The Effects of the Women, Infants, and Children's Supplemental Food Program on Dentally Related Medicaid Expenditures

Jessica Y. Lee, DDS, MPH, PhD; R. Gary Rozier, DDS, MPH; Edward C. Norton, PhD; Jonathan B. Kotch, MD, MPH; William F. Vann, Jr., DMD, PhD

Abstract

Objective: *This study estimates the effects of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) on dentally related Medicaid expenditures for young children.* ***Methods:*** *We used a five-year cohort study design to compare dentally related Medicaid expenditures for children enrolled in WIC versus those not enrolled for each year of life up to age 5 years. There were 49,795 children born in North Carolina in 1992 who met the inclusion criteria for the study. Their birth records were linked to Medicaid enrollment and claims files, WIC master files, and the Area Resource File. Our analysis strategy included a logit and OLS two-part model with CPI dollar adjustments.* ***Results:*** *Children who participated in WIC at ages 1 and 2 years had significantly less dentally related expenditures than those who did not participate. WIC participation at age 3 years did not have a significant effect. Fewer WIC children received dental care under general anesthesia than non-WIC children.* ***Conclusions:*** *The WIC program has the potential for decreasing dentally related costs to the Medicaid program, while increasing use of dental services. [J Public Health Dent 2004;64(2):76-81]*

Key Words: health services accessibility, dental care, dental insurance, Medicaid, food services.

Access to dental care is considered a major public health problem for low-income preschool children in the United States (1,2). This national dilemma recently has come under close scrutiny by policy makers, providers, and researchers (3,4). Many issues are at the heart of this dilemma, including the costs and financing of dental care. The estimated annual dental bill in the United States for children amounts to billions of dollars, making it one of the most expensive, if not the single most expensive, chronic diseases of childhood (5,6). Cost estimates for individual children based on a review of dental records in an academic setting in 1992 ranged from $170 to $2,212 per child (7). In an analysis of 1996 Medical Expenditure Panel Survey (MEPS) data, the cost for dental care for children was estimated to be $12 billion (8). This dollar figure translates into $375 per child, an amount that surpasses the national expenditures for some childhood respiratory diseases such as asthma (9).

Disparities in Dental Disease. Dental caries-related treatment costs are particularly problematic for low-income children. Poor children have disproportionately high levels of disease that carry a larger financial burden for treatment (10). This burden is exacerbated because almost half of these expenditures are paid out of pocket, making access to dental care all the more difficult for children from low-income families (10). Treatment of dental disease in young children also can be costly, particularly when it requires hospitalization. Children younger than than 6 years of age enrolled in Medicaid and treated for dental disease in the hospital or ambulatory care setting represent less than 5 percent of those receiving dental care, but consume 25 to 45 percent of total dental costs for the program (6,11).

Promoting Prevention of Dental Disease. Untreated dental disease increases in severity and necessitates more extensive and costly treatment secondary to postponing care. Considering the evidence that untreated disease can lead to more costly treatment in preschool-aged children (11), early and effective preventive dental care should reduce overall expenditures associated with dental treatment. Some public programs have the potential to deliver a preventive oral health message to children at an early age and facilitate access to dental care, thus decreasing the extent of disease and reducing dentally related expenditures. Among these programs is the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). WIC is administered by the Food and Nutrition Services of the US Department of Agriculture and serves over 7.9 million individuals in the United States every month (12). It directly reaches a population of low-income mothers and their children under 5 years of age.

Oral health screenings are provided in WIC clinics in North Carolina as one dimension of a standard physical assessment protocol to assess risk factors for children. To be recertified for WIC eligibility, children must have an oral health screening every six months until they are no longer eligible for WIC benefits at age 5 years. After the

Send correspondence and reprint requests to Dr. Lee, University of North Carolina, Department of Pediatric Dentistry, CB #7450, Brauer Hall, Carolina Campus, Chapel Hill, NC 27599-7450. E-mail: jessica.lee@dentistry.unc.edu. Drs. Rozier, Norton, Kotch, and Vann are all with the University of North Carolina at Chapel Hill. This research was conducted with the support of the NIDCR grant 1K22DE14743-01, AAPDF's Omnii Fellowship, MCH grant 6T83-MC-00015-11, AHRQ grants T32-HS-00032 and 1-RO3-HS11607-01, and the USDA's Food and Nutrition Services special projects grant (#GMD-OAE-97.017). Manuscript received: 12/20/02; returned to authors for revision: 3/10/03; final version accepted for publication: 10/17/03.

screenings, WIC nurses and nutritionists make dental referrals if indicated (13). The WIC screening manual has several oral health risk factors for infants and children. These include nursing or bottle caries, inappropriate use of the bottle, cavities, and abscessed teeth.

WIC Effects on Child Health. Several nondental investigations have demonstrated associations between participation in WIC and decreased Medicaid costs. These studies show decreased costs for WIC participants associated with care of newborns (14), for treating anemia in children (15), and pediatric hospital costs (16). Only two descriptive studies have investigated the relationship between participation in WIC programs and dental services (17,18). Both reported referral rates within the program. McCunniff and colleagues (17) examined dental referral rates by WIC clinics in Missouri, reporting that of the 1,850 participants seen during a two-month period at one clinic site, 27 percent of children and 17 percent of infants were referred for services outside of the WIC clinic. Dental referrals comprised 10 percent of these referrals. Sargent and colleagues (18) surveyed WIC employees in an inner-city clinic to examine referral patterns. WIC nutritionists at this site offered referrals for a variety of conditions. About 20 percent of all children were referred for health care, the majority of these for dental reasons. Results of these two studies suggest that dental referrals occur within WIC clinics.

Purpose of Current Study. In previous studies we have found that Medicaid children enrolled in WIC have more dental visits than Medicaid children not enrolled in WIC. We also found that WIC children use more preventive and restorative services and less emergency services than their non-WIC counterparts (19). The purpose of the present investigation was to advance our previous research by examining the relationship of the WIC program and dental Medicaid expenditures in preschool children, including dentally related charges by physician and the hospital. Because the WIC program appears to increase dental use in North Carolina, but changes the mix of services, it is important to determine its net effect on Medicaid expenditures.

Methods

We used the following linked North Carolina administrative datasets for our investigation: composite birth records, Medicaid enrollment files, Medicaid dental claims, the WIC files, and the Area Resource File. The linkage process resulted in a matching rate of 98.5 percent for the individual child (20). Children born in North Carolina in calendar year 1992 who were enrolled in the Medicaid program were eligible for inclusion in the study and were followed up to five years. Children were excluded if they had more than one Medicaid identification number in their records (759 children) or if they had recorded periods of Medicaid enrollment indicated prior to the date of birth (1,371 children). A Medicaid enrollment history was created for each child in which enrollment status was indicated for each month of life from birth to age 5 years (months 1–60).

Our major outcome variable was expenditures related to the provision of dental services. Expenditures were measured using dollar amounts reimbursed by Medicaid for any claim for dental services filed with the state agency. These amounts included claims from dental providers in primary care settings and those from physicians and hospitals for dental services using general anesthesia. Expenditures were measured as the cumulative dollar amount reimbursed by Medicaid during the entire five-year study period. Adjustments of 2–3 percent per year for expenditures were made using the Consumer Price Index (CPI) (21). All dollar comparisons were made in 1996 dollars.

Our major explanatory variable, WIC participation, was measured as any WIC participation for each year of life: infant (0–11 months), age 1 year, age 2 years, and age 3 years. Children were considered WIC participants for any year if they redeemed any WIC food vouchers for that particular year of life. WIC children were compared to non-WIC children for each age group. We did not include WIC participation for 4-year-old children in our data analysis to minimize the potential for endogeneity. We recognize that any observed effects of WIC on expenditures could be due to the propensity of the child to use health services and not due to WIC participation itself. By excluding the most current year of WIC participation and examining only the first four lag years (infant, one, two and three) of life, we minimized the potential for simultaneous determination (22).

We relied upon the following control variables in our regression models: minority race (nonwhite), mother unmarried, mother's age in years, mother's education level (highest level completed), dental professionals per 10,000 populations in the county of residence, income, and Medicaid enrollment history defined as the number of months enrolled in the Medicaid program.

We used a two-part model to first estimate the probability of a child having had any dentally related expenditures and then the extent of these expenditures among those who had expenditures. We chose this analytical strategy because many children in the cohort had no dentally related expenditures, resulting in a nonnormal distribution (23). The first part of our two-part model was a logit model that predicted the probability of a child having had *any expenditures* and the second part relied upon ordinary least squares (OLS) to predict the continuous variable *the extent of expenditures,* conditional on having had any expenditures. Because there were two parts to the model, we chose an analytic method to determine the joint decision for the combined first part logit model and second OLS model. This was done to determine the predicted joint decision. For each age group of WIC participation, children were compared to a non-WIC group for that particular age group while controlling for WIC participation at other ages.

Results

The total Medicaid dollar reimbursement for dentally related services for the cohort included in the study was $1,603,399, of which $433,960 was for those who had some care in the hospital and $1,169,439 was for those who had care in a primary care setting. The characteristics of the study population are presented on Table 1. The dentally related expenditures for the individual child ranged from $0 to $6,082 with an average of $32.20 dollars paid per child. Twelve percent of the sample had one or more dental visits. At baseline, the average maternal age was 21 years with an average educational level of 11th

grade. Forty-eight percent of the population was nonwhite. Approximately 50 percent of the sample was on WIC at any time during the study period: 51 percent as an infant, 48 percent at age 1 year, 41 percent at age 2 years, and 48 percent at age 3 years participated in WIC. During the five-year study period, the average time enrolled in WIC was 26 months and in the Medicaid program was 38 months.

Table 2 and 3 illustrate the results of the two-part model regression analysis. The logit results in the first column indicates that participation in WIC as an infant and child participation (at ages 1 year and 2 years) was significantly associated with having any dentally related expenditures; however, this relationship did not hold at age 3 years. Children who participated in WIC as an infant (odds ratio=1.57; 95 percent CI=1.42, 1.67), age 1 years (odds ratio=1.33; 95% CI=1.21, 1.40), and age 2 years (odds ratio=1.24; 95% CI=1.10, 1.35) were significantly more likely to have had dentally related Medicaid expenditures than children who did not participate in WIC at these ages. The conditional OLS results in the second column indicate that infant and child (age 1 year) WIC participation was associated with a decrease in the total amount of dentally related expenditures.

Table 4 presents the predicted dentally related expenditures for WIC and non-WIC children, conditional on having had any dentally related expenditures. Children who participated in WIC as an infant or at age 1 year had significantly fewer dentally related expenditures than those who did not participate. Table 5 represents the results of the joint decision of both the logit and OLS models, which considers both the probability of any expenditure and the amount of expenditures by using the following formula.:

$$\hat{P}\left[(\hat{Y}/Y=1)-(\hat{Y}/Y=0)\right]+$$
$$\hat{Y}\left[(\hat{P}/P=1)-(\hat{P}/P=0)\right]$$

Children who participated in WIC in younger ages had overall decreased dentally related expenditures than those who did not participate in WIC during those earlier years.

Table 6 illustrates the distribution of expenditures by WIC participation and the setting in which dental treatment occurred. In this cohort, 697 children (1.4%) received dental care in the operating room under general anesthesia. Of those, 231 (33%) were WIC participants and 466 (67%) were nonparticipants. An estimated $433,960 (27% of total expenditures) went to the children who had dental care in the hospital, but only 24.3 percent of the total charges for care in the hospital were for WIC participants at any age. A separate logit regression analysis revealed that children who participated in the WIC program were significantly less likely to have had dental expenditures for care in the hospital than non-WIC children (odds ratio=0.79; 95% CI=0.65, 0.93).

TABLE 1
Characteristics of the Study Population for Study Period 1992–97 (*n*=49,795)

Variables	Mean/%	SD	Min	Max
WIC variables				
Child WIC participation	26 months	15.75	0	48
Any child WIC	67%	0.32	0	1
Infant WIC	51%	0.33	0	1
Age 1 WIC	48%	0.40	0	1
Age 2 WIC	41%	0.38	0	1
Age 3 WIC	48%	0.27	0	1
Outcome variables				
Any dental visit	12.18%	0.42	0	1
No. of dental visits	0.8 visits	5.66	0	16
No. of dental visits conditional on any visits	2.2 visits	2.66	1	16
Dentally related expenditures	$32.20	141.56	0	$6,082
Dentally related expenditures conditional on any expenditures	$78.11	248.81	$28.85	$6,082
Control variables				
Maternal age	21 years	5.51	13	39
Maternal education	11th grade	4.39	9	18
Medicaid enrollment	38 months	5.26	1	60
Year 1	10 months	7.35	1	12
Year 2	8 months	5.51	0	12
Year 3	7 months	4.90	0	12
Year 4	7 months	5.10	0	12
Year 5	6 months	4.56	0	12
Household income	$20,550	4,014	12,200	29,130
Dentist/population	6.820	3.81	0	17.6
Unmarried	54%	0.48	0	1
Nonwhite	48%	0.50	0	1

Discussion

This investigation is the first to report the effects of WIC on Medicaid expenditures related to receipt of dental care. Although our findings suggest that a WIC child has an increased probability of having some expenditure, we found a decrease in the total overall expenditures per child. This decrease was significant enough for those participating in WIC to yield an overall costs savings to the Medicaid program. In particular, our findings suggest that early child WIC participation provided reduced Medicaid expenditures for these young children. These findings are quite analogous to those in the medical literature wherein several investigations have demonstrated associations between participation in WIC and decreased Medicaid costs, including costs for newborns (14), for treating anemia in children (15), and pediatric hospital costs (16).

These potential savings to Medicaid seem to result from reduced charges for dental care in the hospital. WIC

TABLE 2
Two-part Model Results for WIC and Medicaid Expenditures

Variables	First Part Logit: Any Dentally Related Expenditures (SE)	Second Part OLS Conditional on Logit: Amount of Dentally Related Expenditures (SE)
WIC variables		
Infant WIC	.88* (.067)	−21.54* (8.74)
WIC age 1 year	.50* (.057)	−21.91* (9.05)
WIC age 2 years	.28† (.057)	−7.69 (7.37)
WIC age 3 years	.17 (.061)	7.95 (7.72)
Control variables		
Maternal age	.0033 (.0021)	.82* (.27)
Maternal education	.0028 (.0016)	−.33 (.41)
Medicaid enrollment	.061* (.016)	1.51* (.21)
Nonwhite	−.11* (.025)	−16.11* (3.03)
Dentist/population	.0094† (.0037)	−.26 (.46)
Unmarried	−.094† (.0015)	−1.76† (.46)
Income	−.031* (.37)	−1.19* (.68)
Constant	−2.87* (.13)	40.41* (16.21)

Two-part model using logit and ordinary least squares regression analyses.
Adjusted to 1997 dollars using general consumer price index.
Standard errors in parentheses.
*Significance $P<.01$ level.
†Significance $P<.05$ level.

TABLE 3
Predicted Probability of Any Dentally Related Medicaid Expenditures by Age (Base Case Child in Model=.26*)

	WIC	Non-WIC	Odds Ratio
Infant	.41	.26	1.57†
Age 1 year	.36	.26	1.33†
Age 2 years	.31	.25	1.24‡
Age 3 years	.29	.24	1.19

*Base case child=white, average household income $20,550; maternal age=21 years; maternal education 11th grade; enrolled in Medicaid for 38 months: dentist population ratio=6.8.
†Significance $P<.01$ level.
‡Significance $P<.05$ level.

TABLE 4
Predicted Total Dentally Related Medicaid Expenditures Conditional on Any Expenditures by Age per Child

	WIC	Non-WIC	% Difference
Infant	93.19	114.74*	19
Year 1–2	91.83	113.74*	20
Year 2–3	92.17	99.86	7
Year 3–4	98.40	87.64	10

*Significance $P<.01$ level.

children were more likely to use dental services and had higher nonoperating room-based care expenditures than non-WIC children ($650,220 vs $519,219). But WIC children had lower expenditures for dental care in the hospital than non-WIC children ($105,616 vs $328,344). Most of this difference is because fewer WIC children received dental care in the hospital. Of the 697 children in our cohort who received dental care under general anesthesia, 231 had participated in WIC, while 466 never participated in WIC. The results of our two-part model suggest that this difference in expenditure amount was enough to offset the increase in dental use in primary care settings and resulted in a net decrease in dentally related expenditures overall for children of this age group in Medicaid. These findings demonstrate that WIC is effective in reducing overall dentally related expenditures in preschool children.

We hypothesize that we found a cost savings for WIC participants for several reasons besides averted hospital care. WIC staff determine the need for dental services and advise clients about the types of health care available, the locations of health care facilities, how they can receive and pay for health care, and why health care is beneficial. They also counsel care givers on healthy oral health behaviors they should practice to promote their children's oral health. These counseling and referral services may result in better oral health practices, including children gaining earlier access to preventive dental services than those Medicaid children not enrolled in WIC. These practices could be preventing or delaying onset and progression of disease. Many WIC clinics are located at or adjacent to public dental health clinics and the proximity facilitates referrals and realized access to dental care. Nevertheless, the dental activities of WIC workers or their effectiveness have not documented and need further exploration.

Strengths and Limitations. Our study addresses several gaps in the existing literature on WIC, oral health, and dentally related expenditures. In contrast to reported descriptive studies (17,18), we explored the relationship of WIC and actual dollar amount reimbursed. Our analysis also applied multiple regression to a datafile of a Medicaid population followed longi-

TABLE 5
Joint Decision Results of WIC and Dentally Related Medicaid Expenditures per Child

Infant WIC	-19.97
WIC during year 1–2	-13.58
WIC during year 2–3	-6.24
WIC during year 3–4	15.26

TABLE 6
Total Expenditures by WIC participation and Dental Care in Hospital Setting

	WIC	Non-WIC	Total
Care in hospital	$105,616	$328,344	$433,960
Care in nonhospital setting	$650,220	$519,219	$1,169,439
Total expenditures	$755,836	$847,563	$1,603,399

tudinally for five years. Finally, the analyses used claims data rather than self-reports, which should provide more accurate measures of dentally related expenditures.

Our results should be interpreted with consideration of a few limitations. First, we did not limit our cohort to those who were continuously enrolled in Medicaid for the observation period. We included all children who were eligible for the study and used a control variable for months enrolled in Medicaid to avoid potential bias in use of services and thus expenditures. The characteristics of continuously enrolled children were different from those of others in the cohort, and those characteristics would suggest greater use of services than children enrolled only for portions of the study.

As a result of the decision to include all eligible children regardless of their enrollment status, bias in expenditures can be introduced in the other direction. Children no longer enrolled in Medicaid may have received care during periods when they were not enrolled in Medicaid. However, we believe that the potential bias toward underestimation of use of services is smaller than the potential bias for overestimation resulting from limiting the analysis to continuously enrolled children. Although low-income children are likely to use medical care when not enrolled in public insurance programs, it is unlikely that they use dental care in large amounts, particularly young children in North Carolina, where excess demand for services exists and dentists' participation in Medicaid is low (24). Privately insured children who otherwise would be eligible for Medicaid because of family income are less likely to have an unmet medical need, but more likely to have an unmet dental need than children enrolled in Medicaid (25). Dental care is the most prevalent unmet need in noninsured children who are eligible for Medicaid (26). These findings underscore the difficulty young Medicaid-eligible children have in gaining access to oral health care regardless of insurance coverage. We recognize that there are several ways to address this issue of Medicaid enrollment. Several investigations in the literature used both approaches and no consensus exists on which is the best approach (6,27-29).

Another limitation is the potential for selection bias. The design might have been stronger if a random assignment of WIC could have been accomplished; however, the practical problem of implementing this strategy in a community-based setting would be daunting and such a design would not be ethically defensible. There is the potential that any observed effects of WIC on expenditures are due to the propensity of the child to use health services and not due to WIC participation. If omitted variable bias exists, then the decisions are simultaneous. We excluded the most current year of WIC participation in our analysis and only examined the first four lag years (infant, 1 year, 2 years, and 3 years) of life to help minimize the potential for simultaneous determination (22). By using lag WIC measures, temporal endogeneity can be interrupted.

A final limitation is that we did not have information on the oral health status of children. Because severity of dental disease can play a significant role in hospitalization and expenditure data, the per capita cost of dental treatment for children who received care in the hospital is far greater than for those who did not. However, it has been well documented that Medicaid children and those children living in poverty have a disproportionately larger amount of dental disease (5). Children on Medicaid are a relatively higher-risk population than the general population (4). Studies have suggested that dental care is a serious unmet need among children living in poverty.

Policy Implications. When treatment of extensive dental caries requires hospitalization, children's dental expenditures increase dramatically. Expenditures for dental care delivered under general anesthesia for Iowa Medicaid children were reported as $2,009 per child in 1999 (6,30), while similar costs for Louisiana Medicaid children in 2000 were estimated at $1,508 versus $104 for children receiving conventional dental care in an office environment (11). Although derived in a very different manner, our data support similar findings reported in the states of Iowa and Louisiana. Collectively, findings from these three states are striking. A disproportionate amount of resources are being spent on a small number of poor children for a preventable disease.

Our results indicate an increase in probability of having any dental expenditures, which can lead to an increase in dental care costs for the Medicaid program because a significant portion of the dental Medicaid expenditures was for operating room care. Children who participated in WIC at an early age had fewer dentally related expenditures than non-WIC children. Therefore, early participation in WIC may potentially decrease overall Medicaid expenditures.

Our findings have several implications for policy makers. It is well documented that children on Medicaid have limited access to care and low utilization of dental services. Evidence suggests that Medicaid alone is insufficient to improve access and utilization of oral health care for preschool children. The WIC program has a direct impact on a population of high-risk, low-income pregnant mothers and children under age 5 years. Because of its early contact, WIC can serve as a vehicle for oral health anticipatory guidance, early detection and referral, and early access to dental care. For these reasons, the strategy to

connect WIC and oral health is sound public health policy and can generate good outcomes for preschool children on Medicaid.

References

1. Office of Technology Assessment. Children's dental services under Medicaid program. Washington, DC: United States Government Printing Office, 1990.
2. US General Accounting Office. Chidren's *dental services under the Medicaid Program*. Washington, DC: US General Accounting Office, 2000.
3. Vargas CM, Crall JJ, Schneider DA. Sociodemographic distribution of pediatric dental caries: NHANES III, 1988-1994. J Am Dent Assoc 1998;129:1229-38.
4. US Department of Health and Human Services. Oral health in America: a report of the surgeon general. Rockville, MD: Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000; NIH pub no 00-4713.
5. Edelstein B. Policy issues in early childhood caries. Community Dent Oral Epidemiol 1998;26(Suppl 1):96-103.
6. Kanellis MJ, Damiano PC, Momany ET. Medicaid costs associated with the hospitalization of young children for restorative dental treatment under general anesthesia. J Public Health Dent 2000;60: 28-32.
7. Ramos-Gomez FJ, Huang GF, Masouredis CM, Braham RL. Prevalence and treatment costs of infant caries in northern California. ASDC J Dent Child 1996;63:108-12.
8. Manski RJ, Moeller JF. Use of dental services: an analysis of visits, procedures and providers, 1996. J Am Dent Assoc 2002; 133:167-75.
9. Edelstein BL, Manski RJ, Moeller JE. Child dental expenditures: 1996. Pediatr Dent 2002;24:11-17.
10. Edelstein BL. Dispelling the myth that 50 percent of US schoolchildren have never had a cavity. Public Health Rep 1995;110: 522-30.
11. Griffin SO, Gooch BF, Beltran E, Sutherland JN, Barsley R. Dental services, costs, and factors associated with hospitalization for Medicaid-eligible children, Louisiana 1996-97. J Public Health Dent 2000; 60:21-7.
12. US General Accounting Office. Early intervention: federal investments like WIC can produce savings. Washington, DC: US General Accounting Office, 1992; GAO doc no HRD-92-18.
13. North Carolina Food and Nutrition Services. The Supplemental Program for Women, Infants, and Children training manual. Raleigh: North Carolina Food and Nutrition Services, 1999.
14. Schramm WF. WIC prenatal participation and its relationship to newborn *Medicaid costs in Missouri: a cost/benefit analysis*. Am J Public Health 1985;75: 851-7.
15. Kennedy ET, Gershoff S. Effect of WIC supplemental feeding on hemoglobin and hematocrit of prenatal patients. J Am Diet Assoc 1982;80:227-30.
16. Rush D, Leighton J, Sloan NL, Alvir JM, Horvitz DG, Seaver WB, et al. The National WIC evaluation: evaluation of the Special Supplemental Food Program for Women, Infants, and Children. VI. Study of infants and children. Am J Clin Nutr 1988;48(Suppl 2):484-511.
17. McCunniff MD, Damiano PC, Kanellis MJ, Levy SM. The impact of WIC dental screenings and referrals on utilization of dental services among low-income children. Pediatr Dent 1998;20:181-7.
18. Sargent JD, Attar-Abate L, Meyers A, Moore L, Kocher-Ahern E. Referrals of participants in an urban WIC program to health and welfare services. Public Health Rep 1992;107:173-8.
19. Lee JY, Rozier RG, Kotch JB, Norton EC, Vann WF. The effects of WIC on use of dental services by young Medicaid children. Am J Public Health (in press).
20. Buescher PA, Horton SJ, Devaney BL, Roholt SJ, Lenihan AJ, Whitmire JT, et al. Child participation in WIC: Medicaid costs and use of health care services. Am J Public Health 2003;93:145-50.
21. Gold MR. Cost effectiveness in medicine. New York, NY: Oxford Press, 1996.
22. Gujarati DN. Basic econometrics. 3rd ed. New York: McGraw Hill, 1995.
23. Duan N, Manning WG, Morris CN, Newhouse JP. A comparison of alternative models for the demand for medical care. J Bus Econ Stat 1983;2:115-26.
24. Mayer ML, Stearns SC, Norton EC, Rozier RG. The effects of Medicaid expansions and reimbursement increases on dentists' participation. Inquiry 2000;37: 33-44.
25. Davidoff AJ, Garrett AB, Makuc DM, Schirmer M. *Medicaid-eligible children* who don't enroll: health status, access to care, and implications for Medicaid enrollment. Inquiry 2000;37:203-18.
26. Newacheck PW, Hughes DC, Hung YY, Wong S, Stoddard JJ. The unmet health needs of America's children. Pediatrics 2000;105(4 Pt 2):989-97.
27. Robison VA, Rozier RG, Weintraub JA. Dental caries and treatment need in schoolchildren related to Medicaid enrollment. J Public Health Dent 1997;57: 163-70.
28. Robison VA, Rozier RG, Weintraub JA, Koch GG. The relationship between clinical tooth status and receipt of sealants among child Medicaid recipients. J Dent Res 1997;76:1862-8.
29. Weintraub JA, Stearns SC, Rozier RG, Huang CC. Treatment outcomes and costs of dental sealants among children enrolled in Medicaid. Am J Public Health 2001;91:1877-81.
30. Domiano P. Iowa Medicaid Utilization. Iowa City, IA: University of Iowa, 1996.