A Review of a Community Program Aimed at Preventing Early Childhood Caries among Jerusalem Infants – A Brief Communication

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Abstract

Early childhood caries (ECC) has not been adequately investigated in Israel. A previous Jerusalem study has demonstrated a potential effect on toothbrushing among infants. The present study was initiated in order to examine caries prevalence and the potential effect of a community intervention program. ***Objectives:*** *This study aims to review an intervention program and assess ECC distribution and associated variables.* ***Methods:*** *The study sample included 1,500 infants in matched "intervention" and "control" Mother and Child Health centers. The 2-year program, initially including all children at the age of 6 months, focused on the free distribution of toothbrushes and toothpastes. ECC prevalence was determined in a cross-sectional study.* ***Results:*** *At 2.5 years, 596 children were examined (40 percent compliance). About half of the parents reported that they had participated once or not at all over the 2-year period, which demonstrated low program participation. Among the examined children, ECC prevalence was 15.3 percent. No difference in caries levels was found between the program and control groups. The reported level of brushing twice daily was 13.9 percent, while 26.8 percent reported not brushing at all. Eighty-one percent reported going to bed at night with a bottle. Children who drank sugar-sweetened beverages had ECC levels significantly higher than those who drank milk or natural juice (18.8 percent versus 8.9 percent).* ***Conclusions:*** *The dental health and behavior and lack of intervention success emphasized the need to seek a more effective strategy. Emphasis on toothbrushing might not be the only nor optimal solution for this serious public health problem.*

Key Words: ECC, caries, community program, program trial, infants, oral health promotion

Introduction

A decline in dental caries prevalence has been reported in most developed countries (1). However, early childhood caries (ECC) remains an issue of considerable public health concern in many societies (2). In Israel, dental caries has been studied and a decline has been reported, but no data concerning ECC prevalence are available since 1989, when a caries level of 42 percent among 95 3-year-old infants in one Jerusalem neighborhood (3) was reported.

Most previous ECC prevention attempts have essentially concentrated on health education, usually aimed at mothers or caretakers. Only a few have been aimed at preventing ECC in children under 3 years of age, while the majority have been applied in kindergartens or other community centers (e.g., "Head Start"), among older children (3 to 6 years old). Some programs have reported certain success in reducing ECC risk-related habits and caries levels (4), while others have described failed attempts (5).

In Israel, all children are registered at neighborhood-based "Mother and Child Health" (MCH) centers. This service, which is offered free of charge to the entire population, is operated by public health nurses. Although oral health promotion has not been one of the MCH nurses' traditional roles, they have been expected to pay attention to certain topics concerning oral health practices, mainly baby bottle use.

A previous study conducted in Jerusalem assessed the effect of health education by MCH nurses, combined with distribution of free toothbrushes and paste. The program failed to demonstrate any effect on bottle drinking behaviors, but succeeded in increasing the reported brushing of 6- to 12-month-old infants' teeth (6). The study investigated reported health behavior, but not actual caries levels. As MCH nurses are considered a source of authority and subsequent influence regarding health behavior, and the compliance (especially for scheduled vaccinations) is usually high, it seemed appropriate and practical to utilize this setting for a community effort to promote oral health and prevent ECC among infants. Based upon the previous results, a "follow-up" program was launched in the same setting. The present phase focused on supplying free toothbrushes and pastes to the participating infants when attending regular visits at the MCH centers.

The objectives of this study were to review the intervention program and to conduct a cross-sectional assessment of ECC distribution and associated variables among Jerusalem infants.

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Methods

Study Sample. Four areas in Jerusalem were chosen by the municipal public health service as characteristic and representative of the secular and religious Jewish residents in Jerusalem. Two MCH centers were chosen in each area. One center from each pair was then randomly assigned to the intervention or control groups.

Sample size was calculated by the "PEPI" software package (7), and 1,500 infants participated, 750 in each study group, allowing for low potential compliance.

In the four intervention centers, all registered children reaching the age of 6 months were included in the program. Each month an additional cohort of infants joined the program population. There were about 95 children born annually in each MCH center area. Inclusion therefore continued for about 8 months, until there were enough children according to the required sample size.

Program and Study Design. This was a 2-year program, which included all children of the chosen MCH centers, initially aged 6 months and finally 2.5 years. The MCH nurses were instructed to supply mothers, at each regular visit to the center (approximately every 3 to 4 months), a toothbrush and fluoridated toothpaste package ("elmex®" toothbrush and "elmex® kid" toothpaste, 250 ppm F, both of GABA®, Basel, Switzerland), followed by a short explanation of their proper use.

During the program's implementation phase, several meetings were held with nurses within the MCH centers. These meetings included explanations of the program's rationale and the nurses' anticipated role and involvement. Much time and concern were dedicated to logistics and administration. Nurses were urged to ask anything they did not understand and to request assistance in any problem that might arise during the planned program. The basic public health principle of community participation was adhered to throughout the present experience. The participation of infants in the program was recorded by the nurses and was reported monthly to a central municipal computerized surveillance system, which produced reports of the actual participation rates in all four program centers.

Program Process Evaluation. The compliance level of the nurses was calculated according to the recorded distribution of toothpaste and brushes and instructions. Nurses were informally interviewed and several group discussions were conducted regarding their general satisfaction during and after the culmination of the program.

Program Outcome Evaluation.

ECC prevalence. The present study was a cross-sectional comparison between children at the age of 30 months who had participated or not in the program. All children (from both intervention and control groups) reaching the age of 30 months, and their parents, were invited through mail for a special visit at the MCH centers for a dental examination, free of any charge, by the examining dentists. Mailed invitations were followed by telephone reminders 1 day prior to the examination.

Two trained dentists examined the children for caries presence and interviewed the parents. Interexaminer calibration was conducted prior to the study among 15 infants. The kappa level found was 0.94. Intraexaminer calibration was not practically possible. Examinations were conducted at the MCH centers, by visual means only, after cleaning (but not completely drying) with a cotton wool applicator, without magnification, and with normal room light. The introductions, dental examinations, and interviews took no longer than 15 minutes per child. Caries was recorded according to WHO criteria (8). ECC was defined as caries of at least one tooth and severe ECC (S-ECC) as at least one smooth carious surface, according to the NIDCR recommendations (9).

Independent variables. All parents attending the dental examinations were interviewed by the dentists. Questions included oral hygiene habits, dietary habits, and number of siblings. The questionnaire was adopted from the previous study, in which it had been found to be valid and appropriate (6). Diet content according to "extrinsic" (added refined sugar, such as sweetened soft drinks, chocolate drinks, formula, sweetened tea, etc.) and "intrinsic" sugar (natural carbohydrates, such as milk, natural unsweetened fruit juice, etc.) was based upon previously used definitions in Israeli studies (10). In the program group, questions included the level of participation in the program.

Data were coded and analyzed. Associations between caries and possible independent variables were analyzed on a bivariate level employing the Chi-square test or Fisher's exact test. Significance level was chosen at $P \leq 0.05$. Because of sparse statistically significant results, multivariate models were not included in the final analyses.

Results

Sample Population. The participating children and their parents represented a broad spectrum of the Jerusalem Jewish population. Because of feasibility considerations, the Arab infant population of the city was not included. Jerusalem is a city distinguished by differently characterized neighborhoods. The two main variables are socioeconomic class and religiosity. These were amply represented in the present study. Jerusalem is rated by the National Statistics Bureau as one of the poorest Israeli cities. The few "richer" neighborhoods were purposively not included as these children, *a priori,* do not participate in public programs. Five hundred ninety-six children (out of the total 1,500) were examined in the MCH centers (305 boys and 291 girls). This represented a 40 percent level of compliance. The mean age at time of examination was 31.9 months (standard deviation = 1.81, range: 28 to 40). Three hundred seven of the children were from "program" centers (52 percent) and 289 from control centers (48 percent).

Program Process Evaluation. Parents of about half of the children (147) from the program centers reported that the child had participated in the dental intervention either only once or not at all over the past 2 years. Only 17.9 percent of the children were reported to have participated four times or more, which was considered as "minimally adequate."

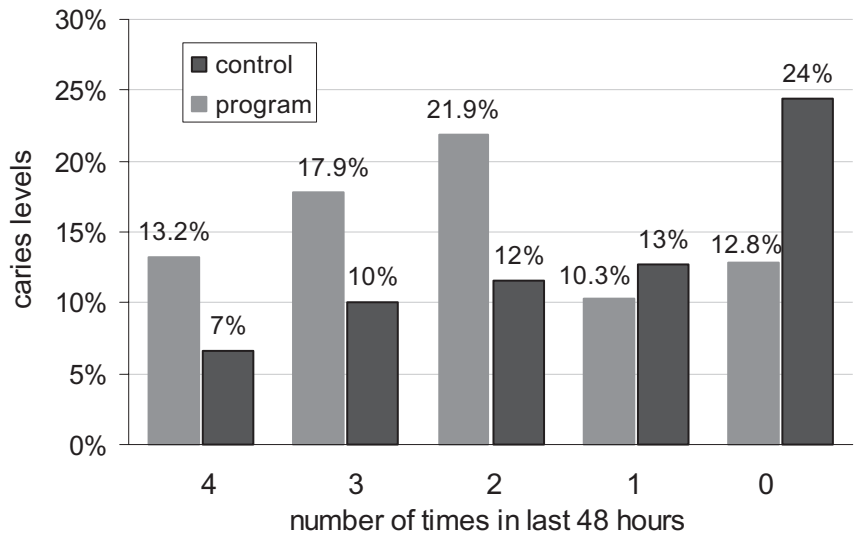
ECC Prevalence. Out of the 596 infants examined, 15.3 percent had caries (ECC). Most of this group (89 percent) demonstrated S-ECC. Over 14 percent of the children had only one carious tooth. The largest proportion (49.5 percent) had two carious teeth, while 36.2 percent revealed three carious teeth or more. All examined children had 20 deciduous teeth.

Effect of the Intervention on ECC Prevalence. No difference in caries presence between the program and control groups was found. Within the program group, the level of participation (number of times toothpastes and brushes were received) was not uniform and therefore the program effect could not be optimally analyzed. Lower (but not statistically significant) levels of caries were found among those children in the program group who reported receiving toothbrushes and pastes four or more times (6/55, 10.9 percent), as compared to those who reported never receiving brushes and pastes (58/362, 16 percent).

Caries and Oral Hygiene Practices. Only 13.9 percent of the parents reported that their babies' teeth had been brushed twice daily. The largest proportion (33.6 percent) reported that teeth had been brushed once daily, and 26.8 percent reported that teeth had not been brushed at all.

Children who reported brushing more than once daily had an average ECC level of 11 percent, compared with 16 percent of the children who brushed once daily or less (not statistically significant). When analyzing these associations within the program and control groups separately, marked differences were found (Figure 1). Among the control group children, a clear and statistically significant association was found between brushing frequency and caries presence (more toothbrushing related with less caries, $P = 0.01$). No similar association was found in the program group.

Figure 1
Association between brushing habits and caries. Statistically significant: $P = 0.01$ within control group; no statistically significant association within program group



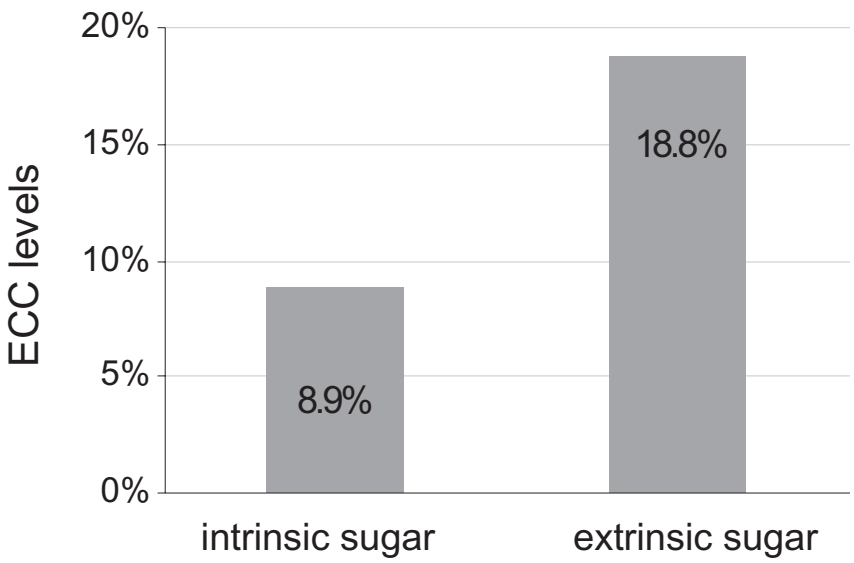
Caries and Diet. Among all the study parents, 81 percent reported that their children went to bed at night with a bottle. Of these 483 children, the favorite reported beverage was milk (27 percent), followed by chocolate drink (21 percent). Only 8 percent reported that their children drank water. The association between the contents of the bottle and caries is shown in Figure 2. The caries level among those children who had been drinking extrinsic sugar-sweetened beverages (n = 304) was twice higher than the level among those who drank intrinsic sugar beverages (n = 135). This difference was statistically significant at the level of $P = 0.01$. The children who reported that they drank water were excluded from this analysis because of the low number (n = 44).

Caries and Number of Siblings. The mean number of siblings in each family was 3.1 (±0061.9). Most of the families had one or two children (46 percent), 37 percent had three to four children, and 16 percent families had five children or more. Of this latter group, 14 families had 10 or more children. The highest level of caries (21 percent) was found among large families (more than five siblings), as compared to 14.1 percent in smaller families (not statistically significant).

Discussion

This study did not succeed in demonstrating a positive effect of early initiation (from first tooth eruption) of brushing with an appropriate fluoride toothpaste on ECC among children who participated in the program. Several possible contributing factors might be related to this outcome. Explanations might include that the children in the program group did not brush their teeth with an optimal frequency, or that the toothbrushing programs may not be as effective in preventing ECC as previously assumed. Future programs should therefore explore other alternative approaches, such as diet modification (as indicated by the

Figure 2
Association between extrinsic or intrinsic sugar beverages and caries among children who reported drinking from a bottle (n = 439). Statistically significant: P = 0.01



association between ECC and the sugar content of bottles revealed in the present study), fluoride varnishes, antibacterial therapy among high-risk groups, or other innovative approaches.

It should be noted that at the time of the program, the toothpaste used contained a level of 250 ppm fluoride. Some researchers have indicated that this concentration may be too low for caries prevention (11).

According to the results, the reported number of intervention group visits to the MCH centers was unfortunately lower than initially expected. This may have been a result of actual low participation, or recall bias, including not remembering, or not differentiating the visits as a component of the intervention program.

The compliance level of the sample at the scheduled dental examinations was very low (40 percent). Apparently, most study participants did not fully appreciate the importance of examinations of children at this early age. It should also be noted that this program took place during a period of violence and lack of security in Jerusalem. Although the psychosocial effect of this variable was not scientifically investigated nor documented in the present study, it could be assumed that issues of physical survival were perceived as more important than dental health.

In the previous survey conducted in Jerusalem, 42 percent caries prevalence was reported (3). The present results (15.3 percent) therefore endorsed the decline in caries levels previously discussed in the general population.

Low compliance for examinations raised the issue of a potential selection bias. However, no socioeconomic or other relevant factors were detected as different between compliers and noncompliers, or between program and control groups.

Association between caries and reported toothbrushing was of special interest in this study. A certain trend toward a negative association was revealed, albeit not statistically significant. This might have been a result of the low number of ECC cases. A significant association was found among the controls, but not in the program group. An explanation for the latter group was the "social desirability bias."

The present program failed to reveal an effect on ECC. Ideally, evaluation of a 2-year program demands a longitudinal design with baseline data, not collected in this study. It should be noted that at 6 months of age deciduous teeth have usually just erupted and caries is very rare. Additionally, it is difficult to examine teeth at this age.

The myriad of problems which arose in this "real-life" situation, the extent of ECC and its related variables (especially high levels of bottle drinking and low levels of toothbrushing), and the lack of compliance and apparent motivation of the caregivers and the population emphasize the need to continue working and seeking to locate a more successful module of dealing with and preventing this severe public health problem.

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