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Longitudinal caries prevalence in a comprehensive, multicomponent, school-based prevention program

Supplemental material is available online.

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ABSTRACT

Background. Globally, children's caries prevalence exceeds 30% and has not markedly changed in 30 years. School-based caries prevention programs can be an effective method to reduce caries prevalence, obviate traditional barriers to care, and use aerosol-free interventions. The objective of this study was to explore the clinical effectiveness of a comprehensive school-based, aerosol-free, caries prevention program.

Methods. The authors conducted a 6-year prospective open cohort study in 33 US public elementary schools, providing care to 6,927 children in communities with and without water fluoridation. After dental examinations, dental hygienists provided twice-yearly prophylaxis, glass ionomer sealants, glass ionomer interim therapeutic restorations, fluoride varnish, toothbrushes, fluoride toothpaste, oral hygiene instruction, and referral to community dentists as needed. The authors used generalized estimating equations to estimate the change in the prevalence of untreated caries over time.

Results. The prevalence of untreated caries decreased by more than 50%: from 39% through 18% in phase 1, and from 28% through 10% in phase 2. The per-visit adjusted odds ratio of untreated caries was 0.79 (95% confidence interval, 0.73 to 0.85).

Conclusions and Practical Implications. This school-based comprehensive caries prevention program was associated with substantial reductions in children's untreated caries, supporting the concept of expanding traditional practices to include office- and community-based aerosol-free care.

Key Words. Caries prevention; community-based care; aerosol-free.

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Globally, in low-, medium-, and high-income countries, children's caries experience exceeds 30% and has not markedly changed in 30 years.[1] From 1990 through 2010, the United States attempted to address the caries epidemic by increasing children's Medicaid spending by more than 300% (from $4.0 billion/year to $12.5 billion/year, adjusted for inflation)[2] and the number of dentists by 22% (from 163,000 to 199,000).[3] However, at the national level, these investments had little impact on children's caries experience in primary (0.6%, from 51.5%-52.1%) or permanent teeth (−3.8%, from 21.2%-17.4%).[4]

School-based caries prevention is a platform that can address the global and national caries burden. More than a dozen federal agencies and national organizations have recommended school-based caries prevention.[5] Consequently, during the past 15 years, there was a dramatic increase in the number of available school-based caries prevention programs.[6,7] However, compared with the standard of care practiced in traditional dental offices, most school-based programs offer limited care. In addition, school-based programs exhibit considerable variation in care type (for example, screening only or screening plus 1 or 2 preventive measures), care frequency (for example, once or twice per year), care focus (for example, specific grades or children's age), or care for specific teeth (for example, occlusal surfaces of permanent first molars only).[6-10] More broadly, state practice acts and financial incentives support the overuse of office-based treatment and the underuse of school-based prevention.[8,11] Furthermore, although there is considerable information on the efficacy of an individual preventive intervention in clinical trials, there is little to no information on implementation or clinical effectiveness of combined interventions in school-based practices.[9]

From 2004 through 2010, we conducted a comprehensive school-based caries prevention program that provided semiannual treatments to prevent and arrest caries on all primary and permanent teeth in children. All care was provided by dental hygienists. We have reported on the cost-effectiveness of the program previously.[8-11] The objective of our study was to show that comprehensive school-based care can obviate barriers to treatment and be clinically effective.

METHODS

Our study was approved by the Institutional Review Board of the Forsyth Institute in Boston, Massachusetts. Our reporting follows Strengthening the Reporting of Observational Studies in Epidemiology guidelines (eTable 1).[12] We have reported the study rationale, calibration, selection of protocols, interventions, and 6-month preliminary outcomes previously.[13]

Schools, participants, clinical program, and data collection

We solicited school systems in suburban (Lynn), rural (Cape Cod), and urban (Boston) Massachusetts for participation. Six schools were initially enrolled in the cohort (phase 1), followed by an additional 27 schools (phase 2). We followed participants from phase 1 for up through 5 years, and participants from phase 2 for up through 3 years.

All children attending a participating school were eligible to participate. The only exclusion criterion was the absence of informed consent forms and oral assent. The clinical team distributed and collected electronically readable paper informed consent forms (Teleform, Cardiff Software) to each participating school for guardian signatures. The informed consent forms requested the child's sex, race, and ethnicity. Paper informed consent forms were then transmitted securely to a central repository and converted to an electronic dental record. We recorded and stored all clinical data on a proprietary electronic dental record software system (New England Survey Systems).

For each primary and permanent tooth, clinicians determined whether the tooth surface had caries, was missing, restored, sound, or sealed. Precavitated lesions were not scored as caries. Clinicians also recorded treatment by tooth surface (for example, sealant or interim therapeutic restoration) or mouth (for example, fluoride varnish). At the completion of data collection, deidentified data were uploaded securely to the Data Coordinating Center at the School of Public Health at Boston University in Boston, MA, for data cleaning and verification.

Interventions

Enrolled children received twice-yearly examinations and comprehensive caries prevention performed in the school by calibrated dental hygienists. Prevention included the provision of prophylaxis, glass ionomer pit and fissure sealants (Fuji IX, GC America), glass ionomer interim therapeutic restorations on asymptomatic carious lesions (Fuji IX), fluoride varnish on all teeth (Duraphat or Prevident, Colgate-Palmolive), toothbrushes, fluoride toothpaste (Colgate Big Red, Colgate-Palmolive), and chairside toothbrushing instruction. All children were referred to their own dentist, a local dentist, or a community health center as needed for acute oral health care (for details see Appendix 1, available online at the end of this article). Teachers and school nurses were instructed to alert the clinical team if a child had any posttreatment problems. We did not monitor or request self-reported home toothbrushing.

Statistical analysis

We tracked participants longitudinally by means of matching full name and date of birth. We numbered the visits for each child sequentially, regardless of time elapsed between visits and calculated the time elapsed between successive visits. In this analysis, we included only children aged at least 5 years at the initial visit, and we excluded any visits for children older than 12 years.

We excluded schools with fewer than 75 participating students ($n = 16$), any child whose date of birth or age at study entry was missing ($n = 89$ and $n = 151$, respectively), and more than 6 visits for a given child ($n = 99$). For the temporal trend analysis, we also excluded children with only 1 visit ($n = 1,625$).

We divided the schools' data analysis into 2 phases; phase 1 included the first 6 schools and phase 2 included the remaining 27 schools with later program initiation. Phase 1 data included 2,588 children with 7,596 visit records. Phase 2 data included 4,339 children with 10,762 visit records.

From the dental examination and treatment, we derived indicators at the tooth and child level (for example, untreated caries on any surface of any tooth) and the number of teeth with any untreated caries. We created these indicators separately for all primary and permanent teeth.

In the analytic set, we identified 333 visit records (of 13,635) with at least 1 tooth identified as both permanent and primary. In these instances, the given tooth was included in analyses of permanent and primary teeth, but counted only once in analyses that included both types of dentition. We also created indicators restricted to the occlusal surface of first molars.

At a child's initial visit, we based the assessment of previous dental treatment on clinical examination. We also derived the following indicators for each child's oral health status at their initial (baseline) visit: any untreated caries, caries experience (treated or untreated), and the number of teeth with untreated caries.

Analysis of temporal trends in the prevalence of untreated caries

We used generalized estimating equations with a logit link and an exchangeable correlation matrix to evaluate the odds of untreated caries relative to the number of dental visits, up to 5 postbaseline visits in both phases 1 and 2. We omitted the baseline visit from analyses except by including an indicator of any untreated caries observed at baseline. In regression models, we included potential confounding factors, identified a priori as covariates associated with both the number of visits and dental outcomes and not influenced by either. These included sex, previous dental treatment (yes or no), and age at examination (exact, in years, based on the date of birth and examination date; if exact dates were missing the day was assumed to be the 15th day of the month). Although we did not include a covariate for community water fluoridation, sensitivity analyses explored confounding at the school level, which would, by definition, include water fluoridation. We included school indicators in phase 1 analyses as planned a priori. The large number of phase 2 schools prohibited the inclusion of indicators in the phase 2 analyses. Children's race was missing for a large proportion of participants. Sensitivity analyses indicated that neither school (Appendix 2, available online at the end of this article) nor race (Appendix 3, available online at the end of this article) were likely to have confounded the results.

We performed all analyses with dentition defined 4 ways as follows: all teeth, permanent teeth only, primary teeth only, and occlusal surface of first molars only.

Temporal trends were assumed to reflect the effectiveness of school-based prevention. The validity of this assumption depends on whether children who stay in the program longer are similar to those who have only 1 or a few visits. To address potential attrition bias, we reanalyzed data restricting to participants with an equal number of visits (3, 4, 5, or 6, in separate analyses) (Appendix 4, available online at the end of this article). We performed an additional series of sensitivity analyses to probe the robustness of results under different assumptions, examining whether results changed in the following 4 different subsets of data: restricting to participants who had fewer than 4 teeth with any untreated caries at baseline, had fewer than 6 teeth with any treated or untreated caries at baseline, were younger than 8 years at baseline, or had visit numbers fewer than 6 (Appendix 4, available online at the end of this article).

RESULTS

Participant demographic characteristics

Demographic characteristics were similar for phase 1 and phase 2. Approximately one-half of the children were girls, close to 60% were 7 years or younger, and approximately 5% were aged 11 years at their first examination (Table 1). Among the 31% reporting race in both phases combined, 19% were black and approximately one-half were white, with most of the remainder being either Asian or reporting more than 1 race (Table 1). The mean participation rate, per school, was approximately 15% and ranged from 10% through 30%.

At their baseline visit, 33% of children had untreated caries in any dentition, with a range of 18% through 54% across the schools (Table 2). Dentition-specific caries prevalence at baseline was 29% for primary teeth and 9% for permanent teeth. Fully 55% (across-school range, 28%-68%) of children had caries experience (treated or untreated caries). Children averaged 2.6 teeth with caries experience at baseline. These oral health indicators were slightly worse in phase 1 participants (Table 2). Approximately 20% had at least 5 teeth with caries experience at baseline, and 10% had at least 3 teeth with untreated caries at baseline (data not shown).

Table 1. Baseline demographic characteristics among children receiving school-based oral health care.

CHARACTERISTIC	TOTAL (33 SCHOOLS), NO. (%)	PHASE 1 (6 SCHOOLS), NO. (%)	PHASE 2 (27 SCHOOLS), NO. (%)
Total	6,927 (100)	2,588 (100)	4,339 (100)
Sex			
Female	3,496 (50)	1,271 (49)	2,225 (51)
Male	3,338 (48)	1,286 (50)	2,052 (47)
Age, Y			
5	996 (14)	254 (10)	742 (17)
6	1,579 (23)	669 (26)	910 (21)
7	1,368 (20)	624 (24)	744 (17)
8	1,169 (17)	501 (19)	668 (15)
9	909 (13)	335 (13)	574 (13)
10	555 (8)	130 (5)	425 (10)
11	283 (4)	62 (2)	221 (5)
12	68 (1)	13 (1)	55 (1)
Race			
Black or African-American	393 (6)	172 (7)	221 (5)
White	1,209 (17)	173 (7)	1,036 (24)
American Indian, Alaska Native, Native Hawaiian, Pacific Islander	50 (1)	9 (0)	41 (1)
Asian	230 (3)	56 (2)	174 (4)
> 1 race	278 (4)	81 (3)	197 (5)
Missing	4,767 (69)	2,097 (81)	2,670 (62)

Of the 6,927 participants in phase 1 and phase 2, there were 5,322 (77%) with more than 1 visit. For phase 1, 45% of students had 3 or more visits, 33% had 4 or more visits, and 18% had 5 or more visits. By definition, phase 2 schools entered later in the study period and had a shorter duration in the program. For phase 2, 35% of students had 3 or more visits, 23% had 4 or more, and 9% had 5 or more visits. In both study phases, the median time elapsed between visits was 6 months, and the 10th and 90th percentiles were approximately 4 and 13 months, respectively.

Temporal trend in untreated caries prevalence

In phase 1, children with untreated caries decreased from 39% at baseline to 18% at visit 7 (54% reduction). In phase 2, children with untreated caries decreased from 28% at baseline to 10% at visit 7 (64% reduction). For children with untreated caries at baseline, the trends were similar in primary and permanent teeth and the occlusal surfaces of first molars for both phase 1 and 2 (Figures 1 and 2).

Considering all children (with or without caries) and including both primary and permanent dentition, multivariable models indicated an average per-visit decrease in the odds of untreated caries (phase 1 odds ratio [OR], 0.90; 95% confidence interval, 0.85 to 0.96; phase 2 OR, 0.88; 95% confidence interval, 0.83 to 0.93) (Table 3). ORs were estimated using a generalized estimating equations approach with logit link, clustered on the participant and were adjusted for sex, age at examination, and any previous oral health care. Stratification by presence of untreated caries at baseline was performed by means of including a multiplicative interaction term, visit times an indicator of any untreated caries at baseline. The OR was lower for the permanent dentition and for the occlusal surface of permanent first molars and higher for the primary dentition (Table 3).

The per-visit change depended heavily on baseline dental health. Specifically, the most beneficial trend occurred in participants who had any untreated caries at baseline (for example, phase 1 OR, 0.79; 95% confidence interval, 0.73 to 0.85) for primary and permanent dentition together (Figure 1 and Table 3). This trend was somewhat stronger for permanent teeth and specifically for the occlusal surfaces of first molars. In contrast, for children with no untreated caries at baseline,

Table 2. Baseline oral health characteristics among children aged 5 through 12 years receiving school-based oral health care.

CHARACTERISTIC	TOTAL (33 SCHOOLS)	PHASE 1 (6 SCHOOLS)	PHASE 2 (27 SCHOOLS)
Children, No. (%)	6,927 (100)	2,588 (100)	4,339 (100)
Teeth With Untreated Caries, No. (%)			
Overall	2,322 (34)	1,060 (41)	1,262 (29)
Primary	2,026 (29)	894 (35)	1,132 (26)
Permanent	639 (9)	437 (17)	202 (5)
Teeth With Untreated Caries Among Children With Untreated Caries, Mean No.			
Overall	4	5	3
Primary	6	8	6
Permanent	1	3	0
Teeth With Treated or Untreated Caries (Caries Experience), No. (%)			
Overall	3,836 (55)	1,608 (62)	2,228 (51)
Primary	3,451 (50)	1,439 (56)	2,012 (46)
Permanent	1,190 (17)	666 (26)	524 (12)
Teeth With Caries or Restored Teeth Among Participants With Any Caries, Mean No.			
Overall	9	11	7
Primary teeth	16	18	15
Permanent teeth	3	5	1
Previous oral health care	61	59	62

there was a slight upward trend, especially for the primary dentition (Figures 1 and 2). All point estimates were similar for phase 1 and 2 analyses (Figures 1 and 2, Table 3).

Other analyses

In most of the sensitivity analyses, results were robust and offered the same interpretation as the primary analyses. There was no evidence that temporal trends in caries risk were due to confounding by school (Appendix 2 and eTables 2 and 3, available online at the end of this article), by race (Appendix 3 and eTables 4 through 6, available online at the end of this article), or due to attrition bias (Appendix 4 and eTables 7 through 9, available online at the end of this article). When we restricted participant analysis by age or based on the number of carious lesions at baseline, the results changed only minimally (Appendix 5 and eTables 10 through 12, available online at the end of this article).

DISCUSSION

In our pragmatic study, we assessed the potential effectiveness of a multicomponent, longitudinal, school-based caries prevention program delivered by dental hygienists. The program focused on US schoolchildren attending Title I[14] elementary schools, at which 50% or more of the student population participated in free or reduced lunch programs, which is a surrogate indicator for lower socioeconomic status.

Children in the program experienced a more than 50% reduction in untreated caries during 6 visits. This 50% reduction is a change that, as explained below, would be unlikely in the absence of school-based caries prevention. Furthermore, wide-ranging sensitivity analyses support the conclusions of a beneficial preventive effect. Results of parallel economic analysis of our cohort indicated that this program is both cost-saving and cost-effective compared with no care or other prevention programs,[11] and the methods reported here offer 1 mechanism to expand the reach of traditional dental practices.[13] These results also support the claim that a low-cost, high-access, community-based caries prevention program can control or reduce the prevalence of caries.[1,15]

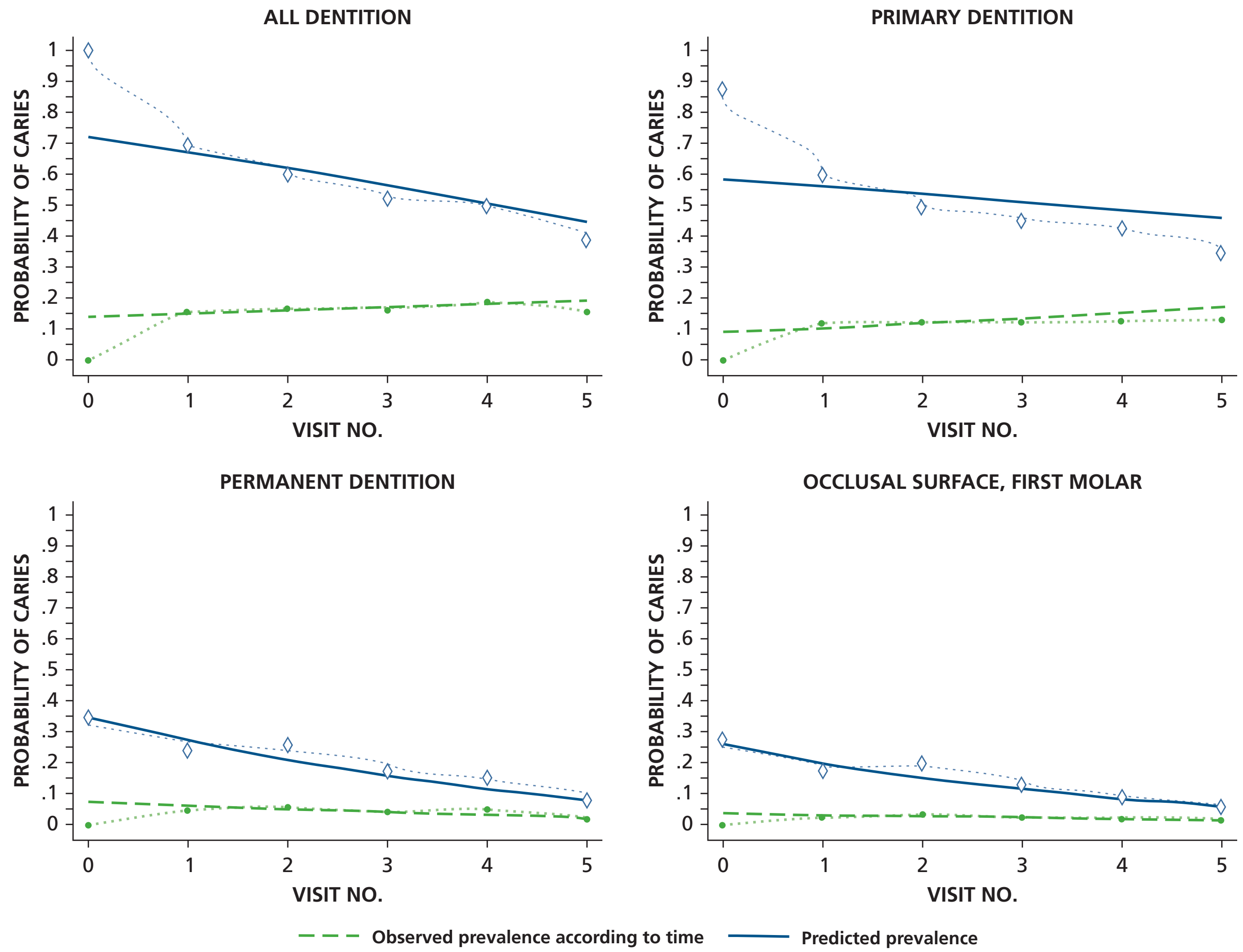

Figure 1. Observed (dashed curves) and predicted (solid lines) prevalence of untreated caries by visit number among children enrolled in study phase 1 of Title I schools in Massachusetts (n = 6 schools) receiving comprehensive oral health preventive care, by type of dentition.

The primary methodological limitation of our study was the absence of a control group of children who did not receive care. Therefore, we tracked longitudinal trends in untreated caries as a surrogate for program effectiveness. This approach is valid if outcomes are similar for participants who stay in the program throughout the follow-up period and for those who drop out of care. Reasons for shorter care duration include movement into or out of a school, administrative censoring, and late entry into the program (for example, 2 visits in the last year of the program). We evaluated whether this attrition bias, rather than program effectiveness, explained the results. Specifically, we conducted a series of analyses in which we restricted the data to subgroups of participants who all shared the same total number of visits. The conclusions regarding the effectiveness of caries prevention for permanent teeth were not altered, particularly for participants who entered with existing untreated caries. Furthermore, if the program was ineffective, one would expect the odds of untreated caries to increase over time because tooth surfaces experienced more time at risk of developing caries. However, these increases did not occur.

Another limitation was the modest overall study participation based on the informed consent process.[16] At the time we conducted our study, the informed consent process required a series of annual repetitive steps, including consent form delivery to the schools, teachers, students, and parents. Informed consent is, therefore, a considerable challenge in all school prevention programs.[17,18] One concern is that parents who return consent forms might be among the most engaged, most economically secure, and most highly educated.[17,18] In the population studied here, the focus was Title I elementary schools with greater than 50% free or reduced lunch participation. In this context, it is notable that at baseline, 28% through 39% of children had untreated caries. These numbers are substantially higher than the 2014 US national average.[19] Conversely, from 10% through 18% of the children ended the study with untreated caries. These averages are at or below 2019 national averages.[4] Extrapolating from the results in program

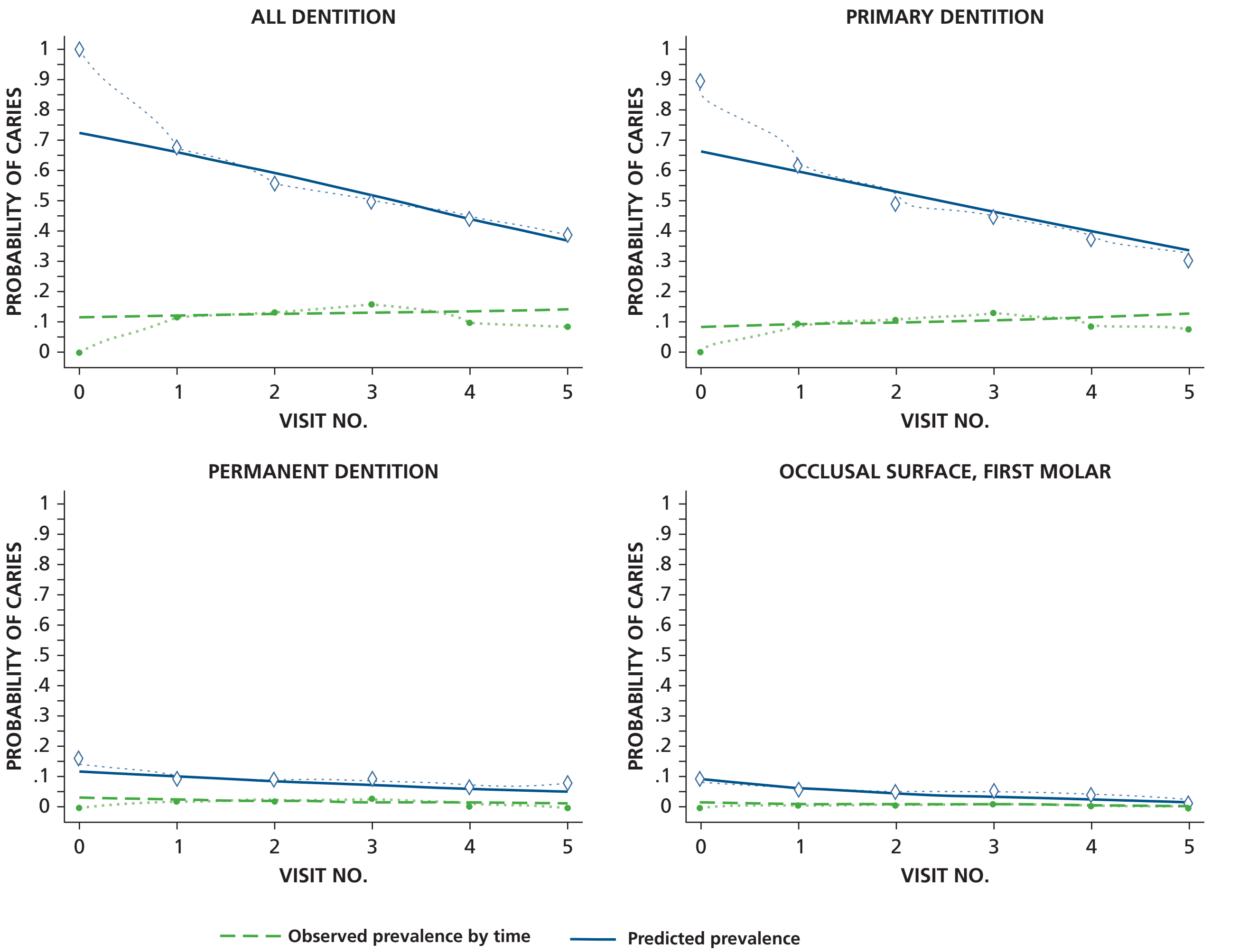

Figure 2. Observed (dashed curve) and predicted (solid line) prevalence of untreated caries by visit number among children enrolled in study phase 2 of Title I schools in Massachusetts (n = 27 schools) receiving comprehensive oral health preventive care, by type of dentition.

participants, and assuming that children without signed consent forms likely had higher caries levels, they might have benefited even more than those with signed consent forms.

Practical implications

Our results have several broad positive practical implications. First and centrally, the findings show the feasibility and clinical benefit of 1 approach to school-based caries prevention programs delivered by dental hygienists. Second, our results support the contention that a nationwide, comprehensive caries prevention program implemented for all US children could reduce children's caries by more than 50%, with potential cost savings of as much as one-half of what Medicaid spent for children's oral health care in 2013.[8,11] Program support from Medicaid and insurers could expand care outside of the traditional dental practice.

Clinical implications

There are several broad clinical practice implications. First, we used a community risk-assessment model to identify high-risk schools serving high-risk populations (that is, $\geq$ 50% free or reduced lunch program).[20] The fact that the baseline caries prevalence was well above national averages suggests that schools' Title I designation was an appropriate criterion with which to identify groups of children at high risk of developing caries and with a high need for oral health care. This approach comports with critiques of individual caries risk assessment and teledentistry. Second, to improve health for all children, we selected and implemented multiple preventive interventions with evidence of effectiveness from systematic reviews.[9] Our comprehensive approach contrasts with most school-based prevention programs

Table 3. Estimated average per-visit change in odds of untreated caries among children enrolled in Title I schools in Massachusetts and receiving comprehensive preventive oral health care through the school-based program, by type of dentition.

ANY BASELINE CARIES	PHASE 1 (6 SCHOOLS)			PHASE 2 (33 SCHOOLS)		
	No.	Odds Ratio*	95% Confidence Interval‡	No.	Odds Ratio	95% Confidence Interval
All Dentition						
No untreated caries at baseline	1,197	1.08	0.99 to 1.17	2,356	1.04	0.97 to 1.12
Any untreated caries at baseline	776	0.79	0.73 to 0.85	936	0.74	0.68 to 0.80
All participants§	1,973	0.90	0.85 to 0.96	3,292	0.88	0.83 to 0.93
Primary Dentition						
No untreated caries at baseline	1,197	1.16	1.06 to 1.28	2,356	1.10	1.01 to 1.20
Any untreated caries at baseline	776	0.90	0.83 to 0.97	936	0.76	0.70 to 0.82
All participants§	1,973	0.99	0.92 to 1.05	3,292	0.90	0.85 to 0.96
Permanent Dentition						
No untreated caries at baseline	1,197	0.80	0.69 to 0.94	2,356	0.81	0.67 to 0.99
Any untreated caries at baseline	776	0.70	0.63 to 0.78	936	0.81	0.69 to 0.95
All participants§	1,973	0.73	0.66 to 0.80	3,292	0.81	0.72 to 0.92
Occlusal Surface First Molar						
No untreated caries at baseline	1,197	0.85	0.70 to 1.03	2,356	0.80	0.59 to 1.08
Any untreated caries at baseline	776	0.72	0.63 to 0.81	936	0.70	0.56 to 0.88
All participants§	1,973	0.74	0.67 to 0.83	3,292	0.73	0.61 to 0.88

* OR: Odds ratio. ‡ CI: Confidence interval. § "All participants" represents all participants regardless of whether they had untreated caries diagnosed at the baseline visit, with results adjusted for the presence of untreated caries at baseline.

that focus on specific teeth in specific-aged children and a limited number of preventive interventions.[6,7] The additional interventions add little cost to the program overall and could be performed quickly. Third, we used glass ionomer for sealing pits and fissures and for interim therapeutic restorations. The use of glass ionomers for these purposes differs from standard practice and guidelines recommending composite resin.[24] Nevertheless, such use aligns with 2016 systematic reviews.[21] Fourth, the program practitioners did not remove caries before placing interim therapeutic restorations, which is harmonious with long-term clinical trials[22,23] and systematic reviews of efficacy.[25]

Given the preceding, it is notable that the program met all 6 of the Institute of Medicine's (now the National Academy of Medicine) quality criteria.[26] Care was safe (≈ 1 in 2,000 adverse events), effective (≈ 50% reduction in caries), patient-centered (care comes to children, rather than children coming to care), timely (care is delivered twice per year), efficient (all care takes < 30 minutes), and equitable (all children with informed consent forms receive care, independent of their insurance or ability to pay). The program met health care's triple aim of improving quality, improving health, and reducing costs.[27] Finally, the program meets the US Supreme Court's standards of care definition,[28,29] which is based on guidelines or systematic reviews of human randomized controlled trials published in peer-reviewed journals.

Policy implications

These results show the feasibility and clinical benefit of 1 approach to comprehensive, school-based caries prevention. This study included 7,037 students attending 33 multiethnic Title I Massachusetts elementary schools located in urban and rural areas, in areas with and without community water fluoridation, among children with and without caries, and among children from immigrant and nonimmigrant families. Given the broad base of the participating population, the results should generalize to other populations.

Aerosol-free preventive care reduces risk of transmitting airborne disease

The US Occupational Safety and Health Administration categorizes oral health care as "very high risk"[30] owing to aerosols harboring and potentially transmitting bacteria, fungi, and viruses, such as severe acute respiratory syndrome coronavirus 2.[31] Virus-laden aerosols in particular are detectable and viable for hours.[32] Consequently, proximity to patients and the exposure to potential disease-borne aerosols place clinicians among workers with the highest infection risk.[33] Based on US Occupational Safety and Health Administration definitions, infection risk can be reduced by means of removing the hazard (eliminating aerosol-based care) and replacing the hazard (providing aerosol-free care). The interventions provided as part of the program analyzed in our study are aerosol-free and, therefore, reduced the Occupational Safety and Health Administration defined risk by 1 category. These interventions and others, such as silver diamine fluoride, comprise a group of simple, aerosol-free, and effective caries prevention procedures.[34]

Barriers to implementation

Despite this evidence, there remain several barriers to clinical and policy change. The economic and diffusion literature suggests that legislative and regulatory barriers for systematic implementation of caries prevention will be considerable; studies indicate that 10% through 20% of stakeholders across governmental, organizational, clinical, and patient groups must support legislative, regulatory, or economic reform to effect wide-scale adoption of caries prevention.[28,35,36] Another barrier is that Medicaid reimbursement rates cover neither the costs nor the value of care.[8,11] Furthermore, most states require a prior examination or direct dental supervision before a dental hygienist provides care and do not allow hygienists to practice to the full extent of their training.[37] Existing practice acts can, therefore, limit access to care due to the availability of dentists or their costs. When this program began, the Massachusetts state practice act required a prior dental examination. By study completion, the practice act allowed dental hygienists to assess needs and provide care with indirect supervision.

CONCLUSIONS

Our results support the concept that a comprehensive school-based caries prevention program can substantially reduce caries prevalence and meet the Institute of Medicine's[26] quality aims and health care's triple aim. Widespread implementation could increase the reach of traditional dental practices while reducing the costs of care[2,38] and inequity,[39] while providing aerosol-free care. ■

SUPPLEMENTAL DATA

Supplemental data related to this article can be found at: https://doi.org/10.1016/j.adaj.2020.12.005.

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APPENDIX 1: DETAILS ABOUT CLINICAL EXAMINATION.

Dentists underwent visual and tactile technique calibration for caries ($\kappa = 0.75$) using the National Institute of Dental and Craniofacial Research diagnostic criteria as a reference standard.[e1] They dried tooth surfaces before examination without prophylaxis or obtaining radiographs.

Dental hygienists provided prophylaxis and oral hygiene instruction; provided toothbrushes and fluoride toothpaste; and placed glass ionomer sealants, glass ionomer temporary restorations (for carious lesions), and fluoride varnish, all on the basis of the dental examination and treatment plan. The dentists and hygienists prepared written reports in parents' and guardians' native languages, through which they disseminated examination results and recommendations for treatment. Parents and guardians also received referrals to collaborating local dentists or community health centers if they did not have a dentist.

For emergency care, the clinical team followed the school protocol. The team first notified the school nurse, then the student's parents. The collaborating dentists offered to set aside time to manage emergencies. Parents provided transportation. Nurses kept a log of post-treatment emergencies and had telephone numbers of local dentists and the program director to facilitate immediate care.

SUPPLEMENTAL REFERENCE

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APPENDIX 2: ASSESSMENT OF CONFOUNDING BY THE SCHOOL

In the a priori data analysis plan, we expected that schools might confound the association between visit number and presence of untreated caries, in part because we had limited covariate information about each participant. In addition, visit patterns and attrition rates might also vary for students in different schools. For the 6 phase 1 schools, it was straightforward to perform explicit adjustment in regression models by means of including indicators for each school.

This same adjustment method was not feasible in phase 2 analyses. Phase 2 schools would have required 27 school indicators. We approached this limitation in 2 different ways. First, we sought empirical evidence of confounding, by the school, in the phase 1 analyses. We did this by means of fitting models with and without the school indicators and comparing the estimated association of untreated caries with visit number (and the standard errors for this association). The similarity of the estimated coefficients and their standard errors (eTable 2) suggested that there was little confounding by the school in the phase 1 analysis. Nevertheless, this does not guarantee that such a relationship did not exist in the phase 2 analyses, with 27 different schools.

Second, we performed both the phase 1 and phase 2 analyses by means of fitting multilevel mixed-effects models with a random effect for school and fixed effects corresponding to other covariates. The results of these analyses were similar to the phase 1 and 2 analyses using generalized estimating equations (eTable 3). Compared with the generalized estimating equation analyses unadjusted for school, the multilevel analyses with random effect for school yielded stronger OR estimates for children entering the program with untreated caries.

APPENDIX 3: ASSESSMENT OF CONFOUNDING BY RACE

Approximately 80% of the participants were missing race. Non-White race is a risk factor for untreated caries and poorer oral health. There was not a specific reason to expect that visit patterns would also differ by race. Yet, to address this possibility, we first stratified the analyses according to whether participants were missing race or not, without adjusting for race in either model. Second, we adjusted for race in the smaller proportion (approximately 20%) that reported race (Black; White; Asian, Native Alaskan, Native American, or Pacific Islander; or more than 1 race or unknown). We performed these analyses aggregating all of the schools and separately for the first 6 (phase 1) and later 27 (phase 2) schools (eTables 4, 5, and 6, respectively).

In most of these analyses, the OR estimates of temporal trend differed only a small amount from the analyses of the main results. When the OR estimates differed more substantially, it was generally to strengthen the results, not weaken them. These differences include apparent confounding by means of a lack of reporting of race (or underlying characteristics associated with it).

On the basis of these sensitivity analyses, it appears that race was unlikely to have confounded the results in an anti-conservative direction.

APPENDIX 4: SENSITIVITY ANALYSES TO ADDRESS BIAS DUE TO ATTRITION

A substantial limitation to this study was the lack of an untreated control group and the concomitant concern that participants who had a longer duration of care, or a greater number of visits, differed in their underlying risk of developing untreated caries. If, for example, the participants at highest risk of developing untreated caries preferentially dropped out after only 2 or 3 visits, the estimated decrease in odds of developing untreated caries over time could be overestimated.

To address this possibility, we fit a series of models in which participants had a fixed total number of visits, either 3, 4, 5, or 6. We compared these results with the primary analyses for all schools (eTable 7), phase 1 (6 schools, eTable 8), and phase 2 schools (eTable 9).

In the participants observed for 4, 5, or 6 visits, the estimated ORs were similar to those estimated from the whole population overall. Estimates of temporal trend changed most markedly among participants who began with no caries at the baseline visit and had only 3 visits; among these participants, the odds of developing caries increased during their 3 visits. The other group of participants, who had only 3 visits—those who began the program with caries diagnosed at baseline—experienced a similar decrease over time in the odds of developing untreated caries as the whole population overall, also similar to those observed for up to 6 visits.

We do not consider these differences to negate our study conclusions because the population-averaged (adjusting for, but not stratifying by, the presence of caries at baseline) temporal trend is still negative, even for participants restricted to 3 visits. We know that over time, the risk of developing untreated caries increases. Furthermore, even effective caries prevention programs are not 100% effective.

APPENDIX 5: SENSITIVITY ANALYSES TO ADDRESS OTHER POSSIBLE SOURCES OF BIAS

Approvals from the Investigational Review Boards of the schools allowed for the collection of only minimal demographic and health information from study participants, which limited the extent to which we could directly account for possible confounders and sources of bias. We considered that either the treatment effect or odds of developing caries might be different in children who entered the study with more caries (that is, more affected sites) at baseline. The study participants who entered at the youngest ages had the highest possibility for longer follow-up. In addition, the numbers of participants decreased over time.

To address these various concerns, we repeated the primary analyses after restricting to participants who had 4 or fewer teeth with any untreated caries at baseline, had fewer than 6 teeth with any treated or untreated caries at baseline, or were younger than 8 years at baseline. We also repeated analyses, excluding visits higher than 5.

Estimated ORs changed only slightly throughout these analyses in all schools combined (eTable 10), in phase 1 (eTable 11), and phase 2 (eTable 12).

eTable 1. Strengthening the Reporting of Observational Studies in Epidemiology.[12]

VARIABLE	ITEM NO.	RECOMMENDATION	PAGE NO.
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3
Introduction			
Background and rationale	2	Explain the scientific background and rationale for the investigation being reported	4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6
		(b) For matched studies, give matching criteria and number of exposed and unexposed	6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources and measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7, 8
Bias	9	Describe any efforts to address potential sources of bias	8
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	8
		(c) Explain how missing data were addressed	8
		(d) If applicable, explain how loss to follow-up was addressed	
		(e) Describe any sensitivity analyses	8, 9
Results			
Participants	13	(a) Report numbers of individuals at each stage of study—for example, numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analyzed	10
		(b) Give reasons for nonparticipation at each stage	12
		(c) Consider use of a flow diagram	NA*
Descriptive data	14	(a) Give characteristics of study participants (for example, demographic, clinical, and social) and information on exposures and potential confounders	10
		(b) Indicate number of participants with missing data for each variable of interest	11
		(c) Summarize follow-up time (for example, average and total amount)	11, 12
Outcome data	15	Report numbers of outcome events or summary measures over time	10
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (for example, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	18, 21, 29-41
		(*b*) Report category boundaries when continuous variables were categorized	21
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—for example analyses of subgroups and interactions, and sensitivity analyses	28-41
Discussion			
Key results	18	Summarize key results with reference to study objectives	12

* NA: Not applicable.

eTable 1. Continued

VARIABLE	ITEM NO.	RECOMMENDATION	PAGE NO.
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	12-13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	13-14
Generalizability	21	Discuss the generalizability (external validity) of the study results	15
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

eTable 2. Temporal trend in the presence of untreated caries over visits: Additional adjustment for school in phase 1 (first 6 schools).

ANY BASELINE CARIES	DENTITION								
		All Teeth		Primary Teeth		Permanent Teeth		Occlusal Surface	
	No.	OR*†	95% CI‡	OR†	95% CI	OR†	95% CI	OR†	95% CI
Main Results									
No baseline caries	1,197	1.07	0.98 to 1.16	1.15	1.05 to 1.26	0.81	0.69 to 0.94	0.84	0.69 to 1.02
With baseline caries	778	0.79	0.73 to 0.85	0.90	0.83 to 0.97	0.70	0.63 to 0.78	0.72	0.63 to 0.81
Adjusted for School									
No baseline caries	1,197	1.06	0.97 to 1.15	1.14	1.04 to 1.26	0.80	0.69 to 0.93	0.84	0.69 to 1.02
With baseline caries	778	0.78	0.72 to 0.85	0.89	0.83 to 0.97	0.69	0.62 to 0.77	0.72	0.63 to 0.81

* OR: Odds ratio. † ORs were estimated through generalized estimating equations models with a logit link and exchangeable correlation matrix to account for the repeated measures per participant. All models were adjusted for participants' sex, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate, the baseline visit was not included in modeling the temporal trend. Analyses adjusted for school additionally included indicators for the 6 schools. ‡ CI: Confidence interval.

eTable 3. Per-visit change in prevalence of untreated caries among children: School random effects.

ANY BASELINE CARIES	DENTITION											
	All Teeth			Primary Teeth			Permanent Teeth			Occlusal Surface		
	No.	OR*†	95% CI‡	No.	OR†	95% CI	No.	OR†	95% CI	No.	OR†	95% CI
First 6 Schools												
No baseline caries	1,197	1.09	0.96 to 1.23	1,294	1.21	1.05 to 1.38	1,699	0.83	0.72 to 0.95	1,760	0.84	0.70 to 1.00
With baseline caries	778	0.66	0.58 to 0.75	681	0.71	0.62 to 0.82	276	0.47	0.38 to 0.58	215	0.46	0.35 to 0.81
Additional Schools												
No baseline caries	2,430	1.05	0.93 to 1.18	2,523	1.13	0.99 to 1.29	3,226	0.89	0.76 to 1.06	3,286	0.82	0.64 to 1.06
With baseline caries	948	0.55	0.47 to 0.64	855	0.49	0.41 to 0.59	152	0.41	0.27 to 0.61	92	0.29	0.16 to 0.52

* OR: Odds ratio. † ORs were estimated through multilevel mixed-effects logistic models with a logit link. All models were adjusted for participants' sex, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate, the baseline visits were not included in modeling the temporal trend. The analysis included a random effect for school. ‡ CI: Confidence interval.

eTable 4. Temporal trend in the presence of untreated caries over visits: Exploration of possible confounding by race in all 33 schools (phases 1 and 2).

ANALYSIS STRATIFIED BY ANY BASELINE CARIES	DENTITION								
		All Teeth		Primary Teeth		Permanent Teeth		Occlusal Surface	
	No.	OR*†	95% CI‡	OR†	95% CI	OR†	95% CI	OR†	95% CI
Main Results									
No baseline caries	3,627	1.04	0.99 to 1.10	1.11	1.04 to 1.18	0.84	0.74 to 0.95	0.85	0.72 to 1.01
With baseline caries	1,726	0.75	0.71 to 0.80	0.81	0.77 to 0.86	0.75	0.69 to 0.82	0.74	0.66 to 0.82
Not Missing Race									
No baseline caries	1,062	1.01	0.89 to 1.14	1.08	0.94 to 1.23	0.63	0.41 to 0.95	0.79	0.48 to 1.32
With baseline caries	452	0.76	0.68 to 0.86	0.84	0.75 to 0.94	0.68	0.52 t 0.87	0.57	0.40 to 0.82
Missing Race									
No baseline caries	2,565	1.04	0.98 to 1.11	1.10	1.03 to 1.18	0.85	0.75 to 0.97	0.84	0.71 to 1.01
With baseline caries	1,274	0.75	0.71 to 0.80	0.81	0.76 to 0.86	0.75	0.68 to 0.82	0.75	0.67 to 0.83
Adjusted for Race									
No baseline caries	1,062	1.01	0.89 to 1.14	1.07	0.94 to 1.22	0.61	0.40 to 0.92	0.76	0.46 to 1.26
With baseline caries	452	0.76	0.67 to 0.86	0.83	0.74 to 0.93	0.66	0.51 to 0.84	0.55	0.39 to 0.78

* OR: Odds ratio. † ORs were estimated through generalized estimating equations models with a logit link and exchangeable correlation matrix to account for the repeated measures per participant. All models were adjusted for participants' sex, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate, the baseline visit was not included in modeling the temporal trend. ‡ CI: Confidence interval.

eTable 5. Temporal trend in the presence of untreated caries over visits: Exploration of possible confounding by race in first 6 schools (phase 1).

ANALYSIS STRATIFIED BY ANY BASELINE CARIES	DENTITION								
		All Teeth		Primary Teeth		Permanent Teeth		Occlusal Surface	
	No.	OR*†	95% CI‡	OR†	95% CI	OR†	95% CI	OR†	95% CI
Main Results									
No baseline caries	1,197	1.07	0.98 to 1.16	1.15	1.05 to 1.26	0.81	0.69 to 0.94	0.84	0.69 to 1.02
With baseline caries	778	0.79	0.73 to 0.85	0.90	0.83 to 0.97	0.70	0.63 to 0.78	0.72	0.63 to 0.81
Not Missing Race									
No baseline caries	237	1.02	0.84 to 1.25	1.11	0.90 to 1.37	0.68	0.44 to 1.05	0.86	0.50 to 1.46
With baseline caries	124	0.80	0.65 to 0.97	0.90	0.75 to 1.08	0.75	0.56 to 1.01	0.81	0.57 to 1.17
Missing Race									
No baseline caries	960	1.07	0.97 to 1.17	1.14	1.03 to 1.27	0.83	0.70 to 0.97	0.84	0.68 to 1.04
With baseline caries	654	0.78	0.72 to 0.85	0.89	0.82 to 0.97	0.69	0.61 to 0.78	0.70	0.62 to 0.80
Adjusted for Race									
No baseline caries	237	1.02	0.84 to 1.25	1.10	0.89 to 1.36	0.68	0.44 to 1.06	0.85	0.50 to 1.46
With baseline caries	124	0.79	0.65 to 0.97	0.89	0.74 to 1.07	0.74	0.55 to 1.00	0.81	0.56 to 1.17

* OR: Odds ratio. † Odds ratios were estimated through generalized estimating equations models with a logit link and exchangeable correlation matrix to account for the repeated measures per participant. All models were adjusted for participants' sex, school, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate, the baseline visit was not included in modeling the temporal trend. ‡ CI: Confidence interval.

eTable 6. Temporal trend in the presence of untreated caries over visits: Exploration of possible confounding by race in latter 27 schools (phase 2).

ANALYSIS STRATIFIED BY ANY BASELINE CARIES	DENTITION								
		All Teeth		Primary Teeth		Permanent Teeth		Occlusal Surface	
	No.	OR*†	95% CI‡	OR†	95% CI	OR†	95% CI	OR†	95% CI
Main Results									
No baseline caries	2,430	1.03	0.96 to 1.11	1.09	1.01 to 1.19	0.82	0.67 to 1.00	0.79	0.58 to 1.06
With baseline caries	948	0.73	0.67 to 0.79	0.75	0.69 to 0.82	0.80	0.68 to 0.94	0.69	0.55 to 0.86
Not Missing Race									
No baseline caries	825	0.98	0.83 to 1.16	1.06	0.90 to 1.26	0.36	0.12 to 1.06	0.46	0.10 to 2.15
With baseline caries	328	0.68	0.57 to 0.80	0.75	0.64 to 0.89	0.58	0.37 to 0.91	0.38	0.18 to 0.78
Missing Race									
No baseline caries	1,605	1.03	0.95 to 1.13	1.09	0.99 to 1.19	0.85	0.70 to 1.04	0.79	0.58 to 1.08
With baseline caries	620	0.74	0.67 to 0.81	0.75	0.68 to 0.82	0.85	0.72 to 1.01	0.79	0.62 to 0.99
Adjusted for Race									
No baseline caries	825	0.98	0.83 to 1.15	1.06	0.89 to 1.26	0.37	0.12 to 1.07	0.46	0.10 to 2.18
With baseline caries	328	0.68	0.57 to 0.80	0.75	0.64 to 0.88	0.58	0.38 to 0.91	0.39	0.19 to 0.79

* OR: Odds ratio. † ORs were estimated through generalized estimating equations models with a logit link and exchangeable correlation matrix to account for the repeated measures per participant. All models were adjusted for participants' sex, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate the baseline visit was not included in modeling the temporal trend. ‡ CI: Confidence interval.

eTable 7. Temporal trend in the presence of untreated caries over visits: Restriction to fixed numbers of visits to explore attrition bias in all 33 schools (phases 1 and 2).

ANY BASELINE CARIES	DENTITION								
		All Teeth		Primary Teeth		Permanent Teeth		Occlusal Surface	
	No.	OR*†	95% CI‡	OR†	95% CI	OR†	95% CI	OR†	95% CI
Main Results									
No baseline caries	3,627	1.04	0.99 to 1.10	1.11	1.04 to 1.18	0.84	0.74 to 0.95	0.85	0.72 to 1.01
With baseline caries	1726	0.75	0.71 to 0.80	0.81	0.77 to 0.86	0.75	0.69 to 0.82	0.74	0.66 to 0.82
3 Visits									
No baseline caries	550	1.28	0.97 to 1.68	1.31	0.98 to 1.74	1.57	0.88 to 2.80	1.25	0.57 to 2.76
With baseline caries	328	0.76	0.59 to 0.97	0.83	0.66 to 1.05	0.84	0.60 to 1.18	0.71	0.48 to 1.05
4 Visits									
No baseline caries	679	1.12	0.98 to 1.27	1.15	1.00 to 1.32	0.84	0.64 to 1.09	0.74	0.52 to 1.05
With baseline caries	299	0.65	0.56 to 0.75	0.72	0.63 to 0.83	0.61	0.50 to 0.76	0.73	0.57 to 0.92
5 Visits									
No baseline caries	268	1.09	0.95 to 1.25	1.16	0.99 to 1.35	0.74	0.56 to 0.98	0.74	0.52 to 1.06
With baseline caries	146	0.83	0.72 to 0.97	0.88	0.76 to 1.03	0.64	0.51 to 0.81	0.61	0.47 to 0.80
6 Visits									
No baseline caries	223	0.98	0.87 to 1.11	1.02	0.90 to 1.16	0.73	0.55 to 0.96	0.86	0.61 to 1.22
With baseline caries	110	0.77	0.68 to 0.88	0.81	0.71 to 0.92	0.75	0.61 to 0.92	0.68 to 0.52	0.88

* OR: Odds ratio. † ORs were estimated through generalized estimating equations models with a logit link and exchangeable correlation matrix to account for the repeated measures per participant. All models were adjusted for participants' sex, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate, the baseline visit was not included in modeling the temporal trend. ‡ CI: Confidence interval.

eTable 8. Temporal trend in the presence of untreated caries over visits: Restriction to fixed numbers of visits to explore attrition bias in first 6 schools (phase 1).

ANY BASELINE CARIES	DENTITION								
		All Teeth		Primary Teeth		Permanent Teeth		Occlusal Surface	
	No.	OR*†	95% CI‡	OR†	95% CI	OR†	95% CI	OR†	95% CI
Main Results									
No baseline caries	1,197	1.07	0.98 to 1.16	1.15	1.05 to 1.26	0.81	0.69 to 0.94	0.84	0.69 to 1.02
With baseline caries	778	0.79	0.73 to 0.85	0.90	0.83 to 0.97	0.70	0.63 to 0.78	0.72	0.63 to 0.81
3 Visits									
No baseline caries	164	1.32	0.79 to 2.21	1.29	0.72 to 2.31	1.38	0.65 to 2.92	1.52	0.57 to 4.07
With baseline caries	149	0.73	0.49 to 1.08	0.92	0.63 to 1.36	0.75	0.50 to 1.14	0.81	0.51 to 1.29
4 Visits									
No baseline caries	236	1.09	0.86 to 1.37	1.24	0.96 to 1.60	0.62	0.41 to 0.94	0.57	0.33 to 0.99
With baseline caries	135	0.67	0.53 to 0.85	0.82	0.65 to 1.03	0.62	0.46 to 0.84	0.77	0.56 to 1.06
5 Visits									
No baseline caries	95	1.24	1.00 to 1.54	1.25	0.98 to 1.60	1.07	0.76 to 1.50	1.10	0.71 to 1.72
With baseline caries	95	0.82	0.67 to 1.00	0.91	0.74 to 1.12	0.71	0.54 to 0.94	0.73	0.54 to 0.99
6 Visits									
No baseline caries	97	1.10	0.90 to 1.33	1.18	0.96 to 1.45	0.73	0.50 to 1.07	0.94	0.60 to 1.45
With baseline caries	60	0.90	0.73 to 1.10	0.99	0.81 to 1.21	0.74	0.55 to 0.99	0.71	0.50 to 1.02

* OR: Odds ratio. † ORs were estimated through generalized estimating equations models with a logit link and exchangeable correlation matrix to account for the repeated measures per participant. All models were adjusted for participants' sex, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate, the baseline visit was not included in modeling the temporal trend. ‡ CI: Confidence interval.

eTable 9. Temporal trend in the presence of untreated caries over visits: Restriction to fixed numbers of visits to explore attrition bias in later 27 schools (phase 2).

ANY BASELINE CARIES	DENTITION								
		All Teeth		Primary Teeth		Permanent Teeth		Occlusal Surface	
	No.	OR*†	95% CI‡	OR†	95% CI	OR†	95% CI	OR†	95% CI
Main Results									
No baseline caries	2430	1.03	0.96 to 1.11	1.09	1.01 to 1.19	0.82	0.67 to 1.00	0.79	0.58 to 1.06
With baseline caries	948	0.73	0.67 to 0.79	0.75	0.69 to 0.82	0.80	0.68 to 0.94	0.69	0.55 to 0.86
3 Visits									
No baseline caries	386	1.24	0.90 to 1.71	1.29	0.94 to 1.78	1.84	0.68 to 4.96	0.87	0.20 to 3.79
With baseline caries	179	0.79	0.57 to 1.08	0.78	0.58 to 1.04	1.28	0.61 to 2.67	0.52	0.20 to 1.34
4 Visits									
No baseline caries	443	1.14	0.98 to 1.33	1.11	0.94 to 1.32	1.02	0.72 to 1.46	0.96	0.60 to 1.53
With baseline caries	164	0.65	0.55 to 0.78	0.68	0.57 to 0.81	0.56	0.40 to 0.79	0.57	0.38 to 0.87
5 Visits									
No baseline caries	173	1.04	0.85 to 1.27	1.15	0.93 to 1.41	0.31	0.16 to 0.62	0.36	0.16 to 0.81
With baseline caries	51	0.92	0.73 to 1.15	0.95	0.75 to 1.19	0.58	0.36 to 0.94	0.52	0.30 to 0.90
6 Visits									
No baseline caries	126	0.93	0.79 to 1.09	0.95	0.81 to 1.13	0.70	0.46 to 1.08	0.75	0.40 to 1.44
With baseline caries	50	0.70	0.59 to 0.84	0.70	0.59 to 0.84	0.79	0.57 to 1.09	0.65	0.42 to 0.99

* OR: Odds ratio. † ORs were estimated through generalized estimating equations models with a logit link and exchangeable correlation matrix to account for the repeated measures per participant. All models were adjusted for participants' sex, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate, the baseline visit was not included in modeling the temporal trend. ‡ CI: Confidence interval.

eTable 10. Temporal trend in the presence of untreated caries over visits: Exploration of other sources of bias in all 33 schools (phases 1 and 2).

ANY BASELINE CARIES	DENTITION								
		All Teeth		Primary Teeth		Permanent Teeth		Occlusal Surface	
	No.	OR*†	95% CI‡	OR†	95% CI	OR†	95% CI	OR†	95% CI
Main Results									
No baseline caries	3,627	1.04	0.99 to 1.10	1.11	1.04 to 1.18	0.84	0.74 to 0.95	0.85	0.72 to 1.01
With baseline caries	1,726	0.75	0.71 to 0.80	0.81	0.77 to 0.86	0.75	0.69 to 0.82	0.74	0.66 to 0.82
Fewer Than 4 Teeth With Untreated Baseline Caries									
No baseline caries	3,627	1.03	0.98 to 1.09	1.09	1.02 to 1.16	0.85	0.75 to 0.96	0.88	0.74 to 1.04
With baseline caries	1,291	0.76	0.72 to 0.81	0.81	0.76 to 0.87	0.79	0.71 to 0.88	0.75	0.65 to 0.86
Fewer Than 6 Teeth With Baseline Caries Experience									
No baseline caries	3,316	1.04	0.98 to 1.11	1.10	1.03 to 1.17	0.86	0.76 to 0.98	0.89	0.74 to 1.07
With baseline caries	1,225	0.77	0.72 to 0.82	0.82	0.77 to 0.88	0.80	0.72 to 0.89	0.81	0.71 to 0.92
Baseline Age Younger Than 8 Years									
No baseline caries	2,224	1.08	1.00 to 1.16	1.13	1.05 to 1.22	0.76	0.63 to 0.90	0.88	0.70 to 1.09
With baseline caries	992	0.80	0.74 to 0.86	0.85	0.79 to 0.92	0.71	0.62 to 0.81	0.69	0.59 to 0.81
Fifth Visit or Earlier (Fourth Post-Baseline Visit)									
No baseline caries	3,627	1.07	1.01 to 1.14	1.13	1.06 to 1.21	0.90	0.79 to 1.03	0.89	0.74 to 1.06
With baseline caries	1,726	0.75	0.71 to 0.80	0.81	0.76 to 0.86	0.78	0.71 to 0.86	0.76	0.68 to 0.85

* OR: Odds ratio. † ORs were estimated through generalized estimating equations models with a logit link and exchangeable correlation matrix to account for the repeated measures per participant. All models were adjusted for participants' sex, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate, the baseline visit was not included in modeling the temporal trend. ‡ CI: Confidence interval.

eTable 11. Temporal trend in the presence of untreated caries over visits: Exploration of other sources of bias in the first 6 schools (phase 1).

ANY BASELINE CARIES		DENTITION							
		All Teeth		Primary Teeth		Permanent Teeth		Occlusal Surface	
	No.	OR*†	95% CI‡	OR†	95% CI	OR†	95% CI	OR†	95% CI
Main Results									
No baseline caries	1,197	1.07	0.98 to 1.16	1.15	1.05 to 1.26	0.81	0.69 to 0.94	0.84	0.69 to 1.02
With baseline caries	778	0.79	0.73 to 0.85	0.90	0.83 to 0.97	0.70	0.63 to 0.78	0.72	0.63 to 0.81
Fewer Than 4 Teeth With Untreated Baseline Caries									
No baseline caries	1,197	1.06	0.97 to 1.15	1.13	1.03 to 1.25	0.82	0.70 to 0.95	0.87	0.71 to 1.06
With baseline caries	541	0.82	0.75 to 0.90	0.93	0.85 to 1.02	0.73	0.64 to 0.84	0.74	0.63 to 0.88
Fewer Than 6 Teeth With Baseline Caries Experience									
No baseline caries	1,083	1.06	0.97 to 1.16	1.13	1.02 to 1.25	0.83	0.70 to 0.97	0.88	0.71 to 1.08
With baseline caries	525	0.81	0.74 to 0.89	0.93	0.84 to 1.01	0.75	0.65 to 0.85	0.78	0.67 to 0.91
Baseline Age Younger Than 8 Years									
No baseline caries	824	1.17	1.06 to 1.31	1.26	1.13 to 1.41	0.75	0.61 to 0.93	0.96	0.74 to 1.23
With baseline caries	480	0.88	0.79 to 0.97	0.97	0.88 to 1.08	0.70	0.60 to 0.81	0.71	0.59 to 0.85
Fifth Visit or Earlier (Fourth Post-Baseline Visit)									
No baseline caries	1,197	1.07	0.97 to 1.19	1.14	1.02 to 1.27	0.86	0.72 to 1.02	0.86	0.69 to 1.08
With baseline caries	778	0.78	0.72 to 0.86	0.89	0.81 to 0.97	0.73	0.65 to 0.82	0.73	0.64 to 0.84

* OR: Odds ratio. † ORs were estimated through generalized estimating equations models with a logit link and exchangeable correlation matrix to account for the repeated measures per participant. All models were adjusted for participants' sex, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate, the baseline visit was not included in modeling the temporal trend. ‡ CI: Confidence interval.

eTable 12. Temporal trend in the presence of untreated caries over visits: Exploration of other sources of bias in later 27 schools (phase 2).

ANY BASELINE CARIES		DENTITION							
		All Teeth		Primary Teeth		Permanent Teeth		Occlusal Surface	
	No.	OR*†	95% CI‡	OR†	95% CI	OR†	95% CI	OR†	95% CI
Main Results									
No baseline caries	2,430	1.03	0.96 to 1.11	1.09	1.01 to 1.19	0.82	0.67 to 1.00	0.79	0.58 to 1.06
With baseline caries	948	0.73	0.67 to 0.79	0.75	0.69 to 0.82	0.80	0.68 to 0.94	0.69	0.55 to 0.86
Fewer Than 4 Teeth With Untreated Baseline Caries									
No baseline caries	2,430	1.02	0.95 to 1.10	1.08	0.99 to 1.17	0.82	0.68 to 1.00	0.80	0.59 to 1.08
With baseline caries	750	0.72	0.65 to 0.79	0.72	0.66 to 0.80	0.81	0.67 to 0.97	0.69	0.53 to 0.90
Fewer Than 6 Teeth With Baseline Caries Experience									
No baseline caries	2,233	1.03	0.95 to 1.12	1.09	1.00 to 1.19	0.83	0.67 to 1.03	0.79	0.55 to 1.13
With baseline caries	700	0.73	0.67 to 0.81	0.74	0.67 to 0.82	0.83	0.68 to 1.00	0.79	0.62 to 1.01
Baseline Age Younger Than 8 Years									
No baseline caries	1,400	1.01	0.91 to 1.12	1.04	0.93 to 1.16	0.84	0.62 to 1.14	0.79	0.51 to 1.22
With baseline caries	512	0.74	0.66 to 0.83	0.75	0.67 to 0.85	0.87	0.67 to 1.11	0.80	0.58 to 1.11
Fifth Visit or Earlier (Fourth Post-Baseline Visit)									
No baseline caries	2,430	1.08	0.99 to 1.17	1.14	1.05 to 1.25	0.89	0.72 to 1.09	0.84	0.62 to 1.16
With baseline caries	948	0.73	0.66 to 0.80	0.76	0.69 to 0.83	0.80	0.67 to 0.95	0.74	0.59 to 0.93

* OR: Odds ratio. † ORs were estimated through generalized estimating equations models with a logit link and exchangeable correlation matrix to account for the repeated measures per participant. All models were adjusted for participants' sex, age at examination, and evidence of any previous oral health care (yes or no). Other than as a covariate, the baseline visit was not included in modeling the temporal trend. ‡ CI: Confidence interval.