Scientific Article

Effect of Motivational Interviewing on Rates of Early Childhood Caries: A Randomized Trial

Rosamund Harrison, DMD, MS[1] • Tonya Benton, MA[2] • Siobhan Everson-Stewart, MS[3] • Phil Weinstein, PhD[4]

Abstract: *Purpose: The purposes of this randomized controlled trial were to: (1) test motivational interviewing (MI) to prevent early childhood caries; and (2) use Poisson regression for data analysis. Methods: A total of 240 South Asian children 6 to 18 months old were enrolled and randomly assigned to either the MI or control condition. Children had a dental exam, and their mothers completed pretested instruments at baseline and 1 and 2 years postintervention. Other covariates that might explain outcomes over and above treatment differences were modeled using Poisson regression. Hazard ratios were produced. Results: Analyses included all participants whenever possible. Poisson regression supported a protective effect of MI (hazard ratio [HR]=0.54 (95%CI=0.35-0.84)—that is, the MI group had about a 46% lower rate of dmfs at 2 years than did control children. Similar treatment effect estimates were obtained from models that included, as alternative outcomes, ds, dms, and dmfs, including "white spot lesions." Exploratory analyses revealed that rates of dmfs were higher in children whose mothers had: (1) prechewed their food; (2) been raised in a rural environment; and (3) a higher family income (P<.05). Conclusions: A motivational interviewing-style intervention shows promise to promote preventive behaviors in mothers of young children at high risk for caries. (Pediatr Dent 2007;29:16-22)*

KEYWORDS: DENTAL CARIES, CHILDREN, PREVENTION, RANDOMIZED CONTROLLED TRIAL, MOTIVATIONAL INTERVIEWING

Although dental health receives scant attention in most discussions of immigrant health,[1] preschool children from immigrant communities are known to be disproportionately afflicted with dental caries.[2] Historically, one of the largest immigrant groups to Canada is from the Indian subcontinent or "South Asia." Similar to other immigrant groups, the dental health of young, low income, immigrant South Asian children has consistently been reported to be poor. In fact, a variety of surveys in Great Britain describe the dental health of Asian children as consistently worse than that of native-born children.[3-7] Comparable observations have been made for South Asian children resident from western Canada.[8]

Many factors contribute to the poor dental health of South Asian children:

1. Their diet may be less than ideal because of parents' unfamiliarity with products available on grocery shelves.
2. Child-rearing is "child-centered" in South Asian families.[9]

3. Children often have no fixed schedules; a child goes to bed when tired and eats when hungry.
4. Sugary snacks and beverages may be used to pacify a fussy child, but parents may not be aware of the effect that this practice will have on their child's teeth.
5. Parents who work long hours may not have the time or money to access dental services. Child care may be also entrusted to grandparents who indulge their grandchildren.

Any of these psychosocial and behavioral factors, in combination with other known risk factors, may contribute to the development of dental caries.

While parents who are struggling with the challenges of acculturation may simply not be aware of the etiology and consequences of early childhood caries (ECC), research does not support the efficacy of providing only education or information to these parents.[10,11] Education alone has been found to be ineffective because direct persuasion by a health professional is often practiced without regard for the parents' readiness to change their existing behaviors.[12] Promising results, however, have been reported using a brief, patient-centered, personalized counseling approach called motivational interviewing (MI).[13] MI focuses on strategies to move parents from inaction to action; many possible paths to a solution are provided in the form of a "menu of options."[14] Use of open-ended questioning, affirmations and the reinforce-

[1]Dr. Harrison is Professor, University of British Columbia, Oral Health Sciences, Vancouver, British Columbia; [2]Ms. Benton is Research Coordinator, [3]Ms. Everson-Stewart is graduate student, and [4]Dr. Weinstein is Professor at Dental Public Health Sciences, University of Washington, Seattle, WA.
Correspond with Dr. Harrison at rosha@interchange.ubc.ca

ment of self-efficacy, reflective listening, and summarizing are used in a directive manner. These techniques move clients toward:

1. self-examination;
2. awareness of the problem; and
3. understanding of how their current behavior is at odds with their desired goal.[13]

The motivation for change comes from the client, but the counselor helps create, by skillful questioning and reflection, the expectation of change. A recent systematic review indicated that treatment effects for MI range from 0.25 to 0.57 for a variety of health behaviors, including: (1) diabetes management; (2) exercise; and (3) dietary modification.[15] Poisson regression to model caries risk is becoming a more widely used statistical approach,[16,17] as more becomes known about the non-normal distribution of dmfs in disadvantaged populations. Poisson regression also incorporates a time covariate. This controls for the amount of time each subject has participated in a study, thereby estimating the possible confounding effect of time on each individual's measurable risk of caries during the study. In addition, the expected number of caries onsets can be related to surface- and subject-specific explanatory variables. For example, an exploratory analysis of a Finnish xylitol prevention trial[18] using Poisson regression confirmed previously reported findings, but also revealed 2 other potential effect modifiers: (1) period effect; and (2) a posteruptive age effect.[19] Despite the fact that Poisson regression methods allow for the estimation of caries incidence rates in the population of interest in a given time period, their use is still infrequent in caries prevention trials. Poisson regression has been recently used to analyze 3-year results of a sealant trial,[20] however, but is more commonly applied to the analysis of existing databases.[21] The most powerful statistical approach allowed by the sample size to ensure confidence in the findings should be used in any analysis.

The purposes of this randomized controlled trial were to:

1. test motivational interviewing as a behavioral approach to prevent early childhood caries; and
2. use Poisson regression, a time-to-event statistical methodology, to increase efficiency of the data analysis.

Methods

Sample participants/inclusion criteria. This project was a joint undertaking of the University of British Columbia and Universtiy of Washington, in collaboration with the Progressive Intercultural Services Society (PICS), a community organization for South Asian immigrants in Surrey, British Columbia, Canada. The Behavioral Research Ethics Board of University of British Columbia approved the project. Required sample size was calculated to be 210 (105 per group.)

Over a 2-year period, 240 6- to 18-month-old South Asian children and their mothers were enrolled in the trial. The procedures and possible discomforts, risks, and benefits were explained fully to the parents in either Punjabi or English. Informed consent was obtained prior to the investigation. Families were recruited: (1) at the PICS community center; (2) at widely attended Sikh temples; (3) at community events; and (4) via radio advertisements. Children were excluded only if they had a serious acute or chronic health condition that would disallow their full participation. Surrey, Canada is a nonfluoridated community.

Design. The study was a randomized, controlled trial with 2 conditions. After children were stratified into 2 age groups (6-12 months; >12 months) within each gender, subjects were assigned to either the experimental MI arm of the trial or to the "traditional health education" (control) arm using a table of random numbers. To keep project staff blinded to treatment condition, stratified groupings of randomization assignments were given in blocks of 10 envelopes previously sealed by the statistician and opened by PICS staff. Age stratification accounted for:

1. individual differences in the number of erupted teeth and time of exposure to cariogenic foods; and
2. gender stratification for any parenting differences that may affect caries risk.

Control condition. Each control mother received a pamphlet on infant oral health designed by the local health unit dental staff, but modified to include strategies to prevent ECC appropriate to the South Asian community. Mothers also watched an 11-minute educational video, "Preventing Tooth Decay for Infants and Toddlers."[22] Both pamphlet and video, available in English and Punjabi, also recommended that parents take their child to PICS for fluoride varnish applications.

Table 1. RAINBOW SMILES MOTIVATIONAL INTERVIEWING "MENU"
Do not add anything sweet or sugary to bottle.
Wean child from bottle; focus on night-time.
Clean your baby's teeth as soon as they appear.
Use a smear of fluoride toothpaste.
Hold baby when feeding.
If baby wakens at night, give water.
Limit sipping and snacking.
Bring your baby to the dentist 2 times per year for fluoride varnish.

Experimental condition.

Parents in the experimental condition received:

1. the pamphlet and video;
2. one 45-minute counseling session;
3. two brief follow-up telephone call at 2 weeks and 1 month after initial contact;
4. four follow-up telephone calls up to 6 months after the initial contact; and
5. two postcard reminders.

Three South Asian women were trained as "MI counselors." Audiotapes of the interventions were periodically reviewed by one of the investigators to ensure that the MI protocol was being delivered consistently. Briefly, the protocol focused on establishing rapport and need and presenting and discussing a "menu of options" for infant oral health care. Prior to beginning the trial, 5 focus groups were held that included South Asian: (1) mothers; (2) fathers; and (3) grandparent caregivers. Their comments and suggestions were the basis for the items in the MI "menu" (Table 1).

Data collection. Each parent completed 2 questionnaires that have been used in previous studies of high-risk children:

1. A modified Evens instrument, which assessed:
    a. parenting practices;
    b. diet;
    c. hygiene factors; and
    d. demographic factors that might influence development of ECC.[23]
2. The Readinesss Assessment for Parents concerning Infant Dental Decay (RAPIDD).[24] This instrument has been validated to yield 4 reliable subscales (alphas range from 0.61 to 0.97):
    a. openness to dental health;
    b. values dental health;
    c. difficulty with change; and
    d. child permissiveness.

Caries was assessed with a visual examination using a modification of the criteria of Radike.[25] Teeth were wiped with

Table 2. RANDOMIZATION EFFECTIVENESS: CATEGORICAL BASELINE CHARACTERISTICS OF STUDY SAMPLE BY TREATMENT GROUP							
	CONTROL			MOTIVATIONAL INTERVIEWING			
VARIABLE	N*	n†	%	N*	n†	%	P VALUE‡
Boys	118	61	52	122	69	57	.45
Mother was raised in an urban setting	107	33	31	109	34	31	.96
Study visit took place at the subject's home	118	22	19	122	38	31	.03
Child has lived in >1 dwelling	114	8	7	118	8	7	.94
Mother is not married	115	4	4	119	5	4	1.0
Mother has less than a high school education	112	22	20	117	17	15	.30
Primary caregiver has poor oral health	111	20	18	112	14	13	.25
Child is in "fair or poor health"	86	21	24	96	23	24	.94
Child has had a major illness	111	14	13	113	9	8	.25
Child has been given antibiotics	53	29	55	63	38	60	.55
Children are given vitamins daily	115	23	20	115	25	22	.75
Mom prechews child's food daily or more	110	18	16	112	19	17	.90
Household income >$30,000/y	86	44	51	97	51	50	.85

* N= total no. of responses per study group.
† n=no. of respondents in study group positive for this variable.
‡ P value determined by chi-square test or, for cell sizes ≤5, by Fisher exact test.

cotton gauze and then examined using front surface mirrors and a dental light. Explorers were primarily used to remove plaque and periodically to verify cavitation of the enamel. Children were examined in the "knee-to-knee" position by one of 3 calibrated, Punjabi-speaking dentist-examiners. Interexaminer reliability yielded a kappa coefficient of 0.78. Examiners were unaware of the child's group designation. After any oral examination, treatment referrals were made and restorative needs completed at the parent's discretion. Surfaces were coded as: (1) decayed; (2) missing due to caries; (3) filled; or (4) "white-spot, noncavitated." Questionnaires were completed, and caries was assessed at the time of enrollment and at the 1- and 2-year follow-up appointments. Final follow-up was completed 4 years after recruitment began.

Questionnaire and dental health data were entered into Excel spreadsheets and analyzed using SAS statistical software (SAS, Inc, Los Angeles, Calif). A preliminary analysis of the data showed crude effects using chi-square and odds ratios.[12;26] Mean dmfs was compared between groups, but with the study completed more powerful analyses were warranted. Factors that the authors hypothesized could explain the rates of dmfs were modeled using Poisson regression. Hazard ratios—or ratios of

Table 3.   RANDOMIZATION EFFECTIVENESS: BASELINE CHARACTERISTICS OF STUDY SAMPLE BY TREATMENT GROUP

		Control			Motivational interviewing		
Variable	N	Mean±(SD)	Range	N	Mean±(SD)	Range	P value*
Recruitment age (mos)	118	12.1±5.3	1.1-29.4	122	10.8±5.3	1.8-23.0	.06
Gestational age (wks)	85	38.7±2.6	28.0-43.0	89	39.0±1.9	32.0-42.0	.36
Time in Canada (mos)	105	95.7±136.0	0.0-240.0	111	138.1±188.4	0.0-420.0	.06
No. in household	112	5.4±2.4	2.0-14.0	112	5.3±2.3	2.0-16.0	.70
Cheerful mood† (1-6)	110	2.0±1.1	1.0-5.0	113	2.0±1.1	1.0-6.0	.92
Calm mood† (1-6)	111	2.3±1.4	1.0-6.0	113	2.1±1.0	1.0-5.0	.26
Active mood† (1-6)	110	2.3±1.3	1.0-6.0	111	2.2±1.2	1.0-6.0	.74
Rested mood† (1-6)	111	2.4±1.5	1.0-6.0	111	2.2±1.3	1.0-6.0	.17
Interested mood† (1-6)	111	2.1±1.2	1.0-6.0	112	2.1±1.3	1.0-6.0	.80
‡ Readiness: Open to health info (1-5)	103	3.2±1.2	1.0-5.0	110	3.4±1.4	1.0-5.0	.27
‡ Readiness: Values dental health (1-5)	99	3.2±1.6	1.0-5.0	97	3.5±1.5	1.0-5.0	.17
‡ Readiness: Change difficulty (1-5)	107	3.0±0.6	1.0-5.0	111	3.1±0.7	1.0-5.0	.12
‡ Readiness: Child permissive (1-5)	103	3.0±0.9	1.0-5.0	98	2.9±1.1	1.0-5.0	.49

* *P*=significance of *t* tests comparing means of motivational interviewing group to control group.
† Mood scales: Larger values=less of specific mood (more depressed).
‡ Readiness scales: Larger values=less agreement with readiness.

Table 4.   DENTAL HEALTH STATUS OF CONTROL COMPARED WITH MOTIVATIONAL INTERVIEWING CHILDREN AT 2 YEARS

	Control (N=100)	Motivational interviewing (N=105)	
Variable	Mean±(SD)	Mean±(SD)	P value*
Decayed surfaces	2.91±5.6	2.03±4.9	.23
White spot surfaces	0.32±1.1	.17±0.6	.21
Missing surfaces	1.25±5.8	.33±2.5	.14
Filled surfaces	3.43±9.7	.99±5.1	.03
dmfs	7.59±14.2	3.35±7.8	.001
dmfs plus white spots	7.91±14.2	3.52±8.0	.01
No. of fluoride varnishes received	0.25±0.5	3.81±1.2	.001

* *P*=significance of *t* tests comparing means of motivational interviewing group to control group.

the dmfs rate of the experimental group (MI) divided by the dmfs rate of the "control" group (traditional education)—were produced by Poisson regression. Hazard ratios are interpreted as an estimate of relative risk, similar to an odds ratio.

Results

The project, named "Rainbow Smiles" by project staff, enrolled and randomized 240 children. No adverse events occurred. Randomization checks were conducted on possible demographic and behavioral differences between groups (Tables 2 and 3). As determined by self-report questionnaires, the randomization effectively equalized the groups on a variety of factors, including the: (1) child's gender; (2) mother's marital status; (3) mother's rural or urban status; (4) mother's history of residence; (5) number of household members; (6) perinatal factors; and (7) child health parameters. Two of the MI children had caries at baseline, compared to 4 children in the control condition; this prevalence

was not significantly different (chi-square=0.75, 2-tailed; P=0.39). Similarly, 26 children in the MI group did not have a fully erupted dentition at time of enrolment, compared to 16 children in the control condition; this difference was not significant. (chi-square=2.50, 2-tailed; P=0.11). Despite stratification, the child's age at initial recruitment differed between groups, with children in the control condition being slightly older when parents were recruited into the study (12 vs 11 months, t [238]=1.89, 2-tailed; P=.06). Therefore, age was considered in all analyses. Although groups were different on 2 other variables at baseline—mother's time in Canada and number of home visits—bivariate analyses showed no significant relationship between either of these variables and any decay outcome after 2 years. Therefore, neither of these variables was included in final models.

Basic comparisons of mean dmfs between experimental and control groups for the 205 children who remained in the project at study's end are detailed in Table 4. Based on an intention-to-treat approach, further analyses were conducted with all 240 participants whenever possible. The MI approach was compared to the traditional approach after controlling for child's age at baseline. Poisson regression results supported a protective effect of MI (hazard ratio [HR]=0.54; (95%CI=0.35-0.84). Subjects in the MI group had a 46% lower rate of dmfs after 2 years than did subjects in the control group. As a sensitivity analysis, decayed surfaces, decayed and missing surfaces, and dmfs (including white spots) were analyzed as alternative outcomes; similar treatment effect estimates were obtained from these models.

Further exploratory analyses tested 42 "theory-driven" baseline covariates in the Poisson model. These covariates included, for example:

1. family's history of decay;
2. mother's mental health;
3. number of adults in the household;
4. whether the mother came from an urban or rural environment in India;
5. if mother prechewed the child's food and family annual income.

These analyses revealed that dmfs rates were higher in children whose mothers had: (1) prechewed their food (P<.008); (2) been raised in a rural environment (P<.004); and (3) an annual family income greater than $30,000 ($P$<.007).

Discussion

Two years after a mother in the experimental group had received the MI intervention, her child was much less likely to have caries than a child in the control group. "MI children" had a 46% lower dmfs rate. The results confirm the findings of recent meta-analyses concluding that adaptations of MI are a promising approach to treat problem behaviors.[15, 27]

The dentally healthy behaviors "practiced" by the "MI mothers" varied because their behaviors depended on what they selected from the MI "menu." (Table 1) Thus, comparisons of at-home parenting practices, like tooth-brushing and dietary changes, cannot be reliably made between conditions. Visits for fluoride varnish, however, were recorded for both experimental and control subjects. Comparisons between both conditions in the trial indicated a higher average number of fluoride varnish applications in the MI group than the control group for the study's second year (Table 4). It was study group (MI vs control group), however, not number of fluoride varnish visits, that remained in the Poisson models as a predictor of caries outcomes at 2 years.

Because families in the MI condition attended for the fluoride varnish treatments much more routinely than control families, it could be concluded that MI mothers embraced the benefit of these fluoride varnish visits more than the control mothers. This finding demonstrates the goal of MI, which is to positively influence the preventive behaviors of patients. A recent report from another randomized controlled trial involving low income, visible minority children in San Francisco, California, also demonstrated promising results from a combination of fluoride varnish and parental counseling for high-risk toddlers. [28]

Given the success of MI in promoting healthier behaviors in a wide range of clients with diverse conditions[15] and the ubiquitous nature of ECC in the child population, there is every reason to be optimistic that future ECC-prevention programs based on an MI approach will be effective in other high-risk children. The importance of using "reflective listening" to involve the community of interest in the content of the "menu," however, cannot be overemphasized.

Similar to other successful health promotion programs targeting high-risk families from cultural minorities,[29] lay health workers of similar culture and background to the community of interest were employed by Rainbow Smiles. The MI counseling approach is a technique that can be readily learned by both lay health workers and professionals. MI techniques were mastered by Indo-Canadian women, none of whom were health care professionals, following a short training period in a workshop setting. In addition, because mothers often had limited access to any kind of transportation to the community center, the initial visits for mothers in both conditions were offered as home visits. While there were more home visits in the MI group, the "number of home visits" covariate did not predict caries in the final model. The protocol did not include any telephone follow-up in the second year of the study. Further telephone or in-person follow-up may serve as a booster to reduce the chance of any "lapses" in parental behavior becoming complete "relapses." Increasing the number of MI counseling appointments and spread-

ing them out over time, in addition to more intense follow-up, will certainly further enhance the effect of the intervention.

In addition to the treatment effect of MI, the Poisson modeling demonstrated that a child whose mother was raised in a rural rather than urban background in her native India was significantly more likely to have caries after 2 years. Certainly, health status for a variety of indicators differs between rural and urban Indian mothers and children.[30-32] It is important to note, however, that in the past decade, the level of urban poverty in India is actually increasing while rural poverty is decreasing.[33] South Asian mothers from a rural background show significant differences from their urban counterparts for both education and income.[34] The fact that mothers from rural areas likely had less opportunity for higher education may be one explanation for their children's poor dental health even after moving to Canada. Use of dental services by immigrants has been reported to be positively correlated, possibly with attainment of postsecondary education.[1] Rural mothers may also face greater barriers to acculturation than urban-born mothers, who likely adapted more easily to the urban environment in their new homes in Canada[35].

The poor dental health of young children from Asian families is explained by a multitude of reasons over and above material deprivation or income status.[7] In contrast to the findings of other investigators,[5,36] children whose families were wealthier had higher rates of dental decay than their less well-off peers. A possible explanation is that South Asian families commonly live together in extended family situations in which incomes are pooled. Thus, these families have more disposable income for nonessential items like sugary foods.[9] In addition, grandparents and other relatives are continuously present in the home to indulge young children with sweets.

In a more traditional, less westernized South Asian home, babies are not generally given special "baby" foods. Solid foods will be given some time after the second month, and by 15 months the baby is eating adult foods.[9] Such foods may, by necessity, be prechewed by mothers. The significant relationship observed between the covariate of a "mother who prechewed food" and caries in her child is not surprising, given our current understanding of transmission of mutans streptococci bacteria from mother to child.[37]

A challenge in any clinical trial is not only recruitment, but retention of subjects. Pirie has indicated the keys to retention of subjects in a trial are:

1. gathering considerable tracking information including multiple contacts;
2. maintaining personal contact with subjects during the study;
3. updating contact information every 6 months; and
4. providing rewards and incentives.[38]

Such procedures in Rainbow Smiles included:

1. recording several contact telephone numbers at enrolment and updating this information every 6 months;
2. a prize draw for all families who attended the 1- and 2-year examinations; and
3. "appreciation" parties for project volunteers.

In addition, the relatively close-knit Sikh community proved to be a helpful resource in "tracking down" families who had lost contact with project staff. Birthday cards were mailed annually to each child in the study. Families were given $5 for each visit to defray costs of transportation, but many families refused the money or donated it to the community center. These strategies proved successful in maintaining 205 of the 240 enrolled children until project's end. It was the dedication and resourcefulness of the project staff, however, plus the large number of community members of all ages who volunteered to work on Rainbow Smiles, who are to be congratulated for the success and positive outcomes of this randomized controlled trial.

Conclusion

Motivational interviewing shows promise as a behavioral intervention to promote preventive dental health behaviors in mothers of young children at high risk for caries.

References

1. Newbold KB, Patel A. Use of dental services by immigrant Canadians. J Can Dent Assoc 2006;72:143.
2. Harrison R, Wong T, Ewan C, Contreras B, Phung Y. Feeding practices and dental caries in an urban Canadian population of Vietnamese preschool children. J Dent Child 1997;64:112-7.
3. Prendergast MJ, Williams SA, Curzon ME. An assessment of dental caries prevalence among Gujurati, Pakistani, and white Caucasian five-year-old children resident in Dewsbury, West Yorkshire. Community Dent Health 1989;6:223-32.
4. Williams SA, Summers RM, Ahmed IA, Prendergast MJ. Caries experience, tooth loss, and oral health-related behaviors among Bangladeshi women resident in West Yorkshire, UK. Community Dent Health 1996;13:150-6.
5. Prendergast MJ, Beal JF, Williams SA. The relationship between deprivation, ethnicity, and dental health in 5-year-old children in Leeds, UK. Community Dent Health 1997;14:18-21.
6. Gray M, Morris AJ, Davies J. The oral health of South Asian five-year-old children in deprived areas of Dudley compared with white children of equal deprivation and fluoridation status. Community Dent Health 2000;17:243-5.
7. Pine C, Burnside G, Craven R. Inequalities in dental health in the northwest of England. Community Dent Health 2003;20:55-6.

8. Williams SA, Hargreaves JA. An inquiry into the effects of health related behavior on dental health among young Asian children residents in a fluoridated city in Canada. Community Dent Health 1990;7:413-20.

9. Assanand S, Dias M, Elizabeth R, Waxler-Morrison N. The South Asians. In: Waxler-Morrison N, Anderson J, Elizabeth R, eds. *Cross-Cultural Caring: A Handbook for Health Professionals.* Vancouver, Wash: UBC Press, 1990:141-80.

10. Benitez C, O'Sullivan D, Tinanoff N. Effect of a preventive approach for the treatment of nursing bottle caries. J Dent Child 1994;61:46-9.

11. Tinanoff N, Daley NS, O'Sullivan DM, Douglass JM. Failure of intense preventive efforts to arrest early childhood and rampant caries: Three case reports. Pediatr Dent 1999;21:160-3.

12. Weinstein P, Harrison R, Benton T. Motivating parents to prevent caries in their young children: One-year findings. J Am Dent Assoc 2004;135:731-8.

13. Miller WR. Motivation for treatment: A review with special emphasis on alcoholism. Psych Bull 1985;98:84-107.

14. DiClemente C. Motivational interviewing and the stages of change. In: Miller WR, Rollnick S, eds. *Motivational Interviewing: Preparing People to Change Addictive Behavior.* New York, NY: Guilford; 1991:191-202.

15. Burke BL, Arkowitz H, Menchola M. The efficacy of motivational interviewing: A meta-analysis of controlled clinical trials. J Consult Clin Psychol 2003;71:843-61.

16. Lewsey JD, Gilthorpe MS, Bulman JS, Bedi R. Is modeling dental caries a "normal" thing to do? Community Dent Health 2000;17:212-7.

17. Mancl LA, Hujoel PP, DeRouen TA. Efficiency issues among statistical methods for demonstrating efficacy of caries prevention. J Dent Res 2004;83(special issue C):C95-8.

18. Isokangas P, Tiekso J, Alanen P, Makinen KK. Long-term effect of xylitol chewing gum on dental caries. Community Dent Oral Epidemiol 1989;17:200-3.

19. Hujoel PP, Isokangas PJ, Tiekso J, et al. A re-analysis of caries rates in a preventive trial using Poisson regression models. J Dent Res 1994;73:573-9.

20. Morgan MV, Adams GG, Campain AC, Wright FA. Assessing sealant retention using a Poisson frailty model. Community Dent Health 2005;22:237-45.

21. Shulman JD, Nunn ME, Taylor SE, Rivera-Hidalgo F. The prevalence of periodontal-related changes in adolescents with asthma: Results of the Third Annual National Health and Nutrition Examination Survey. Pediatr Dent 2003;25:279-84.

22. The Vancouver Health Department. *Preventing Tooth Decay: Infant and Toddlers;* Vancouver, Canada. Vancouver Health Department Multicultural Health Education Program; 1995.

23. Evens C. Snacking patterns as a risk factor for early childhood caries. *Dental Public Health Sciences.* Seattle, Wash: University of Washington; 1997.

24. Weinstein P, Riedy CA. The reliability and validity of the RAPIDD scale: Readiness assessment of parents concerning infant dental decay. J Dent Child 2001;68:129-35, 142.

25. Radike A. *Criteria for Diagnoses of Dental Caries. Principles for the Testing of Cariostatic Agents.* Chicago, Ill: American Dental Association; 1972:87-88.

26. Weinstein P, Harrison R, Benton T. Motivating mothers to prevent caries: Confirmation of beneficial effect. J Am Dent Assoc 2006; 137:189-93.

27. Rubak S, Sandbaek A, Lauritzen T, Christensen B. Motivational interviewing: A systematic review and meta-analysis. Br J Gen Pract 2005;55:305-12.

28. Weintraub JA, Ramos-Gomez F, Jue B, et al. Fluoride varnish efficacy in preventing early childhood caries. J Dent Res 2006;85:172-76.

29. Harrison RL, Wong T. An oral health promotion program for an urban minority population of preschool children. Community Dent Oral Epidemiol 2003;31:392-9.

30. Rao S, Bharambe M. Dental caries and periodontal diseases among urban, rural, and tribal school children. Indian Pediatr 1993;30:759-64.

31. Nandan D, Pandey D, Agarwal S, Qureshi G. Breastfeeding practices among rural and urban mothers—a comparative study. Ind Med Gaz 1991;125:392-5.

32. Nagdeve D, Bharati D. Urban-rural differentials in maternal and child health. Rural Remote Health 2003;146:1-10.

33. Independent Commission on Health in India. Urban health: People living below the poverty line. Health Millions 1998;24:2-4.

34. McConachie H, Huq S, Munir S, Ferdous S, Zaman S, Khan NZ. A randomized controlled trial of alternative modes of service provision to young children with cerebral palsy in Bangladesh. J Pediatr 2000;137:769-76.

35. Dela Cruz F, Padilla G, Agustin E. Adapting a measure of acculturation for cross-cultural research. J Transcult Nurs 2000;11:191-8.

36. Litt MD, Reisine S, Tinanoff N. Multidimensional causal model of dental caries development in low-income preschool children. Public Health Rep 1995;110:607-17.

37. Berkowitz RJ. Acquisition and transmission of mutans streptococci. J Calif Dent Assoc 2003;31:135-8.

38. Pirie PL, Thomson SJ, Mann SL, et al. Tracking and attrition in longitudinal school-based smoking prevention research. Prev Med 1989;18:249-56.