive Dental Care and Children Who Did Not Receive Preventive Dental Care and Significance Testing Results via Chi Square Analyses (N = 107,605)

Measure	Received preventive dental care (N = 52,238) n (%)	Did not receive preventive dental care (N = 55,367) n (%)	Significance (α = 0.05)
Gender			
• Male	26,347 (50.4)	29,212 (52.8)	$P < 0.0001$
Age group			
• 3 to 7 years	19,769 (37.8)	22,841 (41.3)	$P < 0.0001$
• 8 to 12 years	18,332 (35.1)	16,120 (29.1)	–
• 13 to 17 years	14,137 (27.1)	16,406 (29.6)	–
Race/ethnicity			
• White	35,127 (67.2)	34,454 (62.2)	$P < 0.0001$
• Black	4,505 (8.6)	6,118 (11.0)	–
• Hispanic	2,216 (4.2)	2,350 (4.2)	–
• Other	3,180 (6.1)	3,606 (6.5)	–
• Unreported or unknown	7,210 (13.8)	8,839 (16.0)	–
Medicaid eligibility category			
• Temporary Assistance to Needy Families	44,831 (85.8)	47,557 (85.9)	$P < 0.0001$
• Supplementary Security Income	1,804 (3.5)	2,622 (4.7)	–
• Foster care	4,317 (8.3)	3,517 (6.4)	–
• Waiver program	1,027 (2.0)	1,188 (2.1)	–
• Other	259 (0.5)	483 (0.9)	–
Resides in a dental Health Professional Shortage Area			
• Yes	34,068 (65.2)	37,167 (67.1)	$P < 0.0001$
Institutionalized			
• Yes	179 (0.3)	54 (0.1)	$P < 0.0001$
Received Targeted Case Management Services for the mentally retarded			
• Yes	1,127 (2.2)	1,323 (2.4)	$P = 0.01$
Participated in the Home and Community Based Waiver Program			
• Yes	946 (1.8)	1185 (2.1)	$P < 0.0001$
Has Intellectual and/or Developmental Disability (IDD) exception indicator variable			
• Yes	1,144 (2.2)	1,267 (2.3)	$P = 0.276$
Child identified with IDD			
• Yes	2,022 (3.9)	2,363 (4.3)	$P = 0.01$
Degree of urbanization of county of residence			
• Metropolitan	29,492 (56.5)	29,149 (52.6)	$P < 0.0001$
• Urban adjacent to metropolitan	10,149 (19.4)	11,089 (20.0)	–
• Urban non-adjacent to metropolitan	9,600 (18.4)	11,555 (20.9)	–
• Rural	2,997 (5.7)	3,574 (6.5)	–
Any additional Medicaid-enrolled children in the household			
• Yes	39,418 (75.5)	41,331 (74.6)	$P < 0.01$
Any Medicaid-enrolled adults in the household			
• Yes	29,950 (57.3)	33,116 (59.8)	$P < 0.0001$
Child had a primary care physician visit in 2005			
• Yes	44,452 (85.1)	43,196 (78.0)	$P < 0.0001$
Child received a prescription for antibiotics in 2005			
• Yes	31,692 (60.7)	30,220 (54.6)	$P < 0.0001$
Child received a non-antibiotic prescription in 2005			
• Yes	37,064 (71.0)	36,070 (65.1)	$P < 0.0001$

Medicaid-enrolled IDD children. While a direct comparison may not be valid given different identification methodologies and target populations, our IDD prevalence estimate of 4.2 percent is within the range reported in previous studies (18,19). The overall preventive dental utilization rate for children in our study population was 48.5 percent. This rate is similar to results reported in a 2005 study focusing on uninsured low-income children (9) and higher than rates among

Table 4 Final Covariate-Adjusted Conditional Logistic Regression Model of the Relationship between IDD Status and Preventive Dental Care Utilization with Corresponding Odds Ratios, 95% Confidence Intervals, and Significance Testing Results

Covariate	Odds ratio	95% confidence interval	Significance ($\alpha = 0.05$)
Intellectual and/or Developmental Disability	1.08	0.98, 1.18	$P = 0.137$
Female	1.08	1.06, 1.11	$P < 0.0001$
Age category			
• 3 to 7 years*	–	–	–
• 8 to 11 years	1.41	1.37, 1.45	$P < 0.0001$
• 13 to 17 years	1.05	1.02, 1.08	$P < 0.0001$
Medicaid eligibility category			
• Temporary Assistance to Needy Families*	–	–	–
• Supplemental Security Income	0.69	0.65, 0.74	$P < 0.0001$
• Foster care	1.29	1.22, 1.36	$P < 0.0001$
• Waiver program	0.81	0.71, 0.92	$P < 0.001$
• Other	0.51	0.43, 0.59	$P < 0.0001$
Resides in a dental Health Professional Shortage Area	0.91	0.88, 0.93	$P < 0.0001$
Degree of urbanization of county of residence			
• Metropolitan*	–	–	–
• Urban adjacent to metropolitan	0.85	0.83, 0.88	$P < 0.0001$
• Urban non-adjacent to metropolitan	0.78	0.75, 0.80	$P < 0.0001$
• Rural	0.83	0.79, 0.88	$P < 0.0001$
Child had a primary care physician visit in 2005	1.75	1.69, 1.81	$P < 0.0001$
Any additional Medicaid-enrolled children in the household	1.09	1.06, 1.13	$P < 0.0001$
Any Medicaid-enrolled adults in the household	0.90	0.88, 0.93	$P < 0.0001$

*Denotes reference group.

children enrolled in the Connecticut Medicaid managed care program (27) and children enrolled in the New Hampshire Medicaid program (34). After adjusting for covariates, our final regression model suggested that there was no significant difference between the two groups. Instead, we found that other variables such as age, interaction with the medical care system, characteristics of county of residence, and household structure were more important factors in the assessment of preventive dental utilization.

Age is an important factor that should be considered when estimating dental utilization rates among children. After adjusting for other variables, children from the older age groups (8-12 and 13-17) were significantly more likely to have received preventive dental care than those from the youngest age group (3-7). This finding is consistent with previous studies reporting that younger children exhibit relatively lower overall and preventive dental utilization (28,29). However, most studies examining dental utilization arbitrarily include children under age 3 without accounting for these unusually low utilization rates. Despite practice guidelines promoted by the American Academy of Pediatric Dentistry stating that the first dental visit should take place by age 12 months (30,31), we found that preventive utilization was less than 20 percent among 2-year-olds and less than 10 percent among 1-year-olds. Accordingly, the inclusion of these children in our study population would have skewed our utilization estimates toward zero.

Children under age 3 were not included in this study because of the timing of IDD diagnosis. Among children ages 1-2, we found that higher proportions of IDD children received preventive dental care than non-IDD children (10 percent versus 8.2 percent, respectively), while the reverse was true of children aged 3-17 (46.1 percent versus 48.6 percent, respectively). A possible explanation for this phenomenon may be that most children are diagnosed as IDD after turning age 3, which allows clinicians to account for normal variability in terms of developmental milestones (32,33). IDD children under age 3 may be different from those ages 3 and older because children in the former group may be more likely to utilize intensive services from specialized facilities such as the University of Iowa's Center for Disabilities and Development, which offers coordinated, comprehensive health care. Earlier and more intensive interactions with the health-care system among younger IDD children may result in higher preventive dental care utilization for these children compared with their non-IDD counterparts. Thus, the issue of timing of

IDD diagnosis complicates the relationship between IDD status and preventive dental utilization among younger children.

Our results also suggest that those who interacted with the medical system, as measured by whether a child had a primary care physician visit, were 75 percent more likely to have had a preventive dental visit than those without any medical visits. While this difference might be explained by unmeasured differences between children with a medical visit and those without (e.g., selection bias), this finding brings attention to the potential relationship between utilization of ambulatory care services and preventive dental care for Medicaid-enrolled children.

Children who lived in a dental HPSA were significantly less likely to have received preventive dental care than those not living in a dental HPSA. This is not surprising. A shortage of dentists, as exemplified by a low dentist-to-population ratio, could mean that there are not enough dentists in certain parts of the state to ensure that children have a place to go to for dental care, which suggests a general access to care problem. This problem is compounded by low Medicaid participation by dentists in Iowa who do see children. Furthermore, it is important to mention the relationship between IDD severity and workforce shortages. Most general dentists do not have hospital or operating room privileges to treat the most profoundly IDD children, which means that these children often rely on specialists such as pediatric dentists for treatment. Policies must be enacted to ensure that there is an adequate distribution of dental generalists and specialists in dental HPSA to meet the heterogeneous needs of this population. Finally, children living in urban or rural counties were significantly less likely to have had a preventive dental visit than those living in metropolitan counties after controlling for the affects of living in an HPSA. This finding is consistent with the argument that there is a maldistribution of dentists in Iowa, with children living in the largest population centers having the easiest access to preventive dental care, particularly in the surrounding suburbs.

Children with another Medicaid-enrolled child in the household were significantly more likely to have had a preventive visit than those without. Having children treated at a single location by the same provider may make it easier to arrange for transportation. In addition, having other children in the Medicaid program may indicate more experience with the Medicaid program making caregivers more savvy concerning access to services. This latter point presents a potential access to care problem for IDD children because of the different programs through which children become Medicaid-eligible. Most IDD children gain Medicaid eligibility through the waiver program, which traditionally enrolls individual children and excludes other family members because of stringent income thresholds. Nearly 90 percent of non-IDD children gain Medicaid eligibility through TANF, which enrolls children and their families. These findings suggest that enrolling children from the same low-income families in Medicaid may increase access to care for all the children.

On the other hand, we found that having an adult in the household who was also enrolled in Medicaid decreased a child's likelihood of receiving preventive dental care. These results could be because of other unmeasured characteristics of family structure such as the gender and age of the adults or the presence of co-morbidities that requires the family to focus on the medical care of these adults at the expense of the children. The impact of adult enrollment in Medicaid on dental utilization for children is an area that requires further investigation.

There are a number of limitations of this study. Given that the study used administrative data, we lacked an appropriate IDD severity measure. While we attempted to use the number of unique antibiotic or non-antibiotic prescriptions that were filled, this alone was not an accurate measure of disease severity. Future studies should focus on developing methods that can be applied to administrative data to allow researchers to measure IDD severity. Another limitation of this study is that the estimated prevalence of IDD among Medicaid-enrolled children of 4.2 percent may be lower than the actual rate. However, despite the potential for under-identification of IDD cases, we believe our criteria represent the most comprehensive methodology that has been applied to secondary data. Unlike other studies, we do not rely solely on medical diagnoses or institutionalization. Furthermore, restricting our analyses to children enrolled in Medicaid for $\geq$11 months may have biased our utilization estimates toward unity because of the exclusion of children enrolled for <11 months in 2005. Finally, dental utilization rates do not give us an indication of existing dental needs. For instance, among IDD children with a dental visit in 2005, 88.7 percent received preventive dental care. While this rate may seem relatively high, without corresponding clinical data to assess for unmet dental needs we are unable to conclude whether these children are receiving the appropriate dental services. Future studies might link clinical findings with administrative data to assess the relationship between unmet need and utilization.

In conclusion, we found no significant difference in the odds of receiving preventive dental care by IDD status within the final model. Other factors such as older age, not residing in a dental HPSA, interaction with the medical system, and family structural characteristics increased one's likelihood of receiving preventive dental care. We expect future clinical interventions and policies to focus on: a) ensuring that all Medicaid-enrolled children receive appropriate preventive dental care; b) determining whether IDD children are receiving appropriate dental care; and c) assessing the relationship between dental utilization and outcome measures such as cost or adverse treatments.

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