Community-oriented Oral Health Promotion for Infants in Jerusalem: Evaluation of a Program Trial

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Abstract

Objectives: *This study sought to measure the effect of a community health education program on reported infants' bottle-feeding practices and infants' toothbrushing behavior, with or without distribution of toothpaste and toothbrushes.* ***Methods:*** *In this quasi-experimental comparison group design study conducted in mother and child health centers in Jerusalem, parents of 727 children were surveyed by telephone at baseline and six months later. The cohort of infants was aged 6–12 months at baseline. The program group received structured health education. The control group received no organized educational intervention. Within the program and control groups, half of the centers were randomly given toothpaste and toothbrushes.* ***Results:*** *Parents' reports revealed a secular 32.5 percent increase in toothbrushing for infants with no intervention, 45.1 percent for infants only receiving toothpaste and toothbrushes, 43.7 percent for infants only receiving the health education program, and a 60.4 percent increase for infants receiving health education together with toothpaste and toothbrushes (chi-square, P=.0002). Modification of bottle-drinking practices, in this program, was unsuccessful.* ***Conclusion:*** *The free distribution of toothpaste and toothbrushes, together with an oral health education program, is recommended as a potentially practical and effective method of promoting early oral hygiene practices. [J Public Health Dent 2001;61(2):107-13]*

Key Words: early childhood caries, bottle feeding, fluoride-containing dentifrice, preventive dentistry, sugar consumption.

Early childhood caries (ECC), which involves rampant dental caries among infants, remains a disease of serious public health concern in most countries (1-2). ECC predominantly affects the maxillary anterior incisors and canines, but may also affect the rest of the deciduous dentition (2). The current understanding of ECC proposes a wide and complex etiology, including but not exclusively limited to infants' diet, sleeping behavior, and bacterial infection (1,2).

The epidemiology of ECC has been described in a wide range of studies conducted throughout the world (2). Partly due to lack of uniformity in definition, but also apparently due to differences between cultures, the literature has reported a wide range of prevalences. In a literature review, "nursing caries" levels in England ranged from 1 percent to 12 percent (2). Relatively high levels have been described in the Middle East: 19 percent in Kuwait and 15 percent in Iraq (3,4). Alarmingly high levels of this disease, ranging from 41 percent to 72 percent, have been reported among Native American and Alaskan Native children (5-8).

Community attempts at preventing ECC have traditionally included educational efforts to modify and improve feeding practices. After one three-year intense educational program conducted among Native American children—which included the training of parent volunteers, health professionals, and tribal employees, a media campaign in each community, training manuals, counseling booklets, posters, and bumper stickers—ECC prevalence decreased from 57 percent to 43 percent (8). In a Canadian longitudinal study of a high-risk ECC community, the proportion of infants who slept with bottles decreased from 57 percent to 42 percent over a five-year period (9). In a US project evaluated after eight years, a 38 percent reduction in ECC was found among those high-risk communities that continued participation in the program (10). It should be noted that this evaluation was noncontrolled. Despite the modest improvements reported in some studies, other authors have reported failure in changing the feeding practices of mothers despite a reported improvement in their knowledge (11). In a meta-analysis of 134 studies, the authors found that dental health education interventions demonstrated a consistent positive effect on knowledge levels, only a small positive and temporary effect on plaque accumulation, and no evident effect on caries development (12).

In view of the reported ambivalent outcomes of health education interventions, alternative methods of preventing ECC have been attempted and evaluated. These have included topical antimicrobial therapy, application of fluoride varnishes, and other methods (13,14).

The caries decline in most developed countries has been widely attributed to fluoridated dentifrice (15). It is therefore disappointing that reports of community programs including promotion of fluoride toothpaste have been difficult to locate in the literature.

The objectives of the present study were to evaluate the effect of a commu-

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TABLE 1
Study Design Distribution of Total Infants and Infants with Erupted Teeth at Baseline, by Station, Participation in Health Education Program, and Toothpaste and Toothbrush Supply

Center Number	Geographic Location and Religious Profile	$Program_1$ Education w/ Toothpaste and Toothbrush	$Program_2$ Educ. w/out Toothpaste and Toothbrush	$Control_1$ Control w/ Toothpaste and Toothbrush	$Control_2$ Control w/out Toothpaste and Toothbrush
A	Southwest*	74‡ (55§)			
B_1	Southwest*	65 (43)			
B_2	Southwest*		58 (37)		
C_1	North*	63 (36)			
C_2	North*		65 (44)		
D_1	Center†	66 (37)			
D_2	Center†		64 (47)		
E_1	South*			61 (41)	
E_2	South*				73 (41)
F_1	Northwest†			72 (42)	
F_2	Northwest†				66 (41)
Total 4 groups		268 (171)	187 (128)	133 (83)	139 (82)
Total study population			727 (464)		

*Mixed secular and moderately religious profile.
†High proportion of Jewish Orthodox population.
‡Numbers of total respondents.
§Respondents with erupted teeth since baseline.

nity oral health program trial conducted among mother and child health (MCH) centers in Jerusalem on reported compliance of parents concerning modification of bottle-feeding practices and toothcleaning of infants. The effect on bottle feeding was assessed and compared between two groups: (1) a program group receiving organized health education intervention, and (2) a control group not receiving organized health education. For toothbrushing the comparison was made among four groups: (1) the health education program group receiving free toothbrushes and toothpaste, (2) the health education program group not receiving free toothbrushes and toothpaste, (3) the control group receiving free toothbrushes and toothpaste, and (4) the control group not receiving free toothbrushes and toothpaste.

Methods

Jerusalem MCH Background. The 36 MCH centers in Jerusalem are attended by 90 percent of the population up to 2 years of age, providing preventive services for a minimal subsidized fee. To date, services have not included oral health promotion. Water fluoridation has been implemented in Jerusalem since the mid-1980s (16).

The Hebrew University-Hadassah Medical School has established a Community Health Center aimed at developing models for comprehensive community-oriented primary health care in one Jerusalem neighborhood (17). Among this population, a preliminary diagnostic study for ECC was conducted among 3-year-old children (18). ECC was operatively defined as two or more carious anterior maxillary teeth. A total of 95 children participated—an 82 percent response rate. Results revealed a 10.5 percent prevalence of ECC. Only 67 percent of children were brushing their teeth with a fluoridated toothpaste and 52 percent were still drinking from sweetened bottles. At the time of this survey, some nurses were mentioning aspects related to dental health, but no organized community program existed. These data supported the case for public health action.

Study Design. The 36 MCH centers in Jerusalem, serving about 90 percent of the Jewish population, are distributed according to geographic region and population density. In consultation with the Jerusalem Municipality Department of Public Health Services, a pair of centers was chosen from each of five large Jerusalem neighborhoods (centers B1+B2, C1+C2, D1+D2, E1+E2, and F1+F2 in Table 1). The sampling method was purposive. Based on data obtained from the municipality, these neighborhoods were chosen as representative of the city's socioeconomic profile, according to religion, economy, family size, and other social variables. The Hadassah Community Health Center MCH was added to these 10 centers, which together served approximately 25 percent of the total Jewish Jerusalem infant population. A systematic sample was chosen so as to include at least 65 infants from each MCH center. The sampling fraction differed according to the original size of each center. The total study sample included 883 mothers of infants.

Religion in Jerusalem (19,20) and Israel (21) has been demonstrated to be significantly associated with health, health behavior, and socioeconomic status (e.g., family size, level of education, and income). This parameter therefore is commonly considered in Jerusalem epidemiologic surveys. Jerusalem neighborhoods are usually characterized by different religious profiles: usually either a secular-moderately religious mixed profile, or pre-

dominantly Orthodox.

Stage 1: Selection of Program Groups. Two secular-moderately religious pairs (B_1+B_2, C_1+C_2) and one predominantly Orthodox pair (D_1+D_2) were chosen to participate in the health education program (groups: $Program_1$ and $Program_2$). The Hadassah Community Health Center (A), secular-moderately religious mixed profile (similar to B_1+B_2, C_1+C_2), was included within the program (group: $Program_1$). The sample sizes in these centers were, on average, 82 percent of the total populations.

Stage 2: Selection of Control Groups. Two pairs, one secular-moderately religious mix (E_1+E_2) and one predominantly Orthodox (F_1+F_2) were chosen as controls (groups: $Control_1$ and $Control_2$). The sampling methodology was based on the same data as that for the program group. As is often the case, it was difficult to convince the authorities (in this case the municipal nurses) of the evaluative importance of a control group receiving no health education intervention. For this reason, there were fewer control centers (four) than program centers (seven). The sizes of populations surveyed in centers E_1, E_2, F_1, F_2 were, on average, 82 percent of the total population.

Stage 3: Selection of Program and Control Groups Receiving Toothbrushes and Toothpaste. The two centers in each pair from the same neighborhood were not situated geographically adjacent or proximal to each other, but their socioeconomic profiles were similar. Within each pair in both the program and the control groups, a random method was used to determine which center was supplied with toothpaste and toothbrushes and which was not. The Hadassah Community Health Center nonrandomly received toothbrushes and toothpastes (included in $Program_1$). In total, six centers (A, B_1, C_1, D_1, E_1, and F_1) received toothbrushes and toothpaste and five (B_2, C_2, D_2, E_2, and F_2) did not.

The final study design, as presented in Table 1, demonstrates the four study groups: $Program_1$ receiving both health education and toothbrushes and toothpaste; $Program_2$ receiving health education, but no toothbrushes and toothpaste; $Control_1$ receiving toothbrushes and toothpaste, but no organized health education; $Control_2$ receiving no organized health education and no toothbrushes and toothpaste.

The Arab East Jerusalem MCH municipal clinics participated in the health education program described here. Inclusion of this population in the current study could have added significant diversity. Unfortunately, it was not possible to divide this population, which all resides in one section of the city, into four different comparable groups.

All registered infants aged 6–12 months in these MCH centers participated in the study. The total initial study sample included 883 infants. The survey was conducted by telephone. All of this population had telephones at home. When a line had been disconnected, the next person on the list was contacted. Mothers were interviewed at baseline, when infants were aged 6–12 months and again six months later, when the children were aged 12–18 months. The intervention was given between these two points of time.

Health Education Program, Organization, Implementation, and Monitoring. Among the 180 MCH nurses working for the Jerusalem municipality, 55 participated in the present study (about five in each center). Nurses were instructed to include oral health, as recommended in the literature (22), within their regular health education. Nurses were provided with basic in-service training regarding methods of cleaning infants' teeth and amount of toothpaste to be placed on toothbrush. Dental models and toothbrushes were used to demonstrate cleaning of all tooth surfaces. No specific toothbrushing method was advocated. A video was shown that provided suggestions for pacifying methods other than the use of bottles. Nurses were encouraged to look at teeth and look for any early signs of caries. Pictures and slides demonstrating ECC were shown.

Educational and Program Aids. A large poster was designed, framed, and hung in all "program" clinics. The slogan read: "Healthy teeth from the beginning—because the beginning counts!" The poster included the following three simple messages in the text:

- Decrease frequency of sweet drinks.
- Begin drinking from a cup as early as possible.
- Start cleaning teeth soon after they erupt.

A short leaflet was published for distribution among parents. A list of simple messages was included, explaining "how to keep your baby's teeth healthy." These messages had been pretested and accordingly modified in a pilot study conducted among nurses of the Hadassah Community Health Center.

Program Structure and Messages Emphasized. During the first year of the infant's life, the mothers usually visit the MCH center four to six times. During the second year, visits are less frequent (two to three visits). Oral health education takes place at most of these visits; however, sometimes mothers visit the centers with acute problems and thus no extra time is available.

Nurses were instructed to include the following topics, in accordance with the literature (22), within the regular health education, dedicating approximately 10–15 minutes at each visit.

During the infant's first year of life:

- reduce sugar added to bottle and other foods;
- refrain from using bottle as pacifier;
- refrain from sleeping with bottle, unless it only contains water; and
- clean teeth daily with fluoridated toothpaste, beginning at the age of tooth eruption.

During the infant's second year:

- introduce drinking from cup and not from the bottle; and
- dental examination by dentist or hygienist.

A checklist was inserted into the existing medical file of each child in the "program" clinics. Nurses were told to repeat health education messages, individually to each mother, at each visit, and to mark on the checklist when this had been done. This is the standard system for monitoring nurses' activities in Jerusalem MCH centers. In this study, checklists were monitored regularly once a month.

Community participation was a primary principle in this effort. Based on feedback from the nurses, we adopted the rationale of keeping this health education program as simple as possible for all those involved. In accordance with requests, we also sent a large photograph of ECC and a large dental

model and toothbrush to all centers. Therefore, nurses who wished to could actively demonstrate toothbrushing skills. This was not an obligatory component of the program.

Nurses were instructed and monitored to implement the same structured health education program to all of the program group centers. The control centers did not receive any structured health education program. If nurses were asked questions, they were instructed to answer and not deny knowledge.

Toothbrushes and Toothpaste. A 250 ppm fluoride (derived from amine-fluoride) toothpaste ("Elmex Kids Club," Gaba International Ltd., Basel, Switzerland) and a small nylon bristle child's toothbrush ("Elmex Junior") were distributed every two months. Mothers therefore received toothbrushes and toothpastes three times over the study period (at baseline and at two and four months).

Interviews of Parents. Interviews at baseline and six months later were conducted by a group of trained and calibrated interviewers, who were blind to the assignment of the study groups. The resident epidemiologist was responsible for the interview process and was present at all times. Questionnaires had been pretested and were easy to understand. Questions included general background information; bottle use, whether the bottle was given at mealtimes, between meals, before sleep and/or during sleep, whether sugar was added; toothbrush use, use of other toothcleaning, toothpaste use, and brand of toothpaste used. Interviewers presented themselves as representatives of the Municipal Public Health Services Department—not necessarily focusing on a dental survey. Parents were promised by the interviewers, who were not health service staff, that all data would remain anonymous. This methodology was intended to minimize potential bias and answers oriented toward pleasing health care providers (23). The same person, almost always the mother, was interviewed at baseline and follow-up. Interviewers were blinded to the group assignments of the interviewed mothers.

Operational Definitions of Positive, Negative, Improved, and Deteriorated Dental Behavior. Regarding bottle-feeding practices, behavior was ranked as positive if the infant was not given a bottle or was given a bottle containing no added extrinsic sugar.

For toothcleaning, behavior was operationally ranked as positive if teeth were brushed with toothbrush and/or toothpaste. (It is recognized that at this age other methods—e.g., fingercloth—are recommended, but this behavior was not found in the present study.)

For both bottle drinking and toothcleaning, there were four possible combinations at the six-month follow-up: (1) those who reported positive behavior before and after, (2) those who reported negative behavior before and after, (3) those who reported positive behavior before and negative behavior after ("deteriorated"), and (4) those who reported negative behavior before and positive behavior after ("improved").

Statistical Analysis

Data were analyzed for changes in reported practices. The null hypothesis was that the improved behaviors, for both toothbrushing and bottle use, would be the same for all groups after the intervention.

Sample size was calculated based

TABLE 2
Reported Dietary Intake Among Infants by Group, During Meals, Between Meals, and at Bedtime from Bottle, and from Bottle with Added Sugar at Baseline and 6 Months

	Program (*N*=412)		Control (*N*=239)		
	%	*n*	%	n	*P*†
During meals					
Bottle					
Baseline	84.5	348	88.7	212	
6 months	59.2	244	56.5	135	.23
*P**	<.0001		<.0001		
Bottle with added sugar					
Baseline	1.5	6	1.3	3	
6 months	10.2	42	6.3	15	.06
*P**	<.0001		.007		
Between meals					
Bottle					
Baseline	90.6	374	90.3	215	
6 months	82.3	340	84.5	201	.64
*P**	.0002		.06‡		
Bottle with added sugar					
Baseline	20.6	85	20.9	50	
6 months	42.4	175	47.3	113	.03
*P**	<.0001		<.0001		
During sleep					
Bottle					
Baseline	23.8	98	25.3	60	
6 months	24.3	100	23.6	56	.62
*P**	.92‡		.72‡		
Bottle with added sugar					
Baseline	1.0	4	1.3	3	
6 months	5.1	21	4.6	11	.91
*P**	.005		.03		
Total	413		239		

*McNemar tests for all comparisons within groups were highly statistically significant for most comparisons between baseline and 6-month follow-up. Nonsignificant comparisons are marked by ‡.

†Pearson chi-square tests for differences between program and control groups were all not statistically significant, besides for between meals bottles with added sugar.

on an expected improvement of 20 percent for bottle drinking and toothbrushing, with a statistical power of 80 percent and significance level at .05 (24). Accordingly, a minimum group size of 144 (72 test and 72 control) was estimated.

Within each group, changes between baseline and follow-up values were assessed and tested by using McNemar's test. Homogeneity (comparability) between the groups at baseline was tested using the chi-square test, as were the comparisons of the changes from baseline to follow-up. The purpose of the choice of changes from baseline value to follow-up, as the parameters of analysis, was to account for differences in baseline values among groups.

For toothbrushing, only children who had erupted teeth at baseline were included in the analysis. For the effect on toothbrushing, multiple comparisons between the four groups required adjustment of the values for the individual pairwise comparisons. The Holm's method was used, which is applicable in the same cases as the Bonferroni procedure, but is uniformly more powerful (25).

Results

At baseline, the sample included 883 infants 6–12 months old. At the first telephone survey, 823 parents of these infants were located (93.2%). Six months later, when they were aged 12–18 months, the parents of 727 of these infants (82.3% of the original sample) were found and interviewed. Analysis of socioeconomic variables (levels of education, occupation, number of children, religious-secular) associated with respondents and nonrespondents revealed no statistically significant differences.

Bottle Feeding. Parents were asked about the bottle feeding of their infants, contents of the bottle and bottle-feeding times. After excluding the 35 mothers who reported that they only practiced breastfeeding throughout the study period and those who did not complete this section of the interview process for other reasons, we were left with 652 respondents (89% of the original 727). These were divided into 413 in the Program group and 239 in the Control group, as presented in Table 2.

1. *During meals*—Bottle feeding, as expected, decreased from age 6–12 months to age 12–18 months. Adding sugar to bottles, however, increased.

2. *Between meals*—Bottle feeding slightly decreased over the study period. Adding sugar to bottles increased significantly.

3. *During sleep*—The percentage of mothers who allowed an infant to fall asleep with a bottle in the mouth was very similar both at baseline and six months later. Bottles with added sugar were very rare at baseline, but increased six months later.

As seen in Table 2, analysis of changes over the study period in bottle-feeding habits within each group ($Program_1$, $Program_2$, $Control_1$ and $Control_2$) revealed statistically significant changes, for most groups, according to McNemar's test. No significant differences in bottle-feeding habits were found when comparing changes over the study period between program and control groups (besides for bottles with added sugar between meals) according to the chi-square test.

Toothbrushing. Parents of infants who had erupted teeth at baseline were asked if they brushed their infants' teeth at baseline and six months later. After removing those mothers whose interviews had inadequate data, we were left with 449 respondents (96% of the original 464). Table 3 presents the levels of reported toothbrushing in the $Program_1$ (n=169), $Program_2$ (n=118), $Control_1$ (n=82), and $Control_2$ (n=80) groups. The pattern of toothpaste use (almost all brands were

TABLE 3
Reported Toothbrushing of Infants by Group with and without Distribution of Toothpaste and Toothbrush at Baseline, 6 Months, and Improvement

	$Program_1$ (N=169) w/ Toothpaste and Toothbrush		$Program_2$ (N=118) w/out Toothpaste and Toothbrush		$Control_1$ (N=82) w/Toothpaste and Toothbrush		$Control_2$ (N=80) w/outToothpaste and Toothbrush	
	%	n	%	n	%	n	%	n
Baseline	16.4	28	10.9	14	13.3	11	22.0	18
6 months	74.9	128	52.3	67	56.6	47	51.2	42
Improved*	60.4	102	43.7	56	45.1	37	32.5	26
Not improved	39.6	67	56.3	62	54.9	45	67.5	54

*McNemar tests for all comparisons within groups were highly statistically significant from baseline till 6 months (P<.0001).
Pearson chi-square for differences in improved behavior levels between groups:
a. for all groups: P=.0002 (in the 2X4 table: improved, not improved, by P_1, P_2, C_1, C_2)
b. for pair-wise comparisons:
b_1. $Program_1$ vs $Program_2$: P=.004; adjusted† P=.012.
b_2. $Program_1$ vs $Control_1$: P=.022; adjusted† P=.044.
b3. $Program_1$ vs $Control_2$: P=.00004; adjusted† P=.00016.
b4. $Program_2$ vs $Control_1$: P=.83; not significant.
b5. $Program_2$ vs $Control_2$: P=.11; not significant.
b6. $Control_1$ vs $Control_2$: P=.09; not significant.
†Adjusted according to Holm's method.
‡"Improved" refers to those who reported negative behavior at baseline and positive at follow-up. The small proportion (seven cases) who reported positive behavior at baseline but negative at follow-up ("deteriorated") were not included in this analysis.

fluoridated) was the same as that of toothbrush use and is therefore not presented separately. Seven parents reported toothbrushing before but not after the study. This very small group (1.5%) with "deterioration" in health behavior was not included in further analyses.

Reported toothbrushing behavior levels at baseline were found to be significantly different among the groups. Therefore, we analyzed the changes within the groups (Table 3). Within each group, changes between baseline and follow-up values were statistically significant. A secular increase of toothbrushing of 32.5 percent without any intervention was found in the group receiving neither a health education program nor toothbrushes and toothpaste ($Control_2$). However, this level was almost doubled (60.4%) among the group that benefited from the combined intervention of an educational program and distribution of toothbrushes and toothpastes ($Program_1$). $Program_1$ showed more improvement than $Program_2$ (P=.012), more than $Control_1$ (P=.044), and more than $Control_2$ (P=.00016). No significant differences were found between the other groups.

Data from this study were not analyzed for the effect on specific neighborhoods of different socioeconomic profile. Centers had not been chosen as typically representative of the different social strata, and this was not part of the scope and objectives of the study.

Discussion

Results of this trial did not indicate any effect of the program on modifying bottle-feeding habits (Table 2). On the contrary, we found an increased addition of sugar to bottles for all babies during and between meals and during sleep. This is a disturbing result that demands serious public health consideration. Can this actuality be modified at all, and if so, how?

Based on the data concerning reported toothbrushing improvement, the following conclusions are cautiously proposed:

1. The significant difference between a health education program together with distribution of toothbrushes and toothpastes ($Program_1$) and a health education program alone ($Program_2$) indicates that the addition of toothbrush and toothpaste distribution to a health education program among an infant population could enhance early initiation of oral hygiene behavior.

2. The significant difference between a health education program together with distribution of toothbrushes and toothpastes ($Program_1$) and distribution of toothbrushes and toothpastes alone ($Control_1$) indicates the contribution of training nurses to include oral health education in their regular duties.

3. The highly significant difference between a health education program together with distribution of toothbrushes and toothpastes ($Program_1$) and a group receiving neither health education program nor distribution of toothbrushes and toothpaste ($Control_2$) indicates the strong potential effect of combining these interventions on increasing the level of brushing infants' teeth, as reported by mothers.

The MCH clinics in Jerusalem have been in existence since before the establishment of the state of Israel. To the best of our knowledge and experience, and according to all available data regarding possible underlying factors, program and control groups in this study were optimally similar and comparable. This was true for socioeconomic characteristics, religious tradition variables, and possibly age. In theory, if the groups were of different ages, this could account for secular changes unrelated to the interventions of this study. The mean age for children with erupted teeth was 10.2 (SD=1.7) months for the $Program_1$ group, 10.1 (SD=1.9) for the $Program_2$ group, 9.9 (SD=1.7) for the $Control_1$ group, and 9.9 (SD=1.9) for the $Control_2$ group; these mean ages were not statistically different. There was, therefore, no evidence that age differences between groups accounted for observed behavior differences.

Due to random selection, level of similarity was also assumed to be high between the centers that received toothbrushes and toothpaste and those that did not. Despite these efforts, it has to be considered that at baseline the levels of practices were different among program and control groups. To compensate for this, analyses were applied to the respective improvements in behavior.

Centers were chosen, by design, as pairs within each neighborhood. This could arouse the concern of "contamination" within the community, of the control groups. Seeing that these neighborhoods are large (small neighborhoods a priori do not have more than one MCH center), the centers were not situated geographically near each other. Therefore, the level of potential "contamination" was accepted as minimal.

A common problem in validating responses to surveys is the potential bias caused by patients' desire to satisfy the health care providers by providing answers they believe the providers expect to hear (23). In this study, the dental component was relatively masked by placing the dental questions together with general health questions. An additional factor that supports and strengthens the level of validity is the finding that parents did not reply in the expected way concerning baby bottle drinking habits. We can assume that if bias was a factor, parents would have responded positively regarding baby bottle drinking habits and not only regarding oral hygiene behavior.

It is acknowledged that most nurses have individualistic approaches to health education and no uniformity was (nor could have been) enforced in this program. In theory, this could have accounted for differences in outcomes among the participating groups. In practice, there was no evidence that these approaches were in any way clustered, but we assumed that they were distributed equally among all of the population.

Breast suckling and thereafter bottle nursing are probably among the most primordial instincts of man and a preference for the sweet taste is a natural and perhaps genetic instinct (26). However, this instinct can be modified by the environment and either controlled or abused (27). At an early age, the habit can become addictive and extremely hard to break (28). Dietary habits connected with babies' bottles are a product of societal environment, and often include stress, ignorance, poverty, and family pressures (28). It is suggested that part of the reason for the present program's failure in improving bottle habits is the age at which the program began. By age 6 months it may be too late to change this habit. Further efforts should be aimed at parental education immediately after, or even before, the infant's birth.

Fluoridated dentifrice is not suggested here as the ultimate panacea. However, dental public health promoters should accept the reality that successes in the reduction of dental caries, throughout the world, have been attributed by most experts to fluoride utilization and considerably less to a modified diet (29).

Although the ingestion of fluoride at an early age has been reported as a risk factor in the development of fluorosis (30), scientific evidence has been presented for the safety of recommending a small "pea-size" amount (31). A low fluoride (250 ppm) dentifrice concentration was proposed in this study as a component of a program among infants.

In a previous Israeli study on schoolchildren, subjects receiving toothbrushes solely or as part of the education program exhibited improved oral hygiene levels (32).

It is always important to consider the cost component. Health education is both costly and time consuming (33). In the present study, adding distribution of toothbrushes and toothpaste to a program increased the rate of toothbrushing by a ratio of 1.38. Providing toothbrushes and toothpaste to the control group increased the rate of toothbrushing by the same ratio. It is proposed that a free "gift" is a valuable, cheap, and effective incentive.

Over recent years, ECC has been recognized by public health dentistry as a major concern; nevertheless, it has been difficult to identify practical methods of dealing with the problem. Organized efforts at preventing ECC have been only moderately successful (8-10), while others have failed (11). The present study has not reported complete achievement of all its goals; nevertheless, essential components are presented that can be learned from and improved upon. Most importantly, the promotion of toothbrushing, especially by the distribution of toothbrushes and toothpastes, is proposed as a practical and feasible approach among populations of young infants and their parents.

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