School-based Preventive Dental Care: A Different View

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The title of the preceding article in this issue—Cost and Effectiveness of School-based Preventive Dental Care[1]—is unfortunately misleading. The National Preventive Dentistry Demonstration Program (NPDDP) was an ambitious undertaking with many merits as a research program, but it was not designed to have evaluative public policy implications for the type of school-based preventive dental programs that exist in most states. The purpose of the study, as presented in their initial proposal (5/10/76) was to "provide data on the effectiveness of already validated preventive dentistry procedures when applied in various combinations by appropriate dental, auxiliary and school personnel." This is indeed the type of data that is presented in their report.

Why then have these results been so misinterpreted and overinterpreted? This is difficult to understand, especially in light of the gross differences between NPDDP and typical public health programs, differences not only in program objectives (research as opposed to service delivery), but also in program design, administration, implementation, and evaluation, as compared with typical public health programs.

The usual school-based dental public health program is run with largely volunteer help. The hygienists, coordinators, assistants, clerks, dentists, etc., paid at each program site in the NPDDP is a far cry from any real public health program, especially for the small number of participants served (slightly over 2,000 per site initially, and approximately half that at the end of four years). The New York State preventive dentistry fluoride mouthrinse and tablet programs, for example, serve over 65,000 children annually in New York State; they are conducted by a paid staff consisting of one dental hygienist, who administers the program, orders all supplies, and provides in-service training to teachers, school nurses, and other volunteer school personnel, as well as recruiting new program sites. The supply budget for this NYS program serving 65,000 children was $40,000 in 1981. This contrasts sharply with the programs described by Klein, *et al,* where classroom lessons and brushing alone (no rinsing or tablets included) conducted by teachers *not paid* by the project, cost $7.36 per child per year for labor alone. If this research program had been conducted on a scale similar to our New York State program, the per capita cost of labor and supplies for brushing, flossing, and rinsing (reported as $15.15 per child, Table 6[1]) would have amounted to almost $1 million for the 65,000 children currently participating in our rinse programs.

Even more obvious in its contrast to a public health program is the methodology for testing the effectiveness of sealants used by Klein, *et al.* Annual direct per capita costs of $23 per child per year for sealant or prophy/gel applications were cited. This is far more than would be expected in an actual public health program, primarily due to the manner in which the research program was conducted and the number of personnel utilized for this particular research application. The NPDDP apparently applied sealants to all posterior teeth, not targeting the measure to teeth at risk, as is frequently done; moreover, each child was reexamined initially at three-month intervals, and after one year at six-month intervals,[2] and sealants reapplied up to three times during the study period. This, certainly, is the ideal way in which to test the effectiveness of sealants, but it bears very little relationship to the real world and even less to the real world of public health programs. Even sealants applied by private dentists in their offices would probably not receive such frequent follow-up. The purpose of public health programs is to do the most good for the most people, particularly those with greatest need or at highest risk. Yearly follow-up would be considered adequate in a public health program, as the increment in cost needed for more frequent examinations is better spent in providing services to additional children.

Another departure from reality taken by this research study involved the clinical procedures employed. In almost all instances (80 per cent) where sealants were applied, a fluoride paste prohylaxis and fluoride gel treatment were also given. Although not specified in the procedures listed, it must be assumed that the investigators adhered to manufacturers' instructions regarding the contraindications to using a fluoride prophy paste prior to sealing teeth, which means that there was a duplication of effort: the procedure followed in application of sealants must have involved a non-fluoride prophylaxis prior to sealant application, and the sealant application must then have been followed by another prophylaxis, this time with fluoride, and then a fluoride gel application. This certainly bears no resembalance to any public health program. It is no wonder that the cost of these procedures amounted to $40.02 per child per year in this study.

The combined use of fluoride tablets and fluoride mouthrinse in all non-fluoridated sites in the study would also be an anomaly in public health programs. Since tablets given to 5th graders could affect no developing teeth other than third molars, and those given to first and second graders could have only the most minimal effect on the almost fully developed permanent teeth of these children, the reason for including tablets in the study could only have been to elucidate a purely research question concerning incremental topical effects in combination with fluoride mouthrinse. Public health programs, in contrast, would target use of tablets to preschool and kindergarten populations where there would still be appreciable systemic benefits, i.e., when they would be cost-effective.

These brief examples serve to illustrate how erroneous it is to interpret results of this large scale research study as having implications for the unpretentious dental public health programs common in this country. Other points deserve some mention, however. One of these is the discontinuance of all but the clinic procedures (sealants and prophy/gel applications) for Cohort 5 children after the first 1.5 years. This administrative decision reflected the difficulties in student adherence and teacher/volunteer participation that are frequently encountered in such programs. The

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casual reader, however, might fail to take this into account when reading the tables included in the article. The authors' Tables 4 and 5 might better have been presented omitting the misleading information for Cohort 5 regimens. That would include omitting almost half of Table 4 and fully one-fourth of Table 5. The effect of such omissions is displayed in Tables 1 and 2 of the present paper.

The revised Tables make it clear that all preventive measures applied for the duration of the study significantly reduced decay, with the exception of the classroom procedures in fluoridated areas, and lessons and brushing in both fluoridated and non-fluoridated samples. These results, confirming the non-significant reduction in DMFS (decayed, missing, filled surfaces) which occurs in fluoridated areas with the additive benefit of rinse, are not surprising. Likewise, the classroom lessons and brushing for first and second grade children would not be expected to impact significantly on DMFS in so short a period of time; hopefully they would improve oral hygiene (which was not reported in the NPDDP study) and impart the necessary skills and habits which would lead to fewer periodontal problems later in life.

Still another possible source of the misinterpretations is the lack of stress placed by the authors on the difference between the incremental program effects of the measure used and the "actual" effectiveness of these measures. When preventive measures are used in combinations, it cannot be assumed that the effects are additive. Although prophy/gel applications have been shown to be effective in reducing decay in many studies, if they are used in combination with a measure that also results in a significant reduction in caries, an asymptotic effect in reduction of incremental caries would be expected. Thus, comparison of the .44 surfaces saved by the fluoride rinse used in combination with other procedures to an estimation of the effectiveness of fluoride rinse when used alone would most probably result in different degrees of caries reduction, with the former always a lower estimate than the latter.

In effect, the applicable four-year program results of the NPDDP study present a favorable impression of preventive measures applied in a school-based setting. Fluoride mouthrinsing (the effects of tablets can be safely ignored) was significantly effective in reducing caries. The .44 surfaces incremental reduction reported is a cautious estimation of the actual effect, due to the manner in which the researchers evaluated this effect. In addition, use of Regimen 6 (no treatment) as the control group for estimating the size of the treatment effects probably resulted in an underestimation of the actual effectiveness of the regimen as the impact of the Hawthorne effect (a measurable change, irrespective of the intervention attempted, due solely to participation in a study) was not controlled for. The authors remark, in fact, in a previous publication[2] on the surprisingly small DMFS increment in their Regimen 6 group, but attribute this to secular decline and a possible shift in examination standards.

Two final points deserve mention. It would have been interesting if, in addition to mean DMFS increments, the authors could also have reported the proportion of children benefiting from the procedures; the latter measure would have given another and very enlightening, view of the results. Moreover, the DMFS increments were not reported by type of surface, so that there was no way to determine how effective the rinse was in protecting the smooth surfaces, and how effective the sealants were in preventing occlusal caries. Although it is realized that only selected information can be presented in a short paper such as the one under discussion, this type of analysis would have aided the reader in judging the actual impact of the preventive measures on the surfaces they affect, and would have added definition to the findings.

It should be emphasized, however, that the NPDDP was not designed in a way that would allow conclusions to be drawn about the cost of preventive dental public health programs, nor was it designed to test the effectiveness of preventive measures as employed in the usual dental public health programs. This lack of validity of the NPDDP applies only to extrapolation of its results to dental public health programs in general, that is, its public policy implications. The ability of these findings to accurately measure the incremental caries-inhibitory effects of various combinations of dental preventive measures as applied in a national research program of this particular design is not in question.

The major practical value of these results lies in supporting the type of resource targeting that is commonly practiced by public health planners, e.g., initiating fluoride-supplement programs with particular age groups of school children in non-fluoridated low socioeconomic areas in order to maximize the effects. The results reaffirmed fluoridation of public water supplies as the most cost-effective dental public health measure, and sealants as extremely effective in

TABLE 1—Difference between Each Regimen and Its Longitudinal Control Group in the Mean Number of Surfaces that Became Decayed in Four Years

Regimen	Nonfluoridated		Fluoridated	
	Cohort 1 + 2	Cohort 5	Cohort 1 + 2	Cohort 5
1 Rinse [Tablets] + Lessons + Brushing + Sealants + Prophy/Gel	1.90**	XX	1.29**	XX
2 Rinse + Lessons + Brushing + Sealants			1.00**	XX
2 Rinse + Tablets + Lessons + Brushing + Prophy/Gel	.68*	XX		
3 Sealants + Prophy/Gel	1.68**	1.83**	1.24**	1.74**
4 Rinse [Tablets] + Lessons + Brushing	.67*	XX	0.04	XX
5 Lessons + Brushing	.12	XX	−0.25	XX

XX—4-year results not obtained.
*Differs from Regimen 6 at the 0.01 level.
**Differs from Regimen 6 at the 0.001 level.

TABLE 2—Reductions in four-year DMFS Increments, by Treatment Procedure, Cohort, and Fluoridation Status

Procedures	Nonfluoridated		Fluoridated	
	Cohort 1 + 2	Cohort 5	Cohort 1 + 2	Cohort 5
Clinic				
Sealants	1.33**	1.11*	.96**	2.00**
Prophy/gel	.12	1.04	.29	.18
TOTAL	1.46**	2.15**	1.25**	2.18**
Classroom				
Mouthrinse/tablets	.44*	XX	.29	XX
Health lessons	.01	XX	−.24	XX
TOTAL	.45	XX	.05	XX

XX—4-year results not obtained.
*Differs from zero at the 0.05 level.
**Differs from zero at the 0.001 level.

preventing caries. The non-significant incremental effect demonstrated of prophy/gel applications when employed in combination with other procedures (most notably sealants) in reducing tooth morbidity will also be useful for public health planners who were considering this combination of preventive measures.

Unfortunately, these findings have been overshadowed by the monstrous cost of conducting a large scale research project compared to the circumscribed nature of the findings. Neither the scale nor the expense justify the application of the findings to nonapplicable situations. To use these results as a reference for cost or effectiveness data for school-based dental public health programs does such programs a grave injustice, yet the misleading nature of the article's title invites such errors. Unquestionably, the results presented by Klein, *et al.*, have some implications for school-based dental public health programs, when judiciously examined. In contrast to prevalent misinterpretations of these findings, their implications are overwhelmingly favorable.

REFERENCES

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