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## Examining continuity of care for Medicaid-enrolled children receiving oral health services in medical offices

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### Abstract

**Objective**—Children living in poverty encounter barriers to dentist visits and disproportionately experience dental caries. To improve access, most state Medicaid programs reimburse pediatric primary care providers for delivering preventive oral health services. To understand continuity of oral health services for children utilizing the North Carolina (NC) Into the Mouths of Babies (IMB) preventive oral health program, we examined the time to a dentist visit after a child's third birthday.

**Methods**—This retrospective cohort study used NC Medicaid claims from 2000–2006 for 95,578 Medicaid-enrolled children who received oral health services before age 3. We compared children having only dentist visits before age 3 to those with: (1) only IMB visits and (2) both IMB and dentist visits. Cox proportional hazards regression was used to estimate the time to a dentist visit following a child's third birthday. Propensity scores with inverse-probability-of-treatment-weights were used to address confounding.

**Results**—Children with only IMB visits compared to only dentist visits before age 3 had lower rates of dentist visits after their third birthday (adjusted hazard ratio[AHR]=0.41, 95% CI=0.39 to 0.43). No difference was observed for children having both IMB and dentist visits and only dentist visits (AHR=0.99, 95% CI=0.96 to 1.03).

**Conclusions**—Barriers to dental care remain as children age, hindering continuity of care for children receiving oral health services in medical offices.

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Despite professional guidelines recommending a dentist visit by a child's first birthday (1–3), few Medicaid-enrolled children visit dentists. In 2007, only Iowa, North Carolina (NC), Texas, and Washington had 20% or more Medicaid-enrolled children <3 years of age visit dentists (4). Early dentist visits are useful for establishing good oral health practices, evaluating factors associated with caries-risk, and monitoring and treating potential problems (1,2). Early intervention is important because early childhood caries (ECC), the presence of dental caries in young children, can progress rapidly (2). Introduced at an early age, oral health promotion activities may help avoid the consequences of ECC, which include pain, decreased quality of life, and treatment costs (5). Dentist visits are particularly important for Medicaid-enrolled children, as children living in poverty are more likely to experience ECC than children from higher-income families (6).

Young Medicaid-enrollees encounter barriers to dentists due to workforce shortages and dentists' reluctance to see young children and accept Medicaid (7,8). To improve access to preventive oral health services, since 2000 the NC Medicaid Into the Mouths of Babies (IMB) program has trained primary care providers (PCP) to deliver preventive oral health services to children <3 years of age. Similar to preventive visits in a dental office, IMB visits include an open-mouth evaluation and caries-risk assessment, oral health counseling for parents, and fluoride varnish application (9). Children with ECC or at elevated risk are referred to dentists when they are available in the community. Currently, more than 40 state Medicaid programs have adopted policies to reimburse PCPs for providing fluoride varnish in medical offices (10). The IMB program, and similar programs in other states, has helped increase access to preventive services and improved the oral health of young Medicaid-enrollees (11–14).

IMB visits are intended to prevent and control the development of ECC until young children can more easily establish a dental home, where care is comprehensive and continuously accessible (15). Establishing a dental home is particularly important because a large percentage of these Medicaid programs limit benefits to children younger than 4 years of age (16), after which most of these children continue to be at high-risk of developing ECC and encounter barriers to dental care. The timing of IMB services is intended to coincide with recommended well-child medical visits at 6, 9, 12, 15, 18, and 24 months of age (17). Reimbursement for IMB services ends after a child's third birthday because well-child visits in the medical office become less frequent and more dentists are willing to accept older children as patients (18).

For children receiving IMB services, the transition to a dentist at 3 years old has the potential to disrupt their continuity of oral health services. Continuity, defined here as appropriate referral to specialists (19), is achieved through successful referral from PCPs to dentists. Although young children are more likely to have a dentist visit if they received a referral from a physician (20,21), nationally fewer than 50 percent of 2 to 5 year olds receive these types of referrals (20,22). Referral success is constrained by availability of dentists willing to see young children enrolled in Medicaid (7,8). Early studies of the IMB program suggest that PCPs providing IMB services have low referral rates and tend to under-refer children with ECC (21,23). Factors associated with referral include presence of ECC, PCP reported confidence in screening for ECC, and availability of dentists (21,24).

Few studies have examined dentist visits occurring when a child is no longer eligible to receive oral health services in medical offices. Compared to children not having IMB visits, children receiving 4 IMB visits received fewer caries-related treatments (12) and had lower payments for treatment up to 6 years of age (14). However, no study has compared utilization of dental care for children with IMB visits to children visiting dentists, the traditional provider of care.

This study examined continuity of oral health services for Medicaid-enrolled children aging out of the IMB program. We compared the time to a dentist visit following a child's third birthday for children who had only IMB visits to children who had only dentist visits before 3 years of age. Additionally, to examine continuity of care for children living in counties with an adequate dental workforce that allows for successful referral to dentists, we compared the time to a dentist visit for children who had both IMB and dentist visits to children who had only dentist visits before 3 years of age.

## Methods

### Data and study population

We obtained Medicaid enrollment and claims files from the NC Division of Medical Assistance for 400,956 children enrolled during 2000 to 2006. Because we were interested in examining continuity of care, we limited our sample to children who received oral health services at least once before age 3 during an IMB visit or dentist visit in an office-based setting (n=176,970). We included children who were enrolled in the NC Medicaid program before 1 year of age and enrolled for at least 12 months before their third birthday. We excluded children not still enrolled in Medicaid after their third birthday because we were unable to identify dentist visits obtained after their third birthday. The study was approved by an Institutional Review Board.

### Framework

Our framework for understanding utilization of dental care (25) posits that an individual's decision to visit a dentist, or in this case a caregiver's decision to take a child to the dentist, is influenced by four interrelated factors: history (past use and oral health status), structure (sociodemographic characteristics), cognition (perception of need and perceived norms), and expectations (rewards and costs). To examine continuity of care, we were primarily interested in understanding how past use of oral health services affects future dentist visits. Although IMB visits are expected to facilitate access to dentists via parental counseling and referrals, children who received only IMB visits may encounter barriers to dentists as they age. Furthermore, an early dentist visit may be an indicator of caries or high caries-risk, which would likely lead to subsequent visits. We hypothesized that visiting only dentists before age 3 would be associated with a shorter time to a dentist visit after a child's third birthday. Because children who received both IMB and dentist visits before age 3 may encounter fewer structural barriers to care (e.g., live in areas with more dentists), we hypothesized that these children would have a similar time to a dentist visit after their third birthday as children who visited only dentists before age 3.

## Measures

The primary outcome was the time in months from a child's third birthday until his or her first dentist visit in an office-based setting, which was operationalized as any paid claim filed by a dentist up to three years following the child's third birthday. We use this time period because during the study period Medicaid reimbursed PCPs for up to six IMB visits before age 3; and children 6 years and older may receive help obtaining oral health services within their schools. Observations were censored when the child was no longer enrolled in Medicaid or turned 6 years old, and did not yet have an office based dentist claim.

To compare children with only IMB visits and children with only dentist visits before age 3, we constructed a binary variable indicating the child received only IMB visits before 3 years of age. IMB visits were identified with paid claims filed by physicians for any combination of Current Dental Terminology (CDT) codes for screening, counseling, and topical fluoride. Visits to a dentist office for any reason were identified as any paid claim filed by a dentist before a child's third birthday. To compare children with both IMB and dentist visits and children with only dentist visits before age 3, we used this same strategy to construct a binary variable indicating receipt of both IMB and dentist visits before 3 years of age.

Baseline characteristics, derived mostly from Medicaid files, were included as explanatory variables. Variables identifying past use of healthcare services included: number of well-child visits, months enrolled in Medicaid, indicators of special health care needs, a dentist visit <6 months prior to a child's third birthday, and receipt of oral health services in a Federally Qualified Health Center (FQHC), health department, or rural health clinic. We controlled for sociodemographic variables, including: sex, race (white, black, other (reference group)) and Hispanic ethnicity. Characteristics of the child's environment that are expected to influence the time to a dentist visit include: the county level number of dentists and pediatricians and family practice physicians per 10,000 population (26) and the proportion of the county population aged 0–18 years enrolled in Medicaid (27,28), year of child's third birthday, and indicators of the county's level of urbanization (29).

## Propensity score estimation

Because it is unknown if dentist visits are due to existing disease or demand for preventive services, we utilized propensity scores with inverse-probability-of-treatment-weights (IPTW) to address observed confounding. Using logistic regression, we estimated two propensity scores by predicting the likelihood of having: (1) only IMB visits compared to only dentist visits before age 3 (excluding children with both IMB and dentist visits) and (2) both IMB and dentist visits compared to only dentist visits before age 3 (excluding children with only IMB visits). We controlled for the aforementioned covariates, including squared terms of continuous variables. Standardized weights were calculated for each child (30). IPTW-adjustment produces an estimate of the average treatment effect (31). Following IPTW-adjustment, the distribution of propensity scores was more similar for children having only IMB visits compared to only dentist visits before age 3 and for children having both IMB and dentist visits compared to only dentist visits before age 3 (Supplemental Figures 1A and 1B, respectively). Adjustment by IPTW improved covariate balance as evidenced by

reductions in absolute standardized differences for covariates, achieving recommended standardized differences of <10% (Supplemental Figure 2) (32).

### Analytic approach

Descriptive statistics were calculated for variables based on whether oral health services were provided during IMB visits, dentist visits, or both before 3 years of age. Using chi-squared tests to compare proportions and t-tests to compare means, we examined differences in variables across setting of oral health services. We compared the time to a dentist visit after a child's third birthday (IMB only *versus* dentist only and both IMB and dentist *versus* dentist only) by constructing IPTW-adjusted Kaplan-Meier (KM) curves (calculated 1-KM) and tested for differences by using IPTW-adjusted Cox proportional hazard models, including IMB only or both IMB and dentist visits as the only covariate (33). Huber-White empirical standard errors adjusted for intra-group correlation due to clustering of children within counties. Additionally, we conducted a sensitivity analysis to explore whether the number of dentists per county altered the effect of IMB visits on the time to a dentist visit by estimating a Cox model with a continuous measure of the number of dentists, the IMB indicator variable, and their interaction. Adjusted hazard ratios (AHR) were compared using Wald tests and 95% confidence intervals (CI). All analyses were performed in Stata/IC 12 (Statacorp, College Station, TX) using a 0.05 significance level.

### Results

Of the 95,578 NC Medicaid-enrolled children included in this analysis, 63% received only IMB visits (n=60,124), 23% received only dentist visits (n=22,061), and 14% received both IMB and dentist visits before their third birthday (n=13,393) (Table 1). Separate analyses were conducted to compare children having only IMB visits and only dentist visits before age 3 (n=82,185) and children having both IMB and dentist visits and only dentist visits before age 3 (n=35,454). Dentist visits occurring between 3 and 6 years of age were significantly more common among children who had only dentist visits (70%) compared to both IMB and dentist visits before age 3 (66%) and compared to children who had only IMB visits (44%). Compared to children with dentist visits before age 3, children with only IMB visits had more well-child visits, were more likely to receive oral health services in an FQHC, and lived in counties with and fewer dentists. On average, children with both IMB and dentist visits before age 3 had more well-child visits and were more likely to receive oral health services in an FQHC than children who visited only dentists before age 3.

#### IMB visits only

Children who had only IMB visits before age 3 had a 29% probability of a dentist visit within 12 months after their third birthday, which increased to 70% within 36 months after their third birthday (Figure 1A). Children who visited only dentists before age 3 had a 62% probability of a dentist visit within 12 months after their third birthday, which increased to 90% within 36 months after their third birthday. Having only IMB visits compared to only dentist visits was associated with a significantly lower hazard of a dentist visit after a child's third birthday (AHR=0.41, 95% CI=0.39 to 0.43) (Table 2).

### Both IMB and dentist visits

The time to a dentist visit after a child's third birthday was similar for children who had both IMB and dentist visits and children who had only dentist visits before age 3 (Figure 1B). For these children, the probability of a dentist visit within 12 months after their third birthday was 63% and increased to more than 88% within 36 months after their third birthday. Rates of dentist visits after children's third birthday were not significantly different for children who received both IMB and dentist visits or only dentist visits before age 3 (AHR=0.99, 95% CI=0.96 to 1.03) (Table 2).

### Sensitivity analysis

In both models, neither the number of dentists in a county (IMB only: AHR=1.01, 95% CI=0.99 to 1.04; Both: AHR=1.01, 95% CI=0.99 to 1.03) nor the interaction between the IMB indicator variable and the number of dentists (IMB only: AHR=1.00, 95% CI=0.97 to 1.03; Both: AHR=1.00, 95% CI=0.99 to 1.02) was significantly associated with the AHR of the time to a dentist visit.

### Discussion

Preventive oral health services provided by PCPs in the medical office help to improve young children's access to care. Because most state Medicaid programs limit benefits to children <4 years of age (16), we wanted to examine children's continuity of oral health services as they age. Using NC's long-implemented IMB program, we examined the time to a dentist visit after a child's third birthday.

Before age 3, more children received preventive oral health services during IMB visits (n=73,517) than during dentist visits (n=35,454). Consistent with national estimates, we found that prevalence of dentist visits increased with age, as 60% of children had a dentist visit between 3 to 6 years of age (4). Children having dentist visits before age 3 had at least an 89% probability of having a dentist visit between 3 to 6 years of age. Continuity of care was more likely to be achieved by children having both IMB and dentist visits than children with only IMB visits before age 3. The probability of a dentist visit during ages 3 to 6 years ranged from 70% for children with only IMB visits to 89% for children with both IMB and dentist visits before age 3.

Factors that may account for the difference observed in the time to a dentist visit for children receiving only IMB visits compared to dentist visits before age 3 include need, referral practices in medical offices, and barriers to dental care. First, children visiting dentists before 3 years of age may do so because they have ECC. Because we lack clinical measures of oral health status, we cannot assess either appropriateness of care received by children who had a dentist visit or unmet needs of children not visiting dentists. Among children who visited dentists before age 3, 35% received caries-related treatment prior to their third birthday compared to less than 1% of children who received only IMB visits. Because past caries experience is a strong predictor of future dental disease, we would expect high-risk children to have a higher rate of dentist visits (34). However, professional organizations recommend twice yearly dentist visits starting at 1 year of age regardless of risk status (1–3).

Furthermore, caries-risk assessment tools developed for PCPs identify children from low-income households, our study population, as being at high risk of developing ECC (35,36).

Second, medical offices providing IMB services may need to be more attentive to referrals, particularly when children get near the end of their eligibility for IMB services. Referrals from physicians increase young children's likelihood of having a dentist visit (5,20,21). However, few children obtaining IMB services receive referrals, and fewer than half of parents received help scheduling the dentist visit (21,37). Among children having IMB visits, 22% also visited a dentist before age 3. This subgroup of children receiving IMB services was more likely to establish a dental home following the end of their eligibility for the IMB program. Although our administrative data cannot identify which children received referrals, 99% of these children had an IMB visit before their first dentist visit. Compared to the other children in this study, children who received both IMB and dentist visits on average were more likely to receive oral health services in a public clinic and had more well-child visits before age 3.

Finally, a third possible explanation for difference in the time to a dentist visit may be that barriers to dentist visits endure overtime and are unlikely to change as a child ages. Having a prior dentist visit was a strong predictor of subsequent visits, suggesting that children who initially overcame barriers were able to establish and maintain dental homes. Compared to children making only IMB visits, children visiting dentists before age 3 lived in more urban counties with more dentists. A prior study reported that IMB services are more likely to be provided in rural counties where dental workforce shortages are most pronounced (13). Although NC has fewer dentists per capita than most states, 45 of NC's 100 counties experienced an increase in the number of dentists per capita during the period from 2005–2010 (38). In addition to structural barriers, utilization of dental care and oral health outcomes can be affected by parents' beliefs about oral health (39–41). Miller and colleagues found that parents of children with severe caries treatment needs were more likely to have lower oral health literacy than parents of children with mild to moderate treatment needs (42).

To promote continuity of oral health services for young children as they age and to increase the time available for transition from medical to dentist offices, state Medicaid programs may want to consider increasing the upper age limit for reimbursement of oral health services provided in medical offices. This strategy may increase access to care and promote the oral health of children living in communities with few dentists. Currently, 11 state Medicaid programs reimburse the application of fluoride varnish in medical offices for children aged 6 years and older (16). While dentist visits are important for monitoring potential problems and providing treatment, expanding the number and type of providers delivering oral health services may help to increase access to prevention for children at low-risk of developing ECC and also free up space in dentist offices for children with the greatest need in communities with a limited dental workforce. During this study period (2000–2006), 53% of Medicaid-enrollees did not receive oral health services before age 3. Additional research is needed to identify strategies to improve utilization of oral health services among these children.

This study has several limitations. We adjusted for confounding using IPTW, however, this method does not adjust for unobserved factors. Although use of data collected largely for administrative purposes limits availability of variables, we supplemented these data using county-level measures relevant to this analysis. Having additional information about children, such as brushing practices, dietary habits, and parent characteristics would help us to better understand utilization decisions. Our examination of only NC may limit generalizability of these results; however, more than 40 state Medicaid programs reimburse fluoride varnish delivered in medical offices. Since our study period, the number of IMB providers and IMB visits has increased (43). Additional research should examine the effect of the current, widely implemented IMB program. Despite these limitations, this is the first study, to our knowledge, to examine the time to a dentist visit following receipt of oral health services from a non-dental primary care provider and for Medicaid-enrolled children aged 3 years and older.

Although Medicaid programs reimbursing PCPs for preventive oral health services delivered in the medical office can increase access to prevention for young children, the transition to a dentist as children age-out of these programs may disrupt their continuity of oral health services. Strengthening referrals from physicians and expanding the availability of dental providers could help ensure children are able to obtain treatment for dental problems and establish dental homes after they age-out of medical office-based preventive oral health programs.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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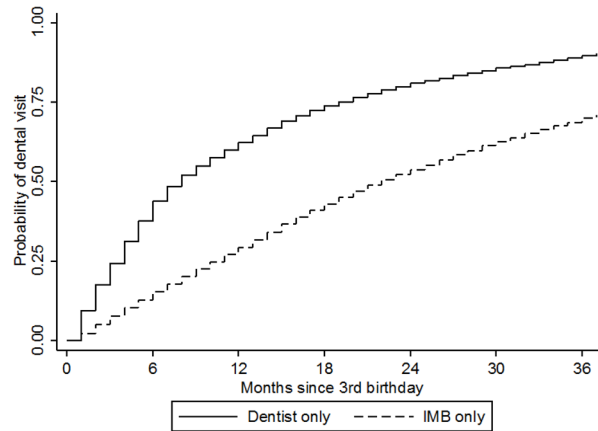
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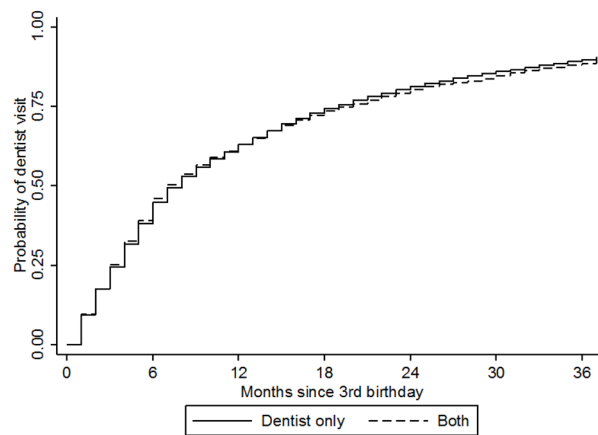
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A. Comparing children with only IMB visits to children with only dentist visits before age 3



B. Comparing children with both IMB and dentist visits to children with only dentist visits before age 3

**Figure 1.**

Cumulative IPTW-adjusted probability of a dentist visit after 3 years of age

A. Comparing children with only IMB visits to children with only dentist visits before age 3

B. Comparing children with both IMB and dentist visits to children with only dentist visits before age 3

**Table 1**

Mean characteristics of young children enrolled in NC Medicaid during 2000–2006 (n=95,578)

Variable description; mean (standard deviation)	Setting for oral health services before 3 years old		
	IMB only (N=60,124)	Dentist only (N=22,061)	Both IMB & dentist (N= 13,393)
Had a dentist visit following third birthday (%)	44**	69.6	66.2**
Months from third birthday to dentist visit (median)	22**	8	7*
<i>Past use of healthcare services</i>			
Number of well-child visits before age 3	4.52 (1.56)**	3.81 (2.02)	4.84 (1.54)**
Dentist visit <6 months before 3rd birthday (%)	0.7**	19.6	22.6**
Received any oral health services received in public dental clinic before age 3 (%)	26.4**	17.7	36.9**
Child has special health care needs (%)	4*	4.3	4.4
Months enrolled in Medicaid before age 3	30.61 (2.15)**	30.46 (2.50)	30.63 (2.05)**
<i>Sociodemographic characteristics</i>			
Race (%)			
White	39**	34.6	36**
Black	37.9**	39.6	36**
Hispanic ethnicity (%)	13.2**	15.7	18**
Male (%)	51	51.2	52.4*
<i>Environmental factors</i>			
Proportion of children aged 0–18 years in county enrolled in Medicaid	0.24 (0.05)**	0.21 (0.06)	0.22 (0.05)**
Primary care providers per 10,000 population	4.37 (2.03)**	4.98 (2.23)	4.62 (2.17)**
Dentists per 10,000 population	3.82 (1.74)**	4.83 (1.98)	4.24 (1.89)**
Year turned 3 years old (%)			
2002	7.1	9.5	4.7
2003	20.2	21	15.4
2004	23.7	23.5	22.7
2005	25.1	24.3	27.3
2006	23.8	21.7	30
Level of urbanization of county (%)			
Metro 1 million population	8.7**	16.5	12.8**
Metro 250 000–1 million population	26.9**	48.2	33.9**
Metro <250 000 population	12**	6.7	11**
Urban 20 000, adjacent to metro area	30.9**	14.1	22.2**
Urban 20 000, not adjacent to metro area	2.1**	0.7	2**
Urban 2 500– 9 999, adjacent to metro area	12.1**	9.5	11.5**
Urban 2 500–19 999, not adjacent to metro area	1.5	1.3	1.4
Completely rural or <2 500 urban, adjacent to metro area	2.6**	1.5	2.6**
Completely rural or <2 500 urban, not adjacent to metro area	3.2**	1.4	2.7**

IMB, Into the Mouths of Babes preventive dental program. Differences between children with only IMB visits vs. only dentist visits and children with both IMB and dentist visits vs. only dentist visits were examined using  $\chi^2$  tests to compare proportions and t-tests to compare means. Log rank tests compared unadjusted difference in months from third birthday to dentist visit (\*\*P<0.001,\*P<0.05).

**Table 2**

Adjusted hazard ratios for time to dentist visit after third birthday for young children enrolled in North Carolina Medicaid

Compared to having only dentist visits before age 3	Adjusted hazard ratio	95% confidence interval
Model 1		
IMB only	0.41 *	(0.39, 0.43)
Model 2		
Both IMB and dentist visits	0.99	(0.96, 1.03)

Results from IPTW-adjusted Cox proportional hazard models.

\* P<0.001.