Do school-based dental sealant programs reach higher risk children?

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Abstract

Objectives: This report compares sealant prevalence by caries risk status among third graders at Ohio schools with and without school-based dental sealant programs (S-BSPs), and estimates the percent of children receiving sealants in S-BSPs who are higher risk for dental caries.
Methods: We analyzed data from a statewide open-mouth oral health survey of Ohio third grade schoolchildren for sealant prevalence by S-BSP availability and caries risk classification. Children were classified as higher or lower risk for dental caries based on school lunch program enrollment and other non-clinical access-related indicators. Differences between groups were evaluated by the chi-square test ($P < 0.05$).
Results: At schools with no S-BSPs, higher risk children were less likely to have dental sealants than lower risk children (28.7 percent versus 42.7 percent, $P < 0.001$). At schools with S-BSPs, sealant prevalence for both risk categories was equivalent for higher and lower risk children (59.4 percent, 63.4 percent, $P = 0.428$). Higher risk children at schools with S-BSPs were more than twice as likely to have a sealant as higher risk children at non–S-BSP schools (59.4 percent versus 28.7 percent, $P < 0.001$). Of higher risk children with at least one sealant, 61 percent attended a school with an S-BSP compared with 12.3 percent of lower risk children with at least one sealant. Higher risk children accounted for at least 75 percent of children receiving sealants through S-BSPs.
Conclusions: In Ohio, targeting S-BSPs by family income-based school-level criteria was effective in reaching higher risk children.

Introduction

Dental sealants are effective in preventing dental caries (1). While most children who receive sealants have them applied in dental offices, school-based dental sealant programs (S-BSPs) are an effective community-based approach to prevent dental caries (2). S-BSPs are most often funded with public dollars and operated by public agencies or private non-profit organizations, and sometimes by educational institutions. Central to the purpose of S-BSPs is serving higher risk children, including those less likely to receive private dental care (3,4).

Although the specific design of S-BSPs can vary among programs, common elements include: restriction to grade levels where children are likely to have newly erupted first or second permanent molars; parental consent; assessment of children and their teeth by a dentist or dental hygienist, consistent with state practice acts; application of sealants using portable dental equipment, at school, by dental hygienists, often with dental assistants; follow-up and reapplication of sealants, as necessary, at the next grade level in the succeeding year; and referral for other treatment needs observed (3,4).

Sealants are most cost-effective when targeted to higher risk teeth (1,5-7) and individuals (1,6), and the principle of targeting has carried over into recommendations for

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S-BSPs (3,4,8,9). The objective of targeting S-BSPs is to reach the greatest number of children who are more likely to experience caries, within the generally limited resources of publicly funded programs. Such children are considered to be "higher risk" for dental caries. We use the term "higher risk" rather than "high risk" in recognition of the fact that prevalence and severity of dental caries have declined notably since the 1970s when about 90 percent of adolescents had experienced caries and a mean of six teeth were affected (10). Public health programs target on two dimensions: caries risk and potential access to dental care, while clinicians target only on the former because patients in their offices already have accessed care. The American Dental Association and the American Academy of Pediatric Dentistry recommendations for risk assessment focus on clinical measures, such as caries history, but mention socioeconomic status and absence of regular dental visits as risk indicators as well (11,12).

It is appropriate for dental public health programs to consider social determinants of health and population health in their assessment of risk (13). National data demonstrate that children from low-income families are at greater risk for dental caries experience and for untreated caries (14,15), are less likely to have dental sealants (15), and are less likely to have a dental visit in a year (15,16) than their higher income counterparts. Children with no dental insurance are less likely to receive preventive dental care and more likely to have unmet need for care than those with insurance (17-19).

Although there is variability between states, the most common targeted S-BSP criterion reported by state dental program directors is the percent of children at a school who are enrolled in the Free and Reduced Price Meal Program (FRPMP), and the most common target level is ≥50 percent (20). FRPMP enrollment has been shown to be an available and effective proxy indicator for family income (21,22). Sometimes, the terms FRPMP eligibility and enrollment are used interchangeably. We chose enrollment as a more descriptive term.

The extent to which S-BSPs reach their target population depends, in part, on how the term "higher risk children" is defined. The definition could be limited to children enrolled in the FRPMP, to reflect the school targeting criterion. This approach, however, would likely result in underestimation because it would exclude other children who have access-related risk indicators, such as a lack of private dental insurance coverage or failure to visit a dentist within the past year, as well as those from low-income families that do not qualify for the FRPMP. For example, in 2008, children in 12 states could be income eligible for Medicaid but not the FRPMP (23).

The Ohio targeting standard for state-funded S-BSPs in 2004-2005 was 50 percent FRPMP enrollment for urban schools and a median income of less than or equal to 150 percent of the Federal Poverty Level (FPL) primarily for rural school districts. The effect of these criteria was a statewide program that, in the 2004-2005 school year, served 464 schools of which 84 percent had ≥50 percent and 93 percent had ≥40 percent of second grade students enrolled in the FRPMP.

In 2004-2005, Ohio completed a statewide survey of third grade students that included a clinical assessment and a questionnaire completed by the children's parents or guardians. Availability of relevant data from this school oral health survey (19) and from Ohio's large network of targeted S-BSPs (3) provided a unique opportunity to study the impact of S-BSPs on sealant prevalence among third grade children. Ohio S-BSPs target second grade children, but the selection of third graders as a study group, rather than second graders, measures the full effect of S-BSPs by allowing the entire school year for the programs to reach schools. This report will analyze the extent to which Ohio S-BSPs increase sealant prevalence and reach higher risk children.

Methods

Data collection

Ohio's "Make Your Smile Count" (19) open-mouth oral health survey of third grade students was conducted according to the Basic Screening Surveys (BSS) methodology (24), which is widely used by state dental programs and others. The BSS methodology collects prevalence data through a combination of direct observation by a screener, dentists and dental hygienists in our survey, and a questionnaire completed by the children's parents or guardians.

Following approval of the Ohio Department of Health's Institutional Review Board, consent forms with questionnaires were sent home with the students to be completed and returned by the parents. In addition to questions about the children's FRPMP enrollment and whether or not they received dental sealants at school, the questionnaires included several multiple-choice access-related questions, including, how recently the children visited a dental office and the payment method for dental care. With light source and disposable dental mirrors, trained dentist and dental hygienist screeners directly observed whether children had one or more decayed, missing, or filled teeth (caries experience); decayed teeth (untreated caries); and dental sealants. Explorers were available but not routinely used and never with force.

Sampling

A stratified, clustered random sample was drawn from a listing of schools with third grades in Ohio. We excluded private schools and charter schools (known as "community schools" in Ohio), the latter because of the transient nature of

Table 1 Development of the Study Sample

	Number of records	Population represented
Total sample (children examined)	14,025	127,194
Records eliminated because of:		
Invalid responses relating to risk criteria	673	7,313
Children at schools served by for-profit diagnostic/preventive services program	2,182	12,252
Inconsistent responses	52	518
Study sample (included in analysis)	11,118	107,111

the schools, teachers, and students (25-27). We stratified based upon county and income level (<50 percent enrolled in the FRPMP, ≥50 percent enrolled), then clustered by school. A probability-proportional-to-size approach determined schools randomly selected, with replacement, for each county to generate county-level estimates, which were aggregated to provide state-level estimates. A total of 374 schools were selected from among 1,960 schools, and all third grade students were eligible to be screened in each school. Only those with parental consent were screened. The participation rate of 53 percent of all eligible third graders at the sample schools yielded 14,025 children with valid records, representing 127,194 children in the underlying population. The data were weighted and adjusted for non-response and against income and race data to reflect the underlying Ohio elementary school student population.

Study sample

Based on our assessment of the literature (15-18)and of Ohio data (19), we defined children as being at higher risk for caries if they met at least one of the following criteria as reported by the parents or guardians who completed the questionnaire: enrolled in the FRPMP, used Medicaid as payment source, or uninsured (i.e., self-pay) with no dental visit in the past year. The risk status of 673 children, representing 7,313 Ohio third graders, could not be determined because of missing data, and therefore, they were eliminated. All other children were categorized as lower risk.

Post-stratification of schools according to S-BSP status determined that 79 were served by public health S-BSPs, 78 by a school-based diagnosis/prevention program (including sealants) provided by a for-profit company, and 217 had no S-BSP. We limited our analyses to comparison of the schools with no program with those that were served by public health S-BSPs. There were 11,170 valid records representing 107,629 Ohio third grade children in these 296 schools. Eliminating the 78 schools served by the for-profit company increased the percentage of children categorized as higher risk by only 0.1 percent. The for-profit company confirmed which schools were served by its program.

Upon initial analysis, parental responses to questions about sealant receipt for 52 third grade children with sealants were found to be inconsistent. The parents indicated that the children had not received sealants at school and also had not visited a dentist within the past 3 years. These observations were excluded from the analysis, resulting in a final total of 11,118 records representing 107,111 Ohio third grade children. Table 1 illustrates how the study sample was developed by eliminating groups of records from a full sample of children examined.

Analysis

For schools with and without an S-BSP, we generated estimates of the percentage of children at higher or lower risk for dental caries, as defined by our criteria, and sealant prevalence among these children. We also estimated the number and percent of children receiving sealants through an S-BSP. An initial review of parent/guardian responses, however, indicated that 16.1 percent of parents were "not sure" if the children received sealants at school. Based on these data, we generated three estimates of the percent of children receiving sealants through an S-BSP. The lowest estimate included only those children who met the following three criteria: attended a school with an S-BSP, had sealants on their teeth, and children whose parents/guardians indicated on the questionnaire that they had received sealants at school ("yes" response). A middle estimate also included those children whose parents/guardians indicated that they were "not sure" that the children received sealants at school ("yes" and "not sure" responses). Children for whom the parents/guardians did not respond to the questionnaire item were eliminated (12 respondents representing 137 third grade children). The third and highest estimate was based on program data on children who received sealants through Ohio S-BSPs ($n = 13,682$); those data, however, were not reported by child risk level.

Using survey procedures in SAS 9.1 software (28) to account for the complex survey design, we computed sealant prevalence, standard errors, 95 percent confidence intervals, chi-square statistics, and corresponding *P*-values.

Table 2 Percent of Third Grade Students by Caries Risk and Attendance at a School with or without a School-Based Dental Sealant Program (S-BSP), Ohio, 2004-2005

Caries risk	Third graders attending schools without S-BSPs (n = 80,020)	Third graders attending schools with S-BSPs (n = 27,091)	Total (n = 107,111)
Higher risk children	36.7% (29,387)	82.3% (22,307)	48.3% (51,694)
FRPMP participant	28.3% (22,640)	75.7% (20,519)	40.3% (43,159)
Not FRPMP, but Medicaid	4.2% (3,333)	4.2% (1,131)	4.2% (4,464)
Not FRPMP but uninsured and no recent dental visit	4.3% (3,414)	2.4% (657)	2.9% (4,071)
Lower risk children	63.3% (50,633)	17.7% (4,784)	51.7% (55,417)

FRPMP, Free and Reduced Price Meal Program.

Results

The inclusion of children who had other access-related risk indicators, but were not enrolled in the FRPMP, increased the percent of all third grade children categorized as higher risk from 40.3 to 48.3 (Table 2). At schools with S-BSPs, there was 1 additional higher risk child based on access-related indicators (1,788 of 22,307) for every 10 based on FRPMP enrollment. Table 2 shows that higher risk children accounted for the majority (82.3 percent) of children in schools with S-BSPs and a minority at schools without an S-BSP (36.7 percent).

Higher risk children who attended schools with S-BSPs were more than twice as likely to have a sealant as higher risk children who attended non–S-BSP schools (59.4 percent versus 28.7 percent, $\chi^2 = 37.28$, d.f. = 1, $P < 0.001$; Table 3). In schools with S-BSPs, however, sealant prevalence among higher risk and lower risk children was not significantly different (59.4 percent versus 63.4 percent, $\chi^2 = 0.629$, d.f. = 1, $P = 0.428$; Table 3). In schools with no S-BSPs, higher risk children were less likely to have dental sealants than their lower risk counterparts (28.7 percent versus 42.7 percent, $\chi^2 = 54.190$, d.f. = 1, $P < 0.001$; Table 3). When viewed by risk status, 61 percent (13,250/21,691; Table 3) of the higher risk children with at least one sealant attended a school with an S-BSP, and 12.3 percent (3,033/24,650; Table 3) of the lower risk children with at least one sealant attended a school with an S-BSP.

Among children with sealants who attended a school with an S-BSP, alternate assumptions and methodologies yielded a substantial range in the estimates of the percentage who likely received their sealants at school. Based on parent/guardian responses, this value would range from 45.9 percent to 61.9 percent S-BSPs (Table 4). The percentage increases to 84.7 when based on sealant program data. Of the 46,342 Ohio third grade children with sealants represented by our sample (Table 3), 16.0 percent (7,411 from Table 4) received their sealants in an S-BSP based on parental reporting in the questionnaire compared with 29 percent (13,682) based on actual S-BSP data. Finally, based on parental reporting, at least 75 percent of children receiving sealants at school met our criteria for higher risk (5,550 of 7,411; Table 4).

Discussion

Our findings for the Ohio network of S-BSPs demonstrate that these programs are effective in reaching their target population of higher risk children. Over 80 percent of children attending schools with an S-BSP met our criteria for higher caries risk, and higher risk children attending these schools were about twice as likely to have dental sealants as their counterparts at schools with no S-BSP. Disparities in sealant prevalence by risk status noted at schools without S-BSPs did not exist at schools with S-BSPs. Finally, up to 60 percent of higher risk children with sealants received them at school. These findings indicate that these programs are a significant source of sealants for children who may be less likely to receive care in dental offices. The pattern of the availability of good care, in this case dental sealants, varying inversely with population needs is not uncommon (29).

Table 3 Dental Sealant Prevalence among Third Grade Children by Caries Risk and Availability of School-Based Dental Sealant Programs (S-BSPs), Ohio, 2004-2005

	Schools without S-BSPs		Schools with S-BSPs		Total	
Caries risk	Children with sealants	95% CI	Children with sealants	95% CI	Children with sealants	95% CI
Higher risk	28.7% (8,441)	25.8-31.7	59.4% (13,250)	52.2-66.6	42.0% (21,691)	37.6-46.3
Lower risk	42.7% (21,617)	39.4-46.0	63.4% (3,033)	56.7-70.1	44.5% (24,650)	41.5-47.5
Total	37.6% (30,059)	34.8-40.3	60.1% (16,283)	53.9-66.3	43.3% (46,342)	40.8-45.7

CI, confidence interval.

Table 4 Percent and Number of Third Grade Children Who Attended Schools with School-Based Dental Sealant Programs (S-BSPs) and Had Sealants on Their Teeth, according to Caries Risk Status and Two Sources of Information about Whether or Not They Received Sealants at School, Ohio, 2004-2005

		Information source				
		Parent/caregiver responses to questionnaire: "Has your child ever had plastic coatings called dental sealants put on his/her teeth at school?"				Actual S-BSP program data
Caries risk status	Number of children at S-BSP schools with sealants*	No	Yes	"Not sure"	Subtotal (yes and not sure)	Received sealants
Higher risk children	13,122	39.7% (5,213)	42.3% (5,550)	18.0% (2,359)	60.3% (7,909)	NA
Lower risk children	3,024	30.6% (924)	61.5% (1,861)	7.9% (239)	69.4% (2,100)	NA
Total	16,146	38.0% (6,137)	45.9% (7,411)	16.1% (2,598)	61.9% (10,009)	84.7% (13,682)

* Does not include children for whom the parents/guardians did not respond to the "sealed at school" question (12 respondents representing 137 third graders).
NA, not available.

It would appear that Ohio's S-BSPs played a substantial role in increasing sealant prevalence among Ohio higher risk third grade children. In this study, 42 percent of higher risk children had received sealants – approximately double that of US 8-year-olds from low-income families (21 percent for those below 100 percent FPL, and 25 percent for those between 100 percent and 199 percent FPL, in 1999-2004 (15)). Sealant prevalence among all children at schools served by Ohio S-BSPs exceeded the national health objective of 50 percent (30) by 10 percentage points.

Ohio has one of the more extensive state S-BSPs with one of the longer histories, dating to 1984 (31). In 2004-2005, 22 local Ohio agencies operated S-BSPs, serving 41 counties and approximately 29,000 children in grades 2, 3, 6, and 7. In comparison with Ohio, most states have smaller programs or none at all. In addition, local S-BSPs may operate in some areas without state dental program involvement (32). The likelihood of a dentist in private practice interacting with an S-BSP will vary by location. A dentist is more likely to become aware of an S-BSP if a parent contacts his or her office upon receiving a consent form for program participation or if the dentist observes, in a child patient, sealants that have not been placed in the practice.

It may be helpful for dentists to learn about the design and operation of S-BSPs, including the eligibility criteria for children served, as these aspects may vary from sealant use in private offices. Ohio S-BSPs offer sealants at eligible schools to all children in selected grade levels with parental consent. One study found that it is more cost-effective for a typical S-BSP to provide sealants to all children who have consent rather than to target specific children based on dental status (33). In addition, Ohio S-BSPs target *schools* as a strategy to reach higher risk *children* because experience has shown that school officials consider it stigmatizing for outside programs to select individual children based on income-related criteria. Grade levels are selected to reach children most likely to have recently erupted permanent molars, which have been shown to be at greatest risk for caries (34), although sometimes compromises are made to optimize the balance of available teeth and student participation levels (35). Our finding that at least 75 percent of children receiving sealants at school met the higher risk criteria indicates that the targeting strategy was successful.

There are some limitations on our findings. This analysis reflects the demographics and oral health status of Ohio children, which may differ from other states. As with all such surveys that require parental consent, the validity of the data may be compromised by the response rate. The weighting of the data for non-response, income (FRPMP enrollment), and race in this analysis should have mitigated that limitation. Information on FRPMP enrollment, insurance status, most recent dental visit, and receipt of sealants at school are self-reported, which increases the risk of compromised validity and reliability. To the extent that the parent or guardian completing the consent form/questionnaire responded inaccurately, the findings would change.

Where possible, survey estimates were compared with other data and estimates to assess validity. Our estimate of 30.2 percent of third grade children being enrolled in Medicaid was consistent with the Ohio Medicaid program's estimate of 33.4 percent of school-age children in 2004 (36). Our finding that 31 percent of FRPMP-eligible children were not enrolled in Medicaid was in line with a national estimate of 25 percent (37) and surveys by other states that ranged from 25 percent to 40 percent (38,39). The aggregate percent of children reported to be enrolled in the FRPMP in our sample of S-BSPs schools was within 1 percentage point of the actual number for all Ohio schools served by an S-BSP. The sample of schools with S-BSPs also was similar to all schools with S-BSPs with regard to school enrollment and participation in the S-BSP. The actual number of children eligible to receive sealants at schools with S-BSPs reported to the state health department was in line with the survey estimate. Although, the estimate of children receiving sealants at school was not consistent with data reported by Ohio S-BSPs, that number was used to adjust the self-reported data to account for underreporting.

Conclusions

The percent of children enrolled in the FRPMP at schools is a reasonable and practical criterion for targeting S-BSPs to higher risk children. Ohio S-BSPs, through which all children with consent at targeted schools are eligible to receive sealants, effectively reach the higher risk children they are seeking and are a significant source of dental sealants. Under the conditions found in Ohio during the 2004-2005 school year, which largely reflect the effect of S-BSPs targeted to second grade students in 2003-2004, higher risk third grade children at schools with S-BSPs were approximately twice as likely to have dental sealants as higher risk children at schools with no S-BSPs. Higher risk children at schools with no S-BSPs were significantly less likely to have dental sealants than their lower risk counterparts at the same schools.

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