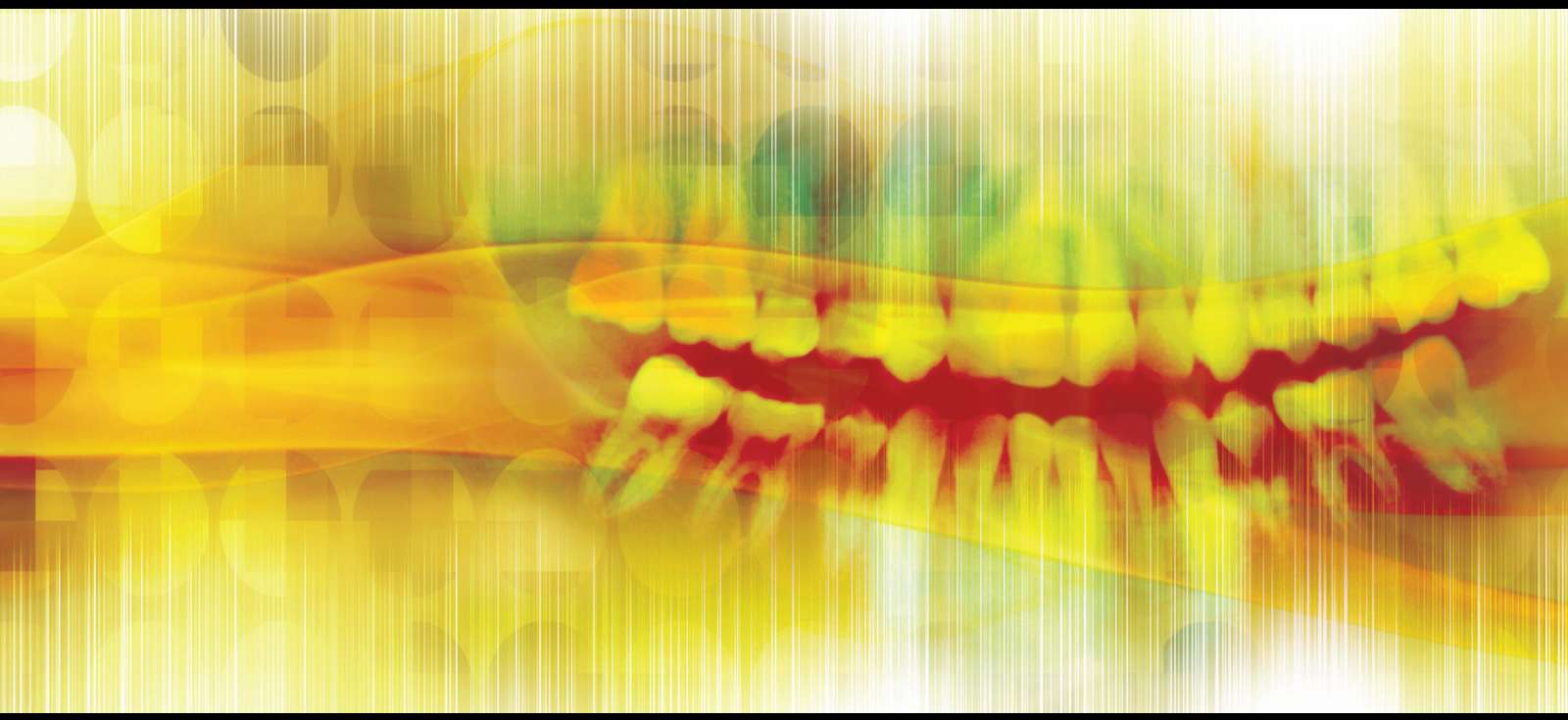
International Journal of Dentistry

Oral Health Promotion in Infants and Children: Models and Long-Term Effectiveness

Guest Editors: Gajanan Kulkarni, Francisco Ramos-Gomez, Robert Schroth, and Ashwin Jawdekar



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Editorial Board

Contents

Oral Health Promotion in Infants and Children: Models and Long-Term Effectiveness, Gajanan Kulkarni
Volume 2014, Article ID 385687, 1 page

Disease Management of Early Childhood Caries: ECC Collaborative Project, Man Wai Ng, Francisco Ramos-Gomez, Martin Lieberman, Jessica Y. Lee, Richard Scoville, Cindy Hannon, and Peter Maramaldi
Volume 2014, Article ID 327801, 10 pages

Diversity Considerations for Promoting Early Childhood Oral Health: A Pilot Study, Sarah Prowse, Robert J. Schroth, Alexandria Wilson, Jeanette M. Edwards, Janet Sarson, Jeremy A. Levi, and Michael E. Moffatt
Volume 2014, Article ID 175084, 10 pages

A Model for Community-Based Pediatric Oral Heath: Implementation of an Infant Oral Care Program, Francisco J. Ramos-Gomez
Volume 2014, Article ID 156821, 9 pages

Comparing Health Promotion Programs in Public Dental Service of Vantaa, Finland: A Clinical Trial in 6-36-Month-Old Children, Irma Arpalahti, Mimmi Tolvanen, and Kaisu Pienihakkinen
Volume 2013, Article ID 757938, 9 pages

Long-Term Effectiveness of Parent Education Using the "Baby Oral Health" Model on the Improvement of Oral Health of Young Children, Gajanan V. Kulkarni
Volume 2013, Article ID 137048, 5 pages

Outcome of a Community-Based Oral Health Promotion Project on Primary Schoolchildren's Oral Hygiene Habits, Heidi Halonen, Paula Pesonen, Liisa Seppä, Eija Peltonen, Leo Tjäderhane, and Vuokko Anttonen
Volume 2013, Article ID 485741, 6 pages

A Proposed Model for Infant and Child Oral Health Promotion in India, Ashwin Muralidhar Jawdekar
Volume 2013, Article ID 685049, 6 pages

Evaluating Two Oral Health Video Interventions with Early Head Start Families, Lynn B. Wilson, Barbara DeBaryshe, Malkeet Singh, and Sharon Taba
Volume 2013, Article ID 437830, 9 pages

Chapter Oral Health Advocates: A Nationwide Model for Pediatrician Peer Education and Advocacy about Oral Health, Charlotte W. Lewis, Lauren Barone, Rocio B. Quinonez, Suzanne Boulter, and Wendy E. Mouradian
Volume 2013, Article ID 498906, 7 pages

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Volume 2014, Article ID 385687, 1 page
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Editorial

Oral Health Promotion in Infants and Children: Models and Long-Term Effectiveness

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The concepts of anticipatory guidance, dental home, and the year one dental visit in the context of oral health in children are slowing permeating the dental community. The above principles are now taught in dental schools, especially at the graduate level in specialty pediatric dentistry programs. Various dental associations, societies, and advocacy bodies have adopted those principles and advocate for them to varying degrees. While the value of oral health promotion in infants and young children is widely recognized, there is a diversity of approaches to the same. To date, a comprehensive overview of the various models, best practices, or the benchmarks for assessing their effectiveness has not been undertaken.

In this special issue, dental and nondental clinicians, health promoters, and investigators have contributed to original research articles as well as proposals that document practices, experiences, and evaluation of outcomes related to oral health promotion in infants and young children from around the world. Some of the articles document the long-term effectiveness of their oral health promotion activities or models with clearly identifiable clinical outcomes.

The issue highlights several facts. There is a diversity of approaches employed by a diversity of professionals. The goals, methodology, and outcome measures vary greatly. For example, the ages of the children at which these efforts ought to be directed vary. The scope of the oral health promotion activities ranges from simply providing education to parents and caregivers to provision of preventive services such as the application of fluoride varnishes. Another issue that comes to light is whether health promotion activities should primarily be aimed at caries prevention or if they should provide comprehensive anticipatory guidance which includes education on matters such as prevention of malocclusions in children due to habits, prevention of trauma, and avoidance of other risk behaviors that can predispose children to oral problems. With the advent of newer digital technologies and platforms for dissemination of information, the scope and reach of such activities are bound to evolve. Teledentistry should allow for well-established programs with documented clinical effectiveness to reach parts of the world where childhood oral disease is endemic and access to care is still an issue. There is a need for the development of oral health promotion models deliverable through modern technologies.

There is great paucity of the literature documenting the effectiveness of such programs, both in the short and especially the long term. Moreover, the relationship between oral health in infancy and that in adulthood has yet to be systematically explored. While it is reasonable to conjecture that the establishment of risk factors very early in life might have long-lasting and indeed life-long effects, this has not been explored and documented. Without such evidence it would be difficult to convince governmental or non-governmental agencies to fund such programs and educational institutions to undertake training of health promoters.

This special journal issue is a starting point for developing a consensus around this important pediatric health topic.

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Research Article

Disease Management of Early Childhood Caries: ECC Collaborative Project

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Until recently, the standard of care for early childhood caries (ECC) has been primarily surgical and restorative treatment with little emphasis on preventing and managing the disease itself. It is now recognized that surgical treatment alone does not address the underlying etiology of the disease. Despite costly surgeries and reparative treatment, the onset and progression of caries are likely to continue. A successful rebalance of risk and protective factors may prevent, slow down, or even arrest dental caries and its progression. An 18-month risk-based chronic disease management (DM) approach to address ECC in preschool children was implemented as a quality improvement (QI) collaborative by seven teams of oral health care providers across the United States. In the aggregate, fewer DM children experienced new cavitation, pain, and referrals to the operating room (OR) for restorative treatment compared to baseline historical controls. The teams found that QI methods facilitated adoption of the DM approach and resulted in improved care to patients and better outcomes overall. Despite these successes, the wide scale adoption and spread of the DM approach may be limited unless health policy and payment reforms are enacted to compensate providers for implementing DM protocols in their practice.

1. Background

Early childhood caries (ECC) is a common childhood disease in the United States (US) and worldwide [1]. Until recently, the standard of care for ECC has been primarily surgical and restorative treatment with relatively little emphasis on the prevention and management of disease [2]. In the US, young children who are not cooperative are commonly sedated or treated under general anesthesia (GA). However, despite receiving costly treatment under GA, such as in the operating room (OR) [3–5], children all too often develop new and recurrent caries [6–10]. It is now accepted that surgical repair alone does not address the underlying etiology of the disease [11]. Unless the caries balance is altered, new and recurrent caries are likely to occur [12]. On the other hand, a successful rebalance of risk and protective factors may slow down or completely halt the disease process, resulting in caries arrest, if not also preventing the onset of new disease [13].

Contemporary approaches to caries prevention and management modeled after medical management of chronic conditions such as diabetes, obesity and asthma, have been described in the scientific literature and are herein known as chronic disease management (DM) [11, 13–15]. DM differs from the traditional approach of oral health care providers relying on a surgical treatment model in response to the disease, while telling the patients what to do. Instead, it assumes that patients have a central role in determining the care of their chronic condition [13]. A close collaboration

Table 1: ECC Phase 1: comparison of rates of new cavitation, pain, and referral to OR between ECC patients and historical controls.

Outcomes	BCH			SHS		
	ECC (N = 403) %	Historical control (N = 129) %	Improvement %	ECC (N = 234) %	Historical control (N = 80) %	Improvement %
New cavitation	26.1	75.2	65.3	41.0	71.3	57.5
Pain	13.4	21.7	38.2	7.3	31.3	23.3
Referral to OR	10.9	20.9	47.8	14.9	25.0	67.8

between the healthcare provider and patient is required, ideally in a culturally and linguistically appropriate manner. In practice, healthcare providers coach patients and parents about the factors that lead to and protect against dental disease and assist them in selecting self-management goals to improve their own and their children's risk for disease. Treatment decisions are based on the latest evidence-based guidelines that are customized to patients' individual needs. Risk-based DM of ECC requires significant patient and family engagement and empowerment from the provider and care team in effective day-to-day behavior modifications (e.g., tooth brushing, topical fluorides, and dietary control) that address disease etiology [13]. Family-centered behavior plans lead to real behavior change and maintenance of oral health behaviors in the child's home. At the same time, the dental practice has a reciprocal role in tracking and managing the care of patients.

1.1. ECC Quality Improvement Learning Collaborative

Phase 1. In 2008, a risk-based DM approach to address preschool children with ECC was implemented and tested as a quality improvement (QI) demonstration project at Boston Children's Hospital in Boston, Massachusetts (BCH), and St. Joseph Health Services of Rhode Island in Providence, RI (SJH). The clinical protocol and project results have been previously published [13]. Thirty months of results found that children in the ECC group experienced lower rates of new cavitated lesions, pain, and referrals for restorative treatment under general anesthesia in the OR as compared to baseline historical controls (Table 1) [13]. At BCH, the ECC group experienced a 62% lower rate of new cavitation compared to the historical control group [13]. Structured interviews with Phase 1 parents revealed that most believed the DM approach to be helpful for their children; almost all parents appreciated given reasons as to why their children may have developed ECC. The collaborative approach allowed clinicians to engage parents or caregivers to better understand that they have a voice in the care their child receives [13].

Phase 2. Building upon the promising results of Phase 1, the project was expanded in 2011 to include five additional teams in the US. Phase 2 further tested the feasibility and effectiveness of the DM approach to reduce ECC in more diverse settings. The five additional teams were in the following locations across the US: Holyoke Health Center (Holyoke, MA); Native American Health Center (San Francisco, CA); Nationwide Children's Hospital (Columbus, OH), Neighborcare Health (Seattle, WA); and University Pediatric Dentistry (Buffalo, NY). The purpose of this report is to describe the Phase 2 project and experiences, present the results after 18 months, and discuss the implications of what was learned.

1.2. Structure of Phase 2. Phase 2 was implemented as an 18-month QI Learning Collaborative. Using established QI methods, a nationwide collection of staff, experts, and faculty provided training and technical assistance to the seven participating teams, which included the two teams that were part of Phase 1. Teams were required to attend three on-site "learning sessions" where each of the seven teams received didactic education and training on QI concepts and activities. The learning session curriculum focused on the use of logic models, measurement plans, Plan-Do-Study-Act (PDSA) cycles, DM of ECC such as caries risk assessment (CRA), self-management goals (SMGs), effective patient-provider communication, and fluorides and other remineralizing modalities. Teams learned from each other by sharing their experiences, successes and struggles. The learning sessions provided invaluable opportunities for synergy as teams exchanged approaches to DM during consultations with experts, faculty, and staff, who provided coaching and support.

QI has been defined as the combined and unceasing efforts of everyone to make changes that will lead to better patient outcomes (health), system performance (care), and professional development (learning) [16]. QI is intended to support the redesign of care processes based on a system of learning, incremental change, and the incorporation of empirically supported best practices from evaluating performance and outcome measures. Unlike a protracted randomized trial, QI uses systematic, data-guided activities designed to bring about immediate improvements in health care delivery in particular settings [16] and can be considered as the scientific method used for action-oriented learning.

The Model for Improvement [17] developed by Associates in Process Improvement was used as the essential framework to guide changes made by each team's care delivery system in order to use a DM approach to address ECC. The Collaborative developed a driver diagram outlining three main outcomes of interests: (1) new cavitation; (2) pain related to untreated caries; and (3) referral to the OR, along with primary and secondary drivers affecting those outcomes (Figure 1).

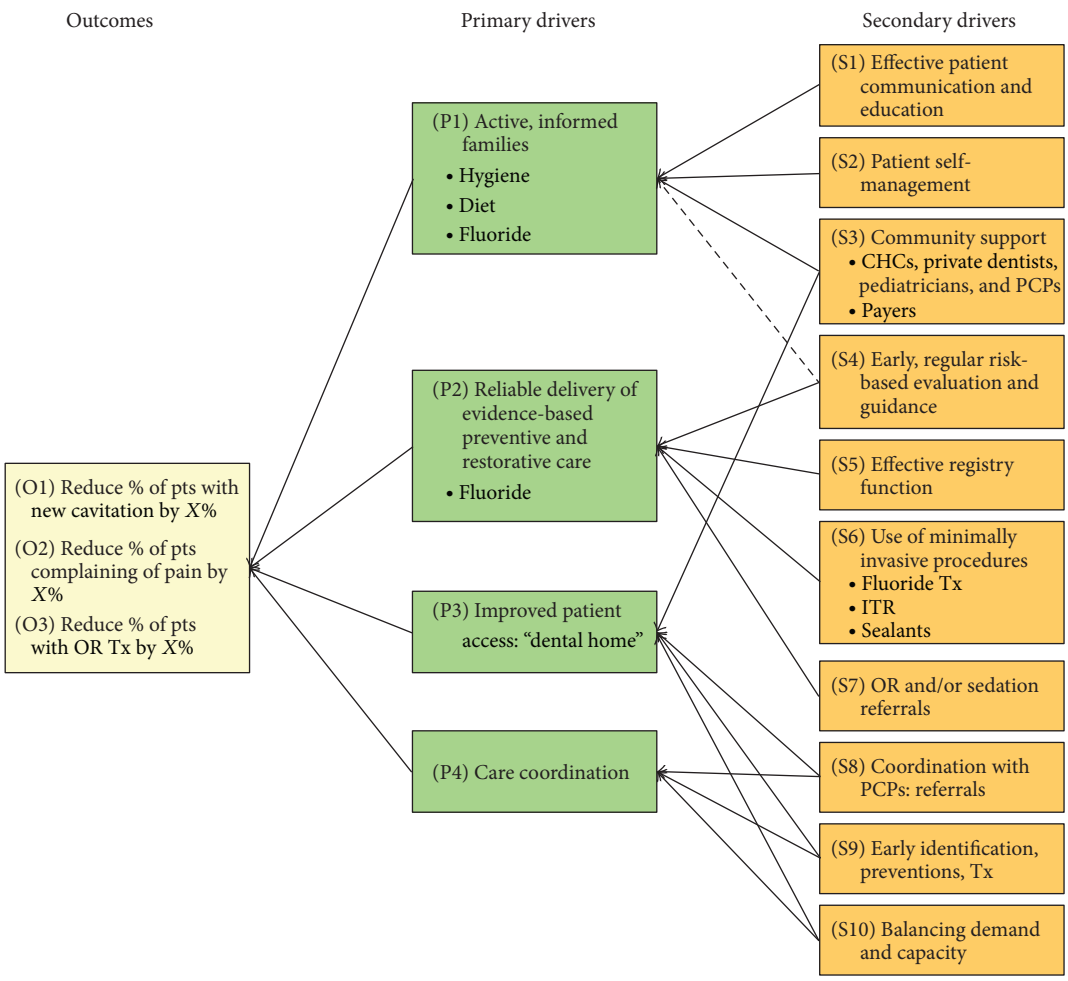

Figure 1: ECC Phase 2 Driver Diagram.

PDSA [17] cycles are small-scale tests of change in real work settings—by planning a test, trying it, observing the results, and acting on what is learned. PDSA cycles promote creativity, offer quick results, and empirically support approaches to DM that are specific to the clinical teams. For example, PDSAs served as learning opportunities for Phase 2 teams to use evidence to determine how to perform activities such as CRA, SMGs, and patient scheduling to support the additional DM visits required.

1.3. ECC DM Protocol. The Phase 2 clinical DM protocol (shown in Figure 2) were modeled after Phase 1. The ECC DM approach assumes that caries risk can change over time.

CRA and SMGs in combination are the cornerstones of DM approach. CRA allows for a customized prevention and maintenance plan to be developed that is appropriate for the child and the family. CRA involves asking parents a few questions to assess each child's risk for caries at the initial visit and every visit thereafter. Figure 3 shows an example of a CRA form used in Phase 2. This form was adapted from the American Academy of Pediatric Dentistry (AAPD CRA) form and the pediatric Caries Management by Risk Assessment (CAMBRA) form. Teams were able to customize forms for use with their specific patient populations and organizational context provided that they included at least the basic questions seen in Figure 3.

1.3.1. DM Clinical Protocol. Children who had at least one tooth with clinical manifestation of caries—tooth decay (including demineralization)—or who had a history of carious lesions was considered an ECC patient. At the initial and recall visits, the medical and dental history were reviewed. A clinical examination and charting were performed to allow for the tracking of caries presence and activity by tooth and surface, since decay may progress and become inactive at different sites of the dentition at the same time.

Parents of ECC patients were engaged and coached about the factors that lead to caries and tooth decay by dentists, hygienist, dental assistants, and/or support staff. Parents learned about the caries process as they were informed of the ways that tooth decay can be prevented and stopped. In addition, parents learned that without a change in diet and home care, new cavities and broken fillings will likely result. Providers and care team members worked with parents to select SMGs to improve their child's disease risk. Figure 4 presents an example of a SMGs handout used in Phase 2.

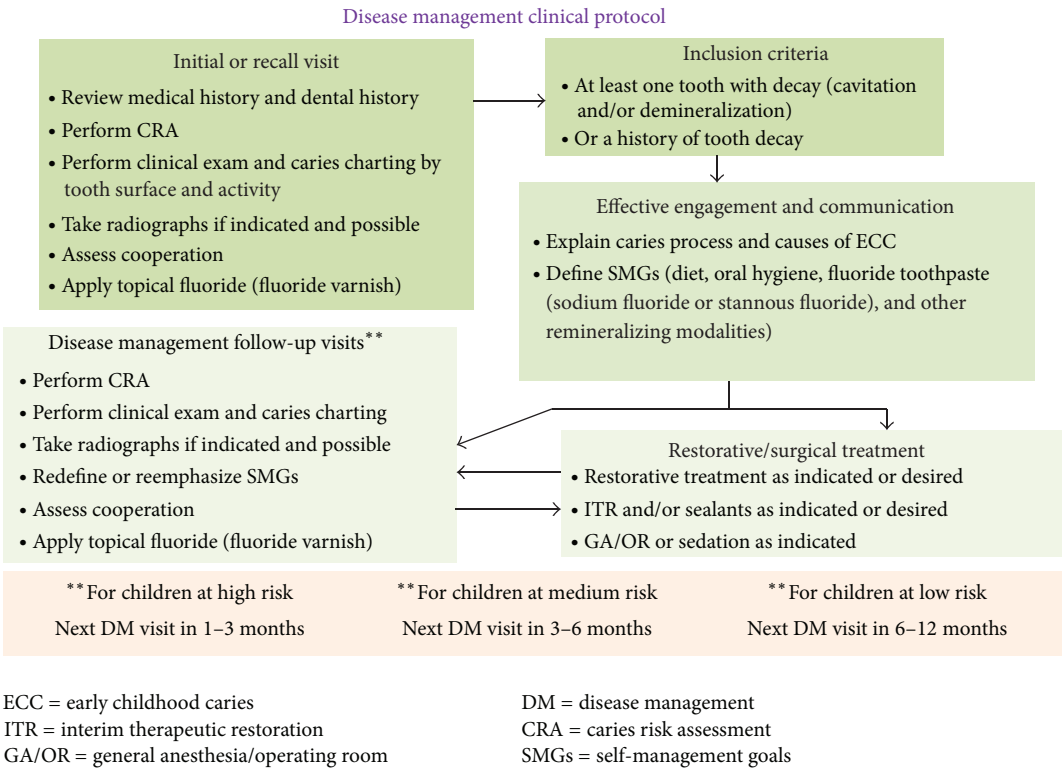

Figure 2: ECC Phase 2 disease management clinical protocol.

Such goals include basic caries control strategies such as more frequent tooth brushing, using topical fluorides at home, and modifying one's diet to include fewer and less frequent intake of sugary products.

The frequency of return DM visits for patients and parents—in-office and at the clinic site—was based on their caries risk. Whenever possible, the DM activities were coordinated with restorative treatment. Table 2 shows the DM protocol with return visit intervals based on the most recent caries risk status in conjunction with restorative care as needed and as desired by the parent and dental provider.

The in-office DM protocol was based on the assumption that children who initially presented as high caries risk may improve their risk over time. Children who were assessed to be high caries risk were advised to return in 1–3 months for a DM visit. Medium or moderate risk children returned in 3–6 months, while low risk children returned in 6–12 months. In some cases, accurate clinical assessment was hampered by the presence of heavy plaque and/or a lack of patient cooperation. As a result, a one-month follow-up visit for a child assessed to be high caries risk allowed for a more accurate assessment of demineralized, cavitated, and remineralized tooth surfaces.

During each recall or subsequent DM visit, a CRA was performed. Providers asked parents to report on their experiences with the SMGs in order to assess the level of compliance and the utility of the agreed-upon SMGs. A clinical examination was also performed, reassessing for the presence of new demineralization and cavitation along with caries remineralization. All findings were recorded. Intraoral radiographs were taken if indicated and possible, and fluoride varnish was applied.

1.3.2. Restorative Treatment. Parents were given the full range of options for restorative treatment, which included pharmacologic management (i.e., use of nitrous oxide, sedation, or GA/OR) as needed by the patient and as desired by the parent. Restorative options included conventional treatment and minimally invasive restorative treatment (i.e., interim therapeutic restorations (ITR)). If the destruction of the tooth structure by the caries process was minimal, caries arrest was possible with remineralization of the tooth structure. The restorative treatment was then deferred in patients if the caries process was stabilized, especially in a child unable to cooperate for restorative treatment. However, close follow-up and preventive care based on caries risk were essential to safeguard from relapse. If the decay had progressed into dentin and caries arrest was not achieved, ITR was offered as an alternative treatment with early cavitated lesions. Parents were informed that this was caries control rather than permanent restoration. A secondary gain from more frequent visits for preventive care was usually a reduction in a child's fears and a gain in trust between the dental provider and the child over time, allowing for restorative treatment to be completed with greater ease at a later time.

1.4. Practice Redesign to Support Disease Prevention and Management of Caries. In order for teams and their sites to support risk-based disease prevention and management

_ _ _ _ _ _ _ _ _ _ _ _ _	_ _ _ _ _ _ _ _ _	_ _ _ _ _ _ _	_ _ _ _ _ _ _ _ _ _ _ _ _	Today's date / /
Patient's first name	Last name	MRN	Name of provider	Child's DOB / /

Type of visit: (circle all that apply)

Initial	Recall	DM	Fluoride varnish	Restorative	ITR	Sealants	Sedation	Emergency	OR	Other

Can be completed by clinical staff, patient or dentist		
Biologic Factors		Comments
Child has history of active caries	Y N	
Mother has active caries	Y N	
Siblings have active caries	Y N	
Continuous bottle use	Y N SW	
Sleeps with bottle or nurses on demand	Y N SW	Describe
Juice/milk in sippy cup	Y N SW	Describe
Frequent snacking	Y N SW	Describe
SHCN	Y N	
Potential caries causing medications	Y N	Describe
Protective factors		
Tooth brushing	Y N	__x/day
Assistance with brushing	Y N SW	
Fluoride toothpaste	Y N	__x/day
Topical fluoride (stannous fluoride toothpaste, Prevident, ACT)	Y N	__x/day
Floss	Y N NA	
Drinks fluoridated water	Y N	

To be completed by dentist		
Disease indicators/risk factors (from clinical examination)		
Cavitation	Y N	Where_____
New cavitation	Y N NA	
Demineralization / New Demin (WS)	Y N	Where_____
Radiographic decay	Y N NA	Where_____
Enamel defects	Y N	Where_____
Visible plaque	Y N SW	Where_____
Gingivitis	Y N Improved	Describe
Deep pits/fissures	Y N	Where_____
Indicators of improved caries risk (from clinical examination)		
Remineralization	Y N SW	Where_____
New remineralization	Y N	Where_____
Meeting self-management goals	Y N SW NA	
Stannous fluoride staining	Y N NA	
Other		
Pain due to untreated caries	Y N	Where_____
Referral to OR/sedation	Y N	
Behavior (Frankl score)	1 2 3 4	

Overall caries risk: Low Medium High

NV: ___ months for DM/F varnish and _____

Self management goals

(1)

(2)

F-toothpaste ___ x/day 0.4% stannous fluoride___x/day

Figure 3: Sample ECC Phase 2 caries risk assessment form.

of ECC, a redesign of their care delivery systems was needed. Dentists, staff, patients, and families who were accustomed to conventional surgical and restorative care were educated about and guided to accept a contemporary approach that emphasizes risk assessment, individualized disease prevention, and management and maintenance of health. For example, scheduling systems, typically set up to accommodate recall preventive visits every six months as allowed by insurance, had to be adjusted to allow for more frequent preventive return visits for high caries risk patients.

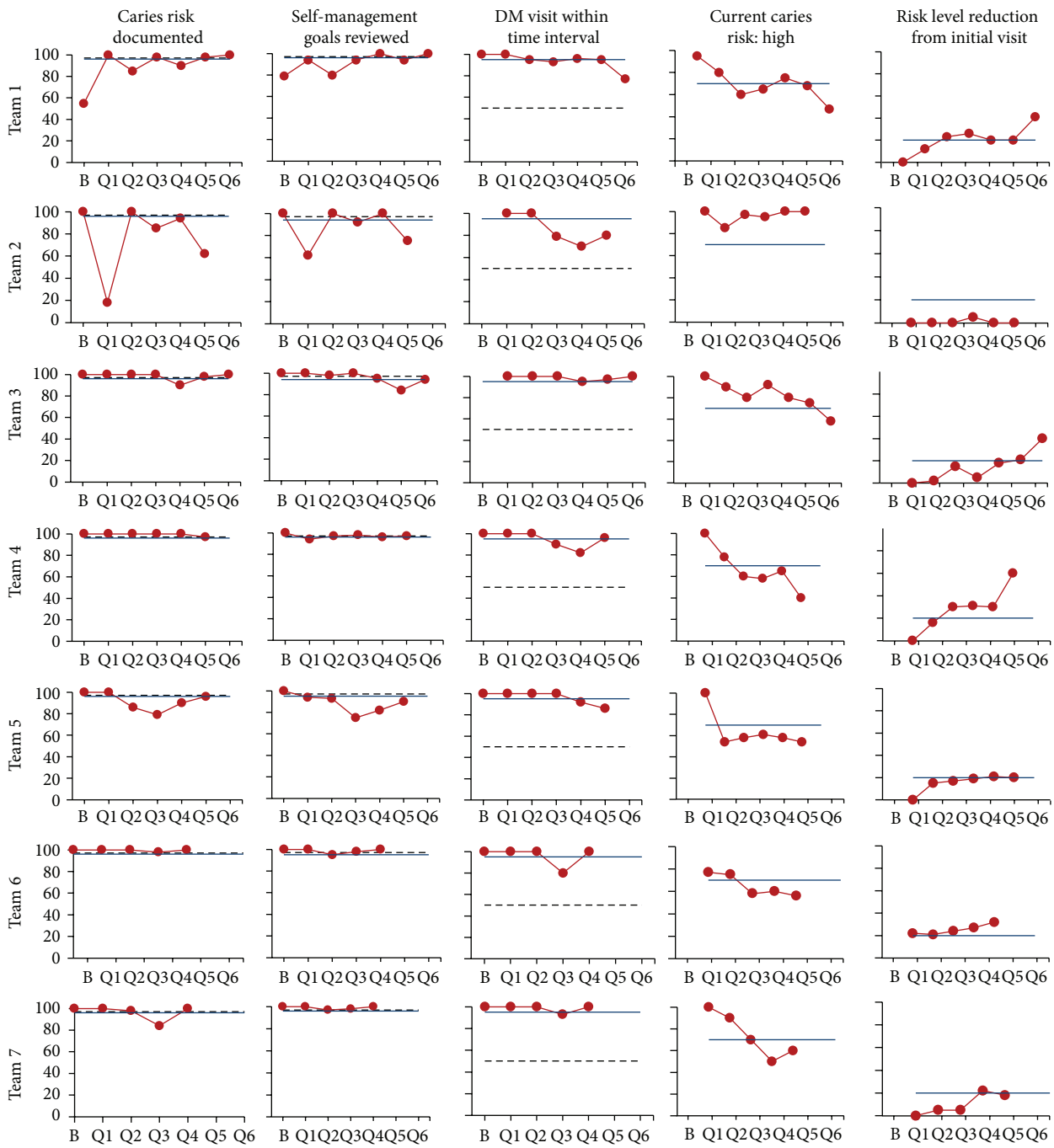

Figure 4: Run charts showing some of the trend data for the ECC Phase 2 teams.

Before and during the implementation of the project, senior leaders and clinical champions of each team provided training to their dental providers and staff about the DM protocol. They shared what they learned from the Learning Sessions and monthly calls on DM and QI methods with those who were involved in the day-to-day work of implementing the ECC DM protocol. Teams were expected to hold regular meetings to address questions about the protocol and care management of patients, review project progress, plan PDSAs, and institute change. Most teams chose to begin the protocol initially with a few providers, followed by spreading to additional providers over time.

2. Methods

2.1. Measurement Plan and Data Collection. In Phase 2, teams collected process and outcome measurement data for the purpose of evaluating improvement trends in care processes and patient outcomes over time. Each month, teams randomly selected 20 patient records (charts) of their ECC

Table 2: ECC Phase 2: disease management protocol.

Existing risk category	New clinical findings	Fluoride varnish interval	Self-management goals	Restorative treatment	DM return interval	Other
Low	(i) No disease indicators of caries (ii) Completely remineralized (arrested) carious lesions	6–12 months	(i) Twice daily brushing with F toothpaste† (ii) Stannous fluoride‡ on cavitated lesions		6–12 months	
Medium	(i) No disease indicators* but has risk factors** and/or inadequate protective factors*** (ii) Disease indicators present with some remineralization	3–6 months	(i) Twice or more daily brushing with F toothpaste† (ii) Stannous fluoride‡ on cavitated lesions (iii) Dietary changes	(i) Sealants (ii) ITR (iii) Conventional Restorative	3–6 months	(i) Xylitol gum or candies or wipes (ii) Calcium phosphate paste
High	(i) Active caries (disease indicators present) (ii) No remineralization occurring (iii) Heavy plaque	1–3 months	(i) Twice or more daily brushing with F toothpaste† (ii) Stannous fluoride‡ on cavitated lesions (iii) Dietary changes	(i) ITR (ii) Sealants (iii) Conventional restorative	1–3 months	(i) Xylitol gum or candies (ii) Calcium phosphate paste

ECC: early childhood caries; DM: disease management; ITR: interim therapeutic restoration.
*Examples of disease indicators include demineralization, cavitated lesions, existing restorations, enamel defects, deep pits, and fissures.
**Examples of risk factors include patient/maternal/family history of decay, plaque on teeth, and frequent snacks of sugars/cooked starch/sugared beverages.
***Examples of protective factors include fluoride exposure (topical and/or systemic) and xylitol.
†Brush with a smear of 1000 ppm F toothpaste.
‡Apply a smear of 1000 ppm stannous fluoride to the cavitated lesions.

patients to record the results of some measures. Meanwhile, on a quarterly basis, they selected 30 charts of ECC patients to record results of other measures. The teams submitted these data to the Collaborative each month without using patient identifiers. The deidentified data were collected and managed using REDCap [18] (Research Electronic Data Capture) electronic data capture tools hosted at BCH. REDCap is a secure, web-based application designed to support data capture for research studies providing (1) an intuitive interface for validated data entry; (2) audit trails for tracking data manipulation and export procedures; (3) automated export procedures for seamless data downloads to common statistical packages; and (4) procedures for importing data from external sources. BCH staff retrieved and processed the data, screened for errors, and managed the deidentified data.

Each month, run charts were produced by BCH and sent to the Collaborative staff. In turn, the Collaborative sent run charts to each team for use in monitoring progress toward improvement. During monthly Collaborative calls, trends in the run charts were reviewed. In addition, any questions and concerns from the teams were addressed by the Collaborative staff, faculty, and Improvement Advisor.

Although this Collaborative was designed as a QI initiative that aimed to identify positive trends in process and outcome measures which would signify improvements in care and outcomes, a trends analysis would not necessarily infer causality. Therefore, there was a need to compare the project outcome data to baseline data derived from historical controls (i.e., patients treated by the teams prior to the start of Phase 2). In the last several months of the Collaborative, after obtaining IRB approval, teams collected data, on the three outcomes of interest (percentage of patients with new cavitation, pain, and unplanned referrals to the OR) by randomly selecting 50 charts of their ECC patients and 50 charts of baseline historical control patients. At each site, a computer generated randomized scheme identified the potential ECC and control patients.

Qualifying ECC patients were those who had been (a) in Phase 2 for a minimum of 6 months and (b) had at least one formally scheduled preventive visit (recall visit) whereby caries charting was performed and documented. All sites reviewed their Phase 2 records (i.e. Excel spreadsheets or billing generated report) and randomly selected 50 ECC patients (one site had only 46 patients).

Qualifying historical control patients were children who were younger than 60 months of age and had (1) a history of decay; (2) at least one recall visit six months after the initial visit; and (3) a last visit that was at least six months prior to the start of the Phase 2.

For each team, a computer generated randomized scheme identified potential patients based on age and whose billing records were reviewed to determine whether they had a recall visit at least 6 months prior to the start of Phase 2. These patient records were selected for further review to determine those patients who met the qualifying criteria.

The following information was documented for both ECC and historical control patients by visit date: (1) type of visit (preventive, restorative, sedation, OR, missed, or canceled), (2) new cavitation identified, (3) pain identified, and (4) referral to OR. The first visit was determined for each patient

Table 3: ECC Phase 2: comparison of rates of new cavitation, pain, and referral to OR between ECC patients and historical controls.

Outcomes	ECC (N = 344) %	Historical control (N = 316) %	Percentage improvement %	Improvement range %
New cavitation	33	46	28	14–71
Pain	8	11	27	80–100
Referral to OR	14	22	36	0–81

as that which decay was initially charted or documented in the patient's clinical notes. Pain and OR referral at first visit, including pain unrelated to untreated decay at any visit were excluded. From this information, the percentage of patients with new cavitation, pain identified, and referral to OR were determined.

The ECC and historical control data were collected by most teams onto paper collection forms. The forms were sent to BCH for data entry into a separate REDCap database. One team entered their data directly into the REDCap database.

3. Results

Figure 4 shows some of the trend data for the seven Phase 2 teams. Over time, the teams demonstrated a highly consistent level of performance with their providers performing CRAs and SMGs. Most teams saw a reduction of ECC children deemed as high caries risk and an increase in ECC children with improved caries risk from the first visit.

Table 3 shows a comparison of the rates of new cavitation, pain, and referral to OR between ECC patients and the baseline patients for Phase 2. These results reflect a random sample of 316 historical control children and 344 ECC children drawn from a total Phase 2 population of 3,030. In the aggregate, children in the ECC DM group experienced lower rates of new cavitated lesions, pain, and referrals for restorative treatment under general anesthesia in the operating room (OR) as compared to baseline historical controls, although there was variability from site to site.

4. Discussion

In Phase 2 of the ECC Learning Collaborative, by using QI methods to change their systems of care, teams were able to efficiently implement the DM protocol into their clinical practice. In the aggregate for Phase 2, fewer ECC children experienced new cavitation, pain, and referrals to the OR compared to baseline historical controls.

There was discrepancy from team to team in the degree of improvement in the process measures and outcomes achieved. The variation in outcomes among teams, as expected, may be attributed to differences in each team's use of the DM protocol or to distinct cultural and socioeconomic differences in patients and families among the sites. Similarly, Phase 1 also found imbalance in terms of outcomes achieved at the two sites. The Phase 1 team that demonstrated a relatively less dramatic improvement in new cavitation rates had predominantly English speaking providers serving predominantly Latino populations who spoke Spanish as their native language. Unfortunately, demographic data were not collected in Phase 2.

In terms of limitations, 50 randomly selected charts for each of the ECC and historical control groups at each site may be insufficiently representative of the groups for each team. At the same time, an 18-month follow-up period may be an inadequate length of time to evaluate the clinical outcomes of some children who were "enrolled" as ECC patients over time. In addition, although dental providers at all sites received training on the DM protocol to chart decay (by using a modified ICDAS system [19]), they did not receive calibration to chart new cavitated or precavitated lesions. However, by protocol, ECC patients were seen more frequently for DM visits, during which time they were examined for new cavitation and thus may have received increased opportunities for new cavitated lesions to be identified.

During their participation in Phase 2, teams shared their experiences including their knowledge and skills gained, lessons learned, and tools developed with other Collaborative participants. Examples of new skills include training of support staff and employing them to assist with CRA and patient education, collaborating with pediatric medical providers to enhance the referral of young children for early preventive dental visits, scheduling differently to accommodate the more frequent return needs of the ECC children for DM visits, and managing no-show appointments by using a registry to track patient visits. Two teams were located in community health centers that initially saw a limited number of young children. These teams developed PDSAs to specifically focus on increasing referrals from pediatricians within their centers, and they were successful in their efforts. One site had a baby's clinic already in place prior to joining Phase 2 and a hygienist to see children specifically younger than age three years for infant oral health visits; this hygienist was already using a CRA tool. This site incorporated the DM protocol, SMGs, and more frequent visits first into their baby's clinic and later spread the DM protocol to other providers in their main dental clinic over time. Tools developed, enhanced, and willingly shared among the Collaborative teams included forms for conducting and documenting carious lesions, CRA, SMGs, and tracking of the ECC patients.

At the conclusion of Phase 2, team leaders convened for a final summary conference. All teams agreed that the DM approach to address ECC was a logical change in practice, albeit not easy to implement. Each team faced challenges that were especially formidable early on. Challenges included having to accommodate the additional DM visits and the

time required for each visit. In some cases, 15 minutes could be added to a restorative visit. Initially, most providers and teams struggled with having to fit in the DM visits, especially if their schedules were booked out in advance. Since most dental insurance plans do not cover more than two diagnostic/preventive visits each year, the additional DM visits and lost time for reimbursable restorative care posed as additional obstacles. Systematic testing of new approaches (via PDSAs) helped to overcome barriers. Changes that worked were implemented across the practice and continually improved upon through further testing. Providers received training and coaching to be able to perform CRA, explain the causes of the caries process, and work with the caregivers to select SMGs more effectively and with greater efficiency. Providers and families began to accept a paradigm shift that addressed disease etiology in lieu of relying solely on a surgical model of treatment.

The use of QI methods was useful in facilitating the adoption of DM to address ECC, first by getting buy-in from the early adopters at each site, followed by later adopters. Some teams had spread the protocol to more providers within their primary site, while others had spread it to all their providers. One team successfully spread the protocol beyond their primary site to other dental sites that were a part of their community center network. Most sites embedded their DM protocols into their systems of care such that dismantling those systems would require effort. Most team affirmed a desire to continue using the DM approach. When the team leaders were asked "What impact did the Collaborative have on you?" responses included "It made me a better provider, a better teacher;" and "I no longer view children 0–5 the same way (I do not pick up the hand-piece first)."

5. Conclusion

We demonstrated the feasibility of an innovative approach to address ECC utilizing DM protocols that can be successfully implemented into dental practice using QI methods in a learning collaborative model. Although not easy to implement, after 18 months, all teams reported that the DM approach resulted in overall improved care delivery and patient outcomes (new cavitation, pain, and referrals to the OR). Teams recognized that while a DM model can be implemented into practice, policy and payment reforms are needed to facilitate a wider-scaled adoption of the DM protocols. Elements to be addressed include compensation for providers' time and efforts to perform CRA, SMGs, patient education and engagement, and the DM visits. Future demonstration should quantify opportunities for cost savings to be realized by avoiding more costly restorative treatment. Future policy changes are necessary to support a paradigm shift from surgical treatment of caries toward an individualized risk-based disease prevention and management model as the new standard of care. At the same time, the use of QI methods may help accelerate the adoption and spread of DM protocols into any dental practice.

Conflict of Interests

Dr. Man Wai Ng is PI on the Early Childhood Caries (ECC) Collaborative projects funded by the DentaQuest Institute. Drs. Francisco Ramos-Gomez, Martin Lieberman, Jessica Y. Lee, Richard Scoville, and Peter Maramaldi have received compensation from DentaQuest Institute as expert faculty members on the ECC Collaborative. Ms. Cindy Hannon is employed by the DentaQuest Institute.

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Research Article

Diversity Considerations for Promoting Early Childhood Oral Health: A Pilot Study

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Objectives. Several groups in Manitoba, Canada, experience early childhood caries (ECC), including Aboriginal, immigrant, and refugee children and those from select rural regions. The purpose of this pilot study was to explore the views of parents and caregivers from four cultural groups on early childhood oral health and ECC. *Methods*. A qualitative descriptive study design using focus groups recruited parents and caregivers from four cultural groups. Discussions were documented, audio-recorded, transcribed, and then analyzed for content based on themes. *Results*. Parents and caregivers identified several potential barriers to good oral health practice, including child's temperament, finances, and inability to control sugar intake. Both religion and genetics were found to influence perceptions of oral health. Misconceptions regarding breastfeeding and bottle use were present. One-on-one discussions, parental networks, and using laypeople from similar backgrounds were suggested methods to promote oral health. The immigrant and refugee participants placed emphasis on the use of visuals for those with language barriers while Hutterite participants suggested a health-education approach. *Conclusions*. These pilot study findings provide initial insight into the oral health-related knowledge and beliefs of these groups. This will help to inform planning of ECC prevention and research strategies, which can be tailored to specific populations.

1. Introduction

Oral health plays an important role in overall health. This is particularly true during early childhood as oral health can influence overall health and well-being [1]. Keeping primary teeth healthy is essential as those who suffer from caries in their preschool years are more likely to experience caries throughout childhood and adolescence [2, 3].

Early childhood caries (ECC) is decay affecting the primary dentition of children <72 months of age [4, 5]. Several groups have been found to be at a high risk for ECC including First Nations and Aboriginal children, refugees and newcomers, and those experiencing poverty [6–9]. Prevalence rates for ECC in several distinct Canadian pediatric populations have been reported with most groups exhibiting rates above 40%. For instance, urban and on-reserve First Nations and Aboriginal children are reported to have high rates, sometimes reaching 80–90% of the population with many meeting the definition of severe early childhood caries (S-ECC), a more rampant form of ECC [8–10]. Meanwhile nearly 40% of rural Hutterite children have been reported to have S-ECC [11]. Other groups in Canada such as Vietnamese children,

immigrants from South Asia, and Portuguese-speaking immigrants have been reported to experience ECC [12–14].

However, still very little is known about the oral health of newcomers, although anecdotal conversations with practitioners would suggest a high level of dental needs. There is a growing realization that newcomers are at increased risk for caries as the American Academy of Pediatric Dentistry (AAPD) has included a question on "immigrant status" in their caries-risk assessment tool (CAT) [15].

There are many challenges involved in promoting oral health to high-risk groups. First and foremost is the difficulty associated with reaching these populations. Additionally, "one-size-fits-all" approaches and strategies that have worked with the general population often have little impact on reducing the incidence of ECC in high-risk populations and may not be effective with distinct cultural groups [16]. Even if it were possible to reach all high-risk children and provide them with tailored programming, the desired behavioural change may not take place (despite the increase in knowledge offered by traditional oral health approaches) [16].

Differing practices and views on oral health, which may be related to cultural diversity, may contribute to increased caries risk. Many aspects of cultural diversity can influence oral hygiene routines, diet, health beliefs, reaction to pain, and access to care, factors which may in turn affect oral health status [17, 18]. If a person belongs to a cultural group that does not define poor oral health as abnormal, they may lack both information about oral health and access to care and may not comply with professional recommendations for treatment [18, 19].

There is a growing realization that qualitative research methods are useful in identifying how knowledge and ideas "develop and operate within a given cultural context" [20]. Overall, there is limited qualitative research on the topic of ECC and the promotion of early childhood oral health (ECOH) among cultural minority groups in North America [21, 22]. There is a growing realization that qualitative research methods may be helpful to uncover family and cultural issues that influence infant and preschool oral health. Having an appreciation of different cultural views may allow for focused outreach and promotion activities [23, 24]. While known barriers to good oral health include a lack of funds to seek dental care (especially with newcomer populations [25]), the effect of knowledge and beliefs on child oral health is less well understood. Parental and caregiver lack of knowledge of and negative attitude towards preschool oral health have been found to be associated with increased caries experience in their young children [23].

The purpose of this pilot study was to examine the knowledge and beliefs of parents and caregivers from four different cultural groups with respect to ECOH and ECC. The ultimate goal was to use these findings to assist in tailoring ongoing promotional activities to improve ECOH and prevent ECC.

2. Methods

A qualitative study design using focus groups was chosen to explore parent and caregiver views on ECOH and ECC from four different cultural groups. This pilot study was undertaken by the Healthy Smile Happy Child (HSHC) partnership that has been promoting ECOH in Manitoba, Canada, since 2000. The partnership adopted and maintains a community engagement approach to address ECC and has been guided by three pillars: community development, health promotion and education and evaluation [26–28]. Focus groups were selected as health promotion programs can often be strengthened through participatory planning approaches that allow participants to voice their experiences and opinions [29]. The project team recognized the value of focus groups and the different findings that can be obtained using such an approach.

Four pilot focus groups involving parents and caregivers of children <6 years of age were held. Each focus group involved a different cultural group and was held in southern Manitoba, Canada. A nonprobabilistic approach to recruitment using a convenience sample of participants was selected. The four groups included parents and caregivers from an urban Aboriginal community, a rural Hutterite colony in southwest Manitoba, a refugee group in the city of Winnipeg, and an urban group of recent newcomer immigrants to the city of Winnipeg, Manitoba. These four distinct groups were selected as children from these communities often experience a higher burden of ECC than the mainstream population.

Aboriginal participants were recruited through an Aboriginal Head Start program and an organization providing culturally relevant preventive and supportive programming to families. All participants were self-identified as Aboriginal (First Nations or Métis). Hutterite participants were recruited with the help of a teacher and research assistant who was a member of a Hutterite colony and who had an existing working relationship with the Department of Pediatrics and Child Health at the University of Manitoba. The Hutterite live on colonies and are a communal branch of Anabaptists (like the Amish and Mennonites) [30]. Meanwhile, refugee participants were recruited through the Canadian Muslim Women's Institute. Participants had refugee status and had been in Canada for at least one year. Finally, the newcomer focus group participants were recruited from an English-as-an-additional-language (EAL) program in Winnipeg, Canada. Participants were landed immigrants, who had an English benchmark of at least four and who had been in Canada for at least one year.

The team facilitating the focus groups included a qualitative research consultant and a HSHC staff member. The study was approved by the University of Manitoba Health Research Ethics Board and followed established community research protocols. Participants provided written informed consent and permission for audiorecording of the discussions. The research team made notes on a flipchart during the discussions while the HSHC team member took additional notes. Participants were invited to review the notes and to correct, delete, or add to any inaccurate or inadequate representations of their comments. Participants in the urban focus groups were provided with bus tickets and all participants received a small honorarium.

Focus group discussions followed a sequence of guiding questions from a semistructured tool developed by the HSHC partnership as follows.

Semistructured Interview Guide

(1) I would like to start by asking you what "healthy teeth" means for babies or very young children (under 5 years old). If I said that someone's child had healthy teeth, what would that mean to you?

  (a) Is it important for kids to have healthy teeth in your culture?
  (b) What do you think makes very young kids get cavities or decay in their baby teeth?

(2) Do you think whether or not a child's baby teeth are healthy makes any difference to their overall health? If yes, ask how or in what ways.

(3) Where did you learn how to take care of your babies' or young children's teeth?

  (a) Has anyone ever learned about dental care for babies or very young kids at any of the programs they attend?
  (b) Has anyone read any pamphlets or brochures about dental health for babies or young kids?
  (c) What do you think is the best way to get information out to parents and families about dental health for babies or young kids?

(4) How do you take care of your babies' or young children's teeth?

  (a) Are there any specific practices that your culture does to keep children's teeth healthy?
  (b) What helps you keep your babies' or young children's teeth healthy?
  (c) Are there any things that make it hard for you to take care of your babies' or young children's teeth?

(5) Does anyone here have children who have had problems with their teeth?

  (a) What kinds of problems did they have?
  (b) What did you do about it?
  (c) Does anyone here know any kids who have had dental surgery? If yes, ask what that was like for the kids and the families.

(6) Is there one thing that somebody (anybody—government, health workers, family members, the people in this room, or anyone else you can think of) could do to help parents and caregivers take care of young children's teeth? What would it be?

(7) Is there anything else that you would like to tell me about what we talked about today?

Questions of particular interest included what good oral health means for their child, their experiences with dental problems like ECC, and how they learned to care for their children's teeth. Another area of interest was whether there were any practices unique to their cultures relating to caring for young children's teeth. Additional probing questions were used as needed to elicit specific details or clarification. Notes and recordings from each focus group were transcribed verbatim and analyzed independently using thematic analysis by two members of the team. When analyzing the data, transcripts from each of the participant groups were examined independently, drawing out participants' responses to the overarching research questions. Themes that emerged in each cultural group were reported separately so that findings would be more practical to inform existing and future oral health promotion and research activities.

3. Results

A total of 40 parents and caregivers participated in this pilot study, including nine in the Aboriginal focus group and 14 in the Hutterite focus group. Eight were residents of the community where the focus group was held while the additional six resided at a different colony. The refugee group included 11 parents and caregivers. Participants originated from countries in Africa, the Middle East, and Western Asia including Chad, Congo, Ethiopia, Iraq, Morocco, Nigeria, and Somalia. Six people participated in the immigrant focus group and were from Africa and Western Asia including Congo, Eritrea, Nigeria, and Sudan.

4. Aboriginal Group

4.1. Definitions and Perceptions of Oral Health. Aboriginal participants described healthy teeth as being clean, free from decay, and not falling out. The majority agreed that baby teeth are important. Participants referred to a link between oral health and temperament, stating that

> if they have a toothache, they're going to be all upset and miserable, crying, in pain and if they have a cavity, then they're going to be crabby. If they have healthy teeth, they won't be grouchy.

However, another participant felt that baby teeth are of little value as they are "going to fall out anyway."

Two main risk factors for caries were identified. One was a mother's diet during pregnancy and the other was the use of bottles and bottle-feeding. One participant expressed,

> "Everything you eat when you're pregnant, everything that goes in your mouth, your baby gets it"

Some participants believed that giving children a bottle at bedtime or naptime causes caries. While several participants had heard this before, a few stated that they did not believe this to be true.

Participants generally learned how to care for their children's teeth from their mothers, grandparents, and friends.

One participant described how her grandparents tought her to use a facecloth and infant toothbrush to clean her babies' gums and teeth. Another indicated that she learned about using infant toothbrushes and toothpaste and the importance of antenatal oral health by attending a community-based Healthy Baby program.

Participants identified several barriers to adopting good family oral hygiene habits. This included uncooperative children, the cost and inability to purchase oral hygiene supplies, and lack of time. One participant expressed,

> It's hard with my kids to get them to brush their teeth. I have to hold them there and brush for them. They do not like to brush their teeth. It only takes a couple of seconds, but it's a big deal.

Another said, "Mine are too lazy."

Some caregivers indicated that they had little difficulty in getting their child to cooperate in brushing, though one parent noted that despite this her child still developed caries in her front teeth.

4.2. Participants' Experience with ECC. Three participants in the Aboriginal group had at least one child or family member who had experienced S-ECC and underwent dental surgery under general anesthesia (GA). One stated that her child's teeth had rotted before she reached the age of two because she did not have enough enamel and had surgery to remove these teeth. The mother of a three-year-old described the surgery experience as "*awful*." Another stated that her niece had all her teeth removed when she was four years old.

> Her teeth rotted really quickly. By the time she was three years old, her top and her bottom was just black, like on posters you see of tooth decay. That's how her teeth were.

Many of the parents indicated that they had difficulty in getting their children to see the dentist. For some, it was because they had been scared or hurt during previous dental encounters or feared needles. Unfortunately, one mother admitted that her son "has five cavities right now because he won't go to the dentist." This fear of the dentist led two parents to agree that it might be better if the dentist were to simply use a gas to "just knock [their children] out."

4.3. Cultural Practices as Related to Oral Health. Aboriginal participants shared information about traditional medicines and practices such as the use of herbal and traditional medicines when babies have rotten teeth. One had taken her child to a traditional healer because of the way "*the gums looked*" and had informed the dentist of this. However, participants suggested that before incorporating any traditional knowledge or medicines into programming and prevention activities, it is important to first seek permission from an elder to share knowledge and teachings.

4.4. Recommendations for Promoting ECOH. Sharing information on a one-to-one basis and making use of existing parental networks were described by participants as effective ways to promote ECOH within the urban Aboriginal community. It was suggested that front-line workers, such as public health nurses and dentists, begin making home visits. Participants also suggested that elders "talk to children in school about taking care of teeth and the [traditional] medicines."

5. Hutterite Group

5.1. Definitions and Perceptions of Oral Health. Hutterite participants identified four factors they believed influenced oral health: oral hygiene, intake of junk food, use of fluoride, and genetics. Some participants felt that brushing and rinsing may be more important than a child's intake of candy and treats.

> You can have a kid who does not eat candy and does not brush or a kid who eats lots of candy and brushes and the kid who eats a lot of candy will be better off.

Participants were not aware of colonies that fluoridate their drinking water, but noted that fluoride does occur naturally in the water of some colonies. Other colonies use water that has been treated by reverse osmosis to remove minerals and one participant wondered whether or not this might affect oral health as it removes fluoride from the water.

Genetics were also identified as possibly contributing to caries in Hutterite children. One mother pointed out that even in colonies where parents "*are making quite a bit of an effort*" to care for children's teeth, "*a lot of kids have to fill their teeth*." Another stated that, while they did not remember ever brushing their teeth as children, they never had cavities and wondered if this might be due to genetics.

Parents and caregivers identified several obstacles to caring for their children's teeth. It was noted that, on several occasions, the children's temperaments hindered oral hygiene. Specifically, children were often too tired, grumpy, or simply unwilling to brush their teeth. Parents and caregivers also expressed difficulty in making the time to help or encourage their children to brush their teeth due to their own fatigue. Several parents in the group spoke about others giving candy to their children. One parent stated, "*I never give her candy, but she gets it from everybody else!*"

One caregiver acknowledged that she only cleans her children's teeth once a day, even though she knows it is recommended to wipe the teeth after each feeding. Her attempt to reduce the risk of decay was to give her baby water to drink, a practice that other parents in the group seemed to share. As one parent pointed out, it is important to clean babies' mouths because there are "something like 8 or 9 [sugar] cubes per cup" of breast milk, only "slightly less than juice."

Participants admitted that it can be painful and traumatic for children when they have cavities, which can affect their quality of life: "if [children] have bad teeth, how can they eat?"

5.2. Participants' Experience with ECC. Two Hutterite participants had children who had dental surgery for S-ECC. One

participant's four-year-old daughter had been complaining of a toothache so she took her to a dentist who "*found a whole mouth full of problems*." She needed five teeth filled and another two removed.

> I never want to go through it again... seeing her in all this pain and you cannot do anything at all. You just have to wait for this appointment. And it drives you crazy. And you're guilty. I took the blame. It's my fault. I did not take enough care of her teeth. Seeing her going into the operating room, they're going to put her to sleep and what if she never wakes up? And all of those things...

5.3. Cultural Practices as Related to Oral Health. Those who had learned about oral health through presentations in their communities were willing to share information with other family members. For instance, one passed along information to family members that you should not give a bottle to a child over one year of age. While participants felt empowered to share with family and friends, they indicated that they might feel uncomfortable about sharing information with others whom they did not know well.

> Participant 1: *I wouldn't dream of, if I see someone giving a baby a bottle, a two-year old, saying, "Do you know that's not healthy?"*
>
> Participant 2: *Of course not.*
>
> Participant 1: *If I know them—but not if I did not know them.*
>
> Participant 2: *They basically wouldn't have to listen to you.*
>
> Participant 1: *Well, it's none of our business. It's a personal preference.*
>
> Participant 3: *I might if I knew them a little—say do you know that this could cause this or that.*
>
> Participant 2: *But it's always better if they get it from somebody higher up.*
>
> Participant 1: *Like at a meeting or a workshop.*
>
> Participant 4: *That's non-confrontational.*

5.4. Recommendations for Promoting ECOH. Hutterite participants indicated that workshops are an effective way to share oral health messages. They appeared to value a "*personal, one-to-one connection*" style of learning. Oral health pamphlets and posters are displayed in the colony. Materials with both text and pictures were recommended as one parent stated, "nothing propels you more to try to help your child than to see the results of non-caring", like "pictures of decayed teeth."

However, they did say that "*if language is too high tech, nobody's going to read it*." The community kitchen seems to be an established area for information sharing in Hutterite colonies.

Some caregivers mentioned that they sometimes obtain articles from the internet. They recommended strategies like a parenting blog, forum, or an email list serve or contact list as ways to disseminate information. Caregivers from this colony also indicated that public health nurses could take a more active role in providing information.

6. Newcomers: Immigrant and Refugee Groups

6.1. Definitions and Perceptions of Oral Health. Those in the immigrant group felt that good oral health meant the absence of swelling, pain, and broken teeth. One parent commented that "*if the first set of teeth starts bad then that will transfer to new [adult] teeth*." Some in the refugee group felt that the health of baby teeth is important and explained that there is a relationship between overall health and healthy teeth. Another felt that baby teeth do not affect adult teeth.

Two refugee participants believed that genetic factors play a role in the process of decay, with one referring to the high occurrence of "*bad teeth*" in her family. The consumption of sweets, lack of oral hygiene, and the use of bottles were also identified as contributing factors in caries development.

Participants also mentioned the inability to control their children's intake of sweets at school, which makes it difficult for them to care for their children's teeth. Milk and dairy products were identified as good choices for children due to their calcium content. One mother from the immigrant group shared how she managed to curb her daughter's intake of sweets:

> Sometimes you need to scare them. My daughter likes chocolate and sugar. When she has cereal, I give her a little sugar but she wants more. I tell her that if I give her more sugar, when I take her to the dentist, he'll remove all her teeth... Now, sometimes she says "Do not put sugar!"

Immigrant participants believed that regular visits to the dentist or doctor were important practices. However, those in the refugee group did not necessarily share this view, as one participant stated that children do not need to go to the dentist unless they are experiencing dental problems.

One immigrant mother mentioned how the dentist recommended that she give her daughter a cup rather than a bottle as her daughter's teeth had "*turned black*." She said the "*bottle is not good for teeth*." Other participants agreed that children should start using a cup at an early age instead of bottles.

Parents and caregivers also shared information regarding oral hygiene practices at home. They described cleaning their babies' gums and tongue using a cloth, warm water and salt, baking soda, glycerin, or cotton wool. The majority of participants indicated they had first learned about oral health care from family members and friends and later from medical practitioners in their home countries. As one stated,

> "I do with my daughter the same my mom did with me."

6.2. Participants' Experience with ECC. Children of participants from the immigrant focus group were reported to have had few dental problems. However, one child did develop

caries involving the primary maxillary incisors. The mother described her experience:

> [The] family doctor, when my child's tooth was a little black, he told me to go to dentist and gave address—but no other information. The dentist said there's nothing too bad about the teeth—it's just the colour. And when her new teeth come out, they'll be better. He said to brush all the time and I do not have to feed her by the bottle. When she was small, I gave her most of the time a bottle. That's why she had the problem. So I have to feed her by the cup and you have to clean always her teeth.

6.3. Cultural Practices as Related to Oral Health. Participants in both groups spoke about the practice of using a twig from a specific tree to clean teeth, stating that it has the additional benefit of being natural and chemical-free. They referred to this twig as a "*sewak*" and reported that the plant has "*lots of benefits for your teeth*." The twig is reportedly very effective: "*Sometimes a brush won't get everything, but that one will take everything off*." Some bring these twigs back when they return from visits to their homeland. Another added that the twig can also be purchased locally.

Participants in the refugee group discussed the importance of hygiene to the Muslim faith. As one participant stated,

> It's part of the obligation. As part of Islam, we pray 5 times in the day. It is most recommended that you brush your teeth. There is a saying from our prophet that if I would have told any human being that these are the obligations that you must do, I would have encouraged them to clean their teeth five times a day. He did not say it's a must for you—it's a very strong recommendation that it is very important.

6.4. Recommendations for Promoting ECOH. Participants suggested that oral health promotion activities could be delivered through existing programs, classes, daycares, schools, and organizations in which parents are already involved (such as EAL classes or programs for moms and tots).

> That's a good reason to use community centres—they can bring parents out, tell them what you want to say, what they need to do. For people who do not understand the language, it's better for them to see it with their eyes.

Some indicated that they would appreciate getting information from a healthcare provider with experience and knowledge whom they could easily trust. One suggested that family doctors could distribute oral health information during immunization appointments. Others felt that basic information could be delivered by laypeople. People from their own cultural community could be trained to pass on this information. There was general agreement that some refugee caregivers might prefer "*someone who is like them*" or who knows their language.

7. Discussion

The purpose of this pilot study was to gain an initial understanding of views on ECOH that may assist in shaping effective and appropriate culturally proficient promotional activities and materials targeting specific "communities" within an increasing diverse population.

Even though the intent of these pilot focus groups was not to contrast findings between the different cultural groupings, it was interesting that there were some differences and apparent similarities. For instance, when asked what contributes to caries in young children, participants in the Aboriginal group identified bottles and bottle-feeding along with prenatal diet as being important while Hutterite participants identified a lack of fluoride in the drinking water, junk food, and genetics. Meanwhile, newcomer participants mentioned sweets, a lack of oral hygiene, and genetics. One apparent similarity between some of the groups related to barriers to regularly cleaning their children's teeth was seen as both participants in the Aboriginal and Hutterite groups mentioned a lack of time as well as their children's temperament and uncooperativeness. With regard to promoting ECOH each group mentioned the importance of reaching parents and making personal connections but offered unique suggestions ranging from including Aboriginal elders to share traditional knowledge, the use of workshops and health-education materials with the Hutterites, and using laypeople in newcomer communities to including oral health messages in existing programs providing assistance to these families.

Each focus group yielded useful suggestions on how to possibly promote oral health and engage members of their cultural community. For instance, Aboriginal participants discussed at length the role of elders. Two specific issues were identified, namely, seeking permission from an elder to incorporate traditional medicine or knowledge into programming and the elder's actual role in information sharing. These findings are consistent with those of a study examining cultural factors affecting children's oral health, which found that elders and their wisdom were highly respected [17].

The Hutterite focus group elicited information not discussed in the other groups. They discussed concerns of passing on information to strangers and the importance of using a nonjudgmental approach as some felt guilty that their child required dental surgery. They felt that appropriate methods included the use of pamphlets, posters, and e-mail updates. This resembles a health-education model rather than health promotion and community development approaches and is not recommended for groups with low literacy levels, language barriers, or limited access to computers. Hutterite communities have a unique lifestyle as they live communally with community ownership of most goods. Communal living allows for less control over some aspects of living as compared to other groups, as is evident with shared meals, dress, and lack of individual finances [30]. This lifestyle may impact their access to oral hygiene supplies and dental care. As decision-making occurs at the community elder level, efforts need to be directed to educating and building relationships with community leaders. It is important to note that women in Hutterite culture play a key role in making decisions about

health [11, 30]. We previously reported that Hutterite mothers had a highly accurate view of their children's oral health [11].

Both Hutterite and refugee participants believed that genetics play a role in ECC development. While there is a proven increase in dental agenesis in the Hutterite population, presently there is no literature to substantiate a genetic predisposition to caries with this group [31]. This belief is likely based on the fact that some genetically associated diseases, such as muscular dystrophy and cystic fibrosis, are more prevalent in or exclusive to the Hutterite population [32, 33]. Some genetic conditions do affect enamel and dentin formation, which can decrease host resistance to caries (e.g. amelogenesis imperfecta). However, there is now emerging evidence supporting a genetic predisposition to caries in some populations [34–36]. The belief that hereditary factors contribute to caries is not exclusive to our study, as these views were also held by Latino immigrant caregivers in another investigation [24]. Regardless of the role that genetics play, it is important to increase parental awareness of the numerous factors involved in caries development so that they can minimize their children's caries risk.

Interestingly, some participants in the Aboriginal group did not believe that putting children to sleep with a bottle could cause caries. This was surprising, as bottle misuse is a highly cariogenic practice. Other reports have suggested that some parents may not understand this and may routinely give their infants and toddlers bottles at bedtime [23, 37]. In a recent qualitative study, nurses reported that parents often do not associate bottle-feeding with caries [38]. Our findings also suggest that there may be some misconceptions about general infant feeding that require clarification. For instance, participants from the Hutterite group stated that breast milk is high in sugar. While breast milk does contain a certain amount of natural sugar, breast milk itself is not cariogenic [39]. A recent review suggests that there is inconclusive evidence to support a relationship between breastfeeding and ECC [40]. However, while some studies have reported that breastfeeding may be protective against caries [41] other studies have reported that prolonged breastfeeding and nocturnal breastfeeding may increase the risk [42]. The Canadian Dental Association's recent position statement on breastfeeding supports this practice but emphasizes the importance of regular oral hygiene once primary teeth begin to erupt [43].

Aboriginal participants received most of their oral health information from mothers and grandmothers. Therefore, it may be important to involve parents and grandparents in oral health promotion activities to equip them with essential oral-health-related information that they can then pass on to younger generations. A move towards family-centred care (which encourages the involvement of all members of a patient's circle, both familial and social) would assist in meeting the needs of this group [44]. In our study, only one participant received oral health messages from a health professional. This was surprising, as the group identified public health nurses as a possible messenger of oral health information.

Immigrant participants possessed a good level of understanding about ECOH and few had children who developed ECC. This may be in part due to what is called the "healthy immigrant effect," which suggests that the healthiest are more likely to migrate and be granted residence in another country [45]. Participants in this focus group held differing opinions about who should deliver information to members of their community. While some felt that professionals would be best as they "trust" them, others believed that lay workers in the community would be better suited to promote ECOH. This has been shown to be effective in the Vietnamese community in British Columbia [14].

Several common themes emerged from the different pilot focus groups. For instance, participants from each group identified that the difficulty in cleaning their children's teeth and limiting sugar intake were challenges to keeping their children's mouths healthy. Similar findings were also reported in a recent study involving African newcomers to Canada as they expressed concern over their inability to keep their children from eating sugar and candies and fighting with their children to brush their teeth [21].

Refugee participants believed that few of their children had dental issues and suggested that children really only need to visit the dentist when they experience a dental problem or toothache. Similarly, another report has suggested that the perceived need for dental care may be low among African newcomers as they mainly rely on their own assessments, toothaches, and advanced signs of caries to indicate the need for dental care rather than the established early warning signs of ECC [21]. Additional evidence supports these findings, as certain groups have been found to seek dental care only after their children begin to experience pain [46]. Seeking preventive dental care may not be the cultural norm [21, 46].

The refugee group discussed the influence of religion on oral health and hygiene. Many participants identified as Muslim said that performing oral hygiene is part of Islam. However, focus groups with a similar population of Canadian newcomers have suggested that oral hygiene may not be a priority, as they believe that oral health is ultimately dictated by God's will [21]. Perhaps the involvement of religious institutions and leaders may be a worthwhile avenue to explore for continuing work with this population.

Language is key to effective and safe communication and therefore must play a critical role if ECOH is to be effectively tailored to specific populations. Participants suggested that using individuals from their own cultural group to deliver oral health messages would be effective. Language barriers have a larger influence on how one successfully interacts with the health care system than cultural beliefs [47]. Language is affected by cultural and historical context and is "often about sharing and validating realities" [48]. Given the obvious language barriers that exist for newcomer populations, participants in the immigrant and refugee groups also suggested that providing visual information and resources may be useful in sharing key messages about ECOH. As rates of immigration continue to grow, cultural groups are less likely to have access to health professionals who share the same beliefs and understandings of health and disease, language, and experiences [49]. "Linguistically appropriate care" can be achieved when a provider shares an understanding of the experiences of the community [48]. Perhaps the use of

interpreters at dental care appointments can help to pass along oral health messages. This service exists in some community-based dental programs in the Winnipeg region.

For practitioners to provide "culturally responsive care" they require awareness of cultural beliefs and practices while recognizing that care still needs to be provided based on an assessment of the individual [49]. Health promotion workers should continue to learn about distinct cultural groups while recognizing that communication and individual beliefs will still have an impact on knowledge acquisition and behavioural change. This approach will help shape health promotion activities and develop prevention strategies targeted to unique at-risk groups. If we are going to reduce the impact of ECC on these groups, we must ensure that preventive strategies are adapted as necessary and incorporate their suggestions.

There are several limitations to our pilot work. Due to our sampling approach, the findings are not generalizable to the entire communities participating in our study as these findings may not be reliable and reproducible if more representative samples were recruited. Further, those agreeing to participate may have been those with a greater appreciation and awareness of oral health. Participation was not restricted to only parents and caregivers of children who were affected by ECC, which may have resulted in an overrepresentation of those whose children were actually in good dental health. The small numbers of participants and the pilot nature of this work also prohibit comparisons between groups. Language issues proved to be a large hurdle in the focus group process, as several participants spoke English as an additional language. This was particularly evident in both focus groups with parents and caregivers who were refugees or other immigrants. While all individuals in the immigrant focus group spoke English well, the majority of participants in the refugee group had limited English skills and relied on other participants to translate for them. The reliance on these individuals as translators constituted another source of error, as the information obtained by researchers was, in a sense, passed through an intermediate party which had "interpretive control." The interpreters had control over what they communicated as the content and meaning of their language peers' responses. While the immigrant and refugee focus groups were somewhat heterogeneous in terms of country of origin, it can be argued that all participants in each respective group shared similarity as they self-identified as being either an immigrant or refugee. Participants in this study may have already had some understanding of ECC through exposure to the HSHC initiative or other resources. Regardless, the information obtained during these focus group sessions is extremely valuable and provides useful insight into the best ways to promote ECOH amongst these at-risk populations.

The HSHC partnership understands that meaningful community development requires that attention be paid to cultural proficiency for meaningful community engagement, the development of interventions, oral health promotion, and health education. That is why this pilot work was undertaken. Culturally and linguistically proficient approaches must be developed for at-risk communities if they are to fully participate in prevention and promotional activities [50]. Developing culturally proficient and therefore relevant approaches to oral health promotion and caries prevention requires an understanding of diversity. Cultural proficiency can be enhanced by increasing awareness of the views and beliefs of cultural groups.

This pilot work will certainly help to inform our further qualitative and quantitative research and outreach activities with these different groups, especially immigrants and refugees to Manitoba, Canada. There is a growing need for further qualitative investigation with larger samples of parents, especially those whose children have experienced ECC, to gain their perspectives. Larger sample sizes would also assist in drawing comparisons between different cultural groups. This would also assist in the development of questions for use in survey instruments and caries-risk assessment tools for these cultural groups. Since little is known about the true oral health status of refugee and immigrant newcomers to Manitoba, baseline studies on the prevalence of ECC and associated risk factors are warranted. At the present time we are using these findings to assist us in developing pictorial-based ECOH promotion materials for newcomer populations.

8. Conclusion

These pilot focus group sessions were useful in identifying potential barriers to ECOH, sources of oral-health information, oral health-related misconceptions, and how to best reach each community with ECOH messages. Caregivers identified several barriers to maintaining ideal early childhood oral health including the child's temperament, finances, and inability to control sugar intake. Each group appeared to have a reasonable understanding of early childhood oral health. However, both religion and genetics were found to influence the perception of oral health in some groups. Misconceptions regarding breast milk and bottle use were present. while participants from the refugee group believed that dental visits were only necessary if dental pain or problems were experienced.

Each group proposed strategies to improve oral health promotion. One-on-one discussions, use of parental networks, and the use of laypeople from similar cultural backgrounds were suggested as ways to promote oral health. The immigrant and refugee group placed emphasis on the use of visuals for those with language barriers while the Hutterite participants recommended a more traditional health-education focused approach.

The findings from this paper have provided some initial insight into the oral-health-related knowledge and beliefs of these high-risk cultural groups. These insights will help to inform planning of ECC prevention and research strategies, which can be tailored to specific populations.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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Research Article

A Model for Community-Based Pediatric Oral Heath: Implementation of an Infant Oral Care Program

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The Affordable Care Act (ACA) mandates risk assessments, preventive care, and evaluations based on outcomes. ACA compliance will require easily accessible, cost-effective care models that are flexible and simple to establish. UCLA has developed an Infant Oral Care Program (IOCP) in partnership with community-based organizations that is an intervention model providing culturally competent perinatal and infant oral care for underserved, low-income, and/or minority children aged 0–5 and their caregivers. In collaboration with the Venice Family Clinic's Simms/Mann Health and Wellness Center, UCLA Pediatrics, Women, Infants, and Children (WIC), and Early Head Start and Head Start programs, the IOCP increases family-centered care access and promotes early utilization of dental services in nontraditional, primary care settings. Emphasizing disease prevention, management, and care that is sensitive to cultural, language, and oral health literacy challenges, IOCP patients achieve better oral health maintenance "in health" not in "disease modality". IOCP uses interprofessional education to promote pediatric oral health across multiple disciplines and highlights the necessity for the "age-one visit". This innovative clinical model facilitates early intervention and disease management. It sets a new standard of minimally invasive dental care that is widely available and prevention focused, with high retention rates due to strong collaborations with the community-based organizations serving these vulnerable, high-risk children.

1. Introduction

The US Surgeon General has identified early childhood caries (ECC) as the most common chronic childhood disease; it is five times more prevalent than asthma [1]. It is a highly infectious disease caused by bacteria easily transmitted horizontally from person to person and vertically from caregiver to child. As a result, even newborns are susceptible to infection [2].

About 80% of dental disease, including ECC, is concentrated in 20%–25% of children, primarily those from low-income and/or minority backgrounds [3, 4]. Ironically, those at highest risk are also those who face the greatest barriers to accessing early and ongoing dental care [5, 6]. Approximately 25% of children younger than six years of age have seen a dentist with the probability decreasing based on lower levels of income [5]. While many of these children are hindered in obtaining dental care by their socioeconomic level, ethnicity, primary language, and the education level of their parents or caregivers, many families also only seek care when a problem arises or permanent teeth have erupted. Preventive care is neither a priority nor deemed essential. Even among those with insurance, utilization rates are low, particularly in public insurance programs. In fact, the pediatric dental service utilization rate for the USA's largest safety net program, Medicaid, is only 38% [7].

Although ECC is exceedingly prevalent among young children, it is also highly preventable with early intervention. Early identification of oral diseases like ECC can reduce the risk of, arrest, or even reverse disease. The American Academy of Pediatric Dentistry [8, 9], American Dental Association [10], American Academy of Pediatrics [11], American Association of Public Health Dentistry, [12], and many public health organizations have recommended that children be seen by a dentist on a recurring basis no later than six months after the eruption of a child's first tooth or by one year of age. Although this protocol was adopted 27

years ago, dental professionals have also not wholeheartedly endorsed the recommendation and many parents and caregivers remain unaware of this advice.

As such, strategies are necessary to ensure and promote early recurring dental care, particularly for populations suffering the greatest burden of disease. To that end, for instance, the American Academy of Pediatric Dentists has funded grants to improve access to high quality dental care for children in need. From 2010 to 2012, eighteen grant recipients received assistance to support community-based programs that expanded dental care to children in need; another 15 received grants in 2013 [13]. The American Dental Association launched its Give Kids A Smile (GKAS) program in 2003 to encourage dentists nationwide to provide free dental care to underserved children. Through GKAS, dentists volunteer their time and services year-round through local health fairs and other events [14]. Other options include free or low-cost programs through dental school clinics, programs offered through state or local health departments, or at non-profit organizations including school-based health centers [15, 16]. In many programs, patient retention rates are often low for reasons that include housing and employment instability, lack of transportation, and unreliable communication methods. However, despite the success of these grants and programs, the need for consistent, ongoing dental care continues to grow. While these programs have assisted with serving more children in need, a greater focus on reaching children through untraditional venues, such as by engaging community stakeholders like Head Start/Early Head Start (HS/EHS), Women, Infants, and Children (WIC), day care centers, and schools, is required [17].

The Commission Dental Accreditation (CODA) has also recently recognized the value of community-based learning for dental students by updating their standards to include broader clinical experiences [18]. Most dental schools typically provide care through a number of venues, such as university and affiliated hospital clinics, mobile dental vans, and community-based health centers. UCLA has had a long standing commitment to providing services to underserved populations and has been a leader in recognizing the education value of diverse clinical encounters. Ahead of CODA's recent change in regulations, UCLA established its Community Health and Advocacy Postdoctoral Resident Training (CHAT) program in 2006, and in 2010, UCLA realized an opportunity to strengthen their focus on community-based care by partnering with key stakeholders to inaugurate UCLA's Infant Oral Care Program (IOCP) through the Pediatric Section of the School of Dentistry.

2. Materials and Methods

IOCP launched in 2010 through UCLA's School of Dentistry's Section of Pediatric Dentistry in partnership with the Venice Family Clinic's Simms/Mann Health and Wellness Center (VFC) and nearby WIC and EHS/HS sites. IOCP functions on the assumption that at-risk children and their parents/caregivers visit venues like community clinics and HS/EHS and WIC sites earlier and with more regularity than dental clinics. Therefore, these program sites offered significant promise as partners for outreach, education, and referrals to increase compliance with the age-one visit [19]. In some cases, these partners can also become venues through which care is provided, thereby increasing entry points to care and the opportunity to become children's dental homes; that is, a stable facility through which early, ongoing, and culturally sensitive dental care may be provided to children starting at perinatal stage through infancy. These collaborations foster an integrated approach to health care, where a team of dentists and nondental providers, such as pediatricians, nurse practitioners, and obstetricians, as well as community workers can cross-train to offer better care that improves both dental and overall health. This increases the quality of care both types of providers give and inevitably increases access to dental care for vulnerable populations and reduces oral health disparities.

IOCP was established with the goal of offering early and ongoing dental care to low-income and/or minority children aged 0–5 years old. VFC and WIC donated office space and medical exam rooms for IOCP operations. The IOCP provided trainings to all community partners, for example, WIC and HS/EHS staff, VFC pediatricians and nurse practitioners, and other allied health workers, on the effect of oral health on overall health over the life course. These trainings were key in obtaining patient recruitment and referrals as well as to initiate a cultural and perception change on when to seek dental care. Pediatric residents, supervised by faculty and assisted by 3rd and 4th year predoctoral dental students, conducted exams for IOCP patients. Exam protocols emphasized early, ongoing care provided in a culturally appropriate manner. The IOCP remained the child's dental home until he/she "graduated" at age 3–5 years to a full service dental clinic. In addition, patients of the IOCP who required restorations or other more invasive procedures were seamlessly referred to the VFC's dental clinic, while referrals for tertiary care, such as full mouth rehabilitation under general anesthesia, were made to university clinics or comparable hospital programs. Whenever possible, the IOCP designed its operational procedures to be as simple and as streamlined as possible, to make access entry and continuation effortless for its patients and their families.

2.1. Operational Model. IOCP has limited overhead and start-up costs. The provision of basic dental services only requires a "pod"—a private room with two chairs and a portable light as well as educational materials, intake forms, and disposable dental equipment and supplies such as mirrors, gloves, fluoride varnish, and gauze. For UCLA's IOCP, VFC and WIC provided space within their existing facilities for a minimum of four hours per week. With an already established pool of low-income and/or minority patients and clients at these facilities, the IOCP had immediate access to its target population; for example, VFC had a well-established Well Baby clinic. All IOCP patients were required to register as a patient of VFC to facilitate tracking, record keeping, and care coordination. Initially, IOCP clinicians did not have access to an electronic medical record system (EHR). Data

and communications with caregivers and other providers were manually captured and tracked. However, the recent installation of new software at VFC has enabled the IOCP clinicians to more efficiently document and track a child's oral health status over time through electronic medical records (EHR), which have incorporated forms for caries management by risk assessment (CAMBRA) and self-management goals.

IOCP is also a required three-month rotation for UCLA pediatric dentistry residents to provide more in-depth exposure to working within a community health setting with children at high risk for disease due to socioeconomic circumstances. In addition, their IOCP rotation is supplemented by didactic experiences that enhance their understanding of oral health from a public health perspective, rather than merely clinical one. IOCP is also an elective offered to third and fourth year predoctoral dental students interested in increasing their experience in pediatric dentistry. Candidates in UCLA's Advanced Education in General Dentistry program and foreign-trained dentists participating in UCLA's Preceptorship program may also elect for a rotation through IOCP. Even further, practicing dentists of any type as well as pediatricians and nurse practitioners may participate in IOCP; in fact, many have taken part to increase their comfort level in working with children and their understanding of access disparities for high-risk populations.

All partner staff involved in IOCP received trainings led by UCLA pediatric dentistry residents on the oral disease process and commitment to oral health. To more deliberately encourage these diverse team members to work collaboratively, structured discussions are also held to gain consensus on how each profession can contribute to a child's optimal oral health and on how to better coordinate care across disciplines to improve their health through IOCP. Due to the cultural diversity of the patients served, IOCP practitioners also received specific training to sensitize them to the language, culture, and oral health literacy challenges they would face in order to effectively treat these patients. Further, a focus on interprofessional collaboration among medical and dental professionals and with community-based organizations required taking a multifaceted approach to "health", including a focus on holistic and comprehensive care that factor in things that include but are not limited to diet and physical activity.

2.2. The Patient Visit and Risk-Based Care. The IOCP provides early and culturally competent perinatal and infant oral care for mothers/caregivers and children aged 0–5 years old based on a simple standard of care infant oral protocol [20]. The IOCP improves oral health outcomes through a disease prevention and management model focused on establishing a dental home and on an individualized, oral health risk-based schedule of recall visits. This complies with the recommendation of several national and medical professional organizations including the American Academy of Pediatric Dentistry [8, 9], American Dental Association [10], American Academy of Pediatrics [11], and American Association of Public Health Dentistry [12] for their "age-one visit" and the establishment of a dental home.

Figure 1: Step 1: CAMBRA interview.

At each scheduled visit, providers conduct an Infant Well Baby Oral Exam, similar to a Well Baby visit with a pediatrician. This exam includes six steps: (1) caries risk assessment, (2) proper positioning of the child for a knee-to-knee exam, (3) age-appropriate tooth-brushing prophylaxis, (4) a clinical exam, (5) fluoride varnish treatment, and (6) anticipatory guidance, counseling, and self-management goals [19]. The most critical step of the Infant Well Baby Oral Exam is the caries risk assessment. Conducted through an interview with the parent/caregiver, the caries risk assessment offers an opportunity to set visit expectations and establish rapport with the child and the caregiver (Figure 1). The examiner can also begin gathering key information on the child's risk and protective factors that, when combined with clinical findings, will be the foundation of a treatment plan based on the child's individual risk for developing caries.

At VFC, IOCP clinicians use the caries management By risk assessment (CAMBRA) caries risk assessment tool to rate a child as having high, moderate, or low caries risk (Figure 7). A child's caries risk level is used to design and implement a minimally invasive treatment plan, or "care path", that factors a child's biology and individual, family, and community factors that can influence oral health such as prior cultural and country norms and fluoridation of public water supplies. CAMBRA guides clinicians to prevent and manage disease for their patients using a comprehensive approach that utilizes anticipatory guidance, counseling, and the creation of self-management goals tailored to the child's age and individual risk [21].

The CAMBRA interview is followed by the oral exam. First and foremost is proper positioning of the child to ensure that he/she is comfortable, safe, and secure. In young children or those with special needs, a knee-to-knee position is best (Figure 2). In the knee-to-knee position, the parent/caregiver sits facing the dental examiner and the child lays with his/her head in the examiner's lap. This allows the parent/caregiver to see the child's face and hold their child's hands in theirs, while maintaining control over the child's legs. In this position, the parent can also observe and learn about his/her child's teeth and development.

During each exam, the provider performs a toothbrush prophylaxis to remove any plaque or debris from the teeth prior to the clinical exam (Figure 3). Using the tell-show-do technique the examiner can also demonstrate

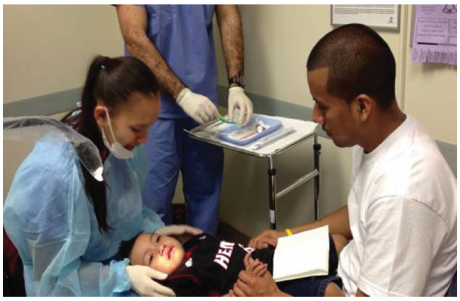


Figure 2: Step 2: knee-to-knee exam.

Figure 3: Step 3: toothbrush prophylaxis.

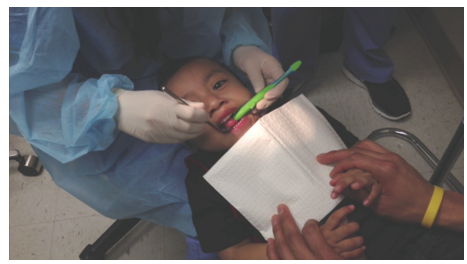


Figure 4: Step 4: clinical exam.

the proper technique for brushing the child's teeth for the parent/caregiver.

The examiner will then conduct a clinical exam that includes counting the child's teeth aloud, using the toothbrush handle as a mouth prop, if necessary (Figure 4). Since a child may start to fidget at this point, practitioners often make a game of this task, singing songs and so forth, to engage the child. Examiners should remember to praise the child often for his/her cooperation during the process. During the process of counting, the examiner should inspect the soft tissues, hard tissues, and occlusion of the child's mouth documenting any visible plaque and its location; white spot lesions; demineralized or remineralized enamel; brown spots on the occlusal surfaces; tooth defects; deep pits/fissures; missing and/or decayed teeth; existing restorations; defective restoration; gingivitis or other soft tissue abnormalities; occlusions; and any indications of trauma. The information from the clinical exam is then combined with data gathered during the CAMBRA interview to determine the child's individual caries risk as well as a care path that establishes the periodicity of follow-up visits. For example, while most children are recommended for a reapplication of fluoride varnish at a minimum of every six months, a monthly reapplication may be required in some children to reduce ECC risk. In addition, in children with severe ECC, topical fluoride may be insufficient alone to overcome a particular child's bacterial challenges. In this situation, additional interventions such as combination therapies based on age and risk, antibacterial regimens, or more frequent examinations may be used to arrest progression, protect the tooth structure, and implement measures to break the cycle of continued reinfection. Needs for acute or specialized care, such as restorative treatment, are referred out. After the clinical exam, fluoride varnish is applied to the child's teeth, consistent with current accepted prevention protocols (Figure 5). All children and caregivers also receive oral health education, which covers the causes, onset, and progression of oral disease. The establishment of self-management goals is the final step of the Infant Well Baby Oral Exam. (Figures 6 and 8). Integrated as part of the child's care path, parents/caregivers are asked to select two of the several recommended behavioral modifications proposed in Figure 8. For instance, a parent may need to improve upon their own and their children's oral hygiene practices, such as brushing at least twice daily using fluoridated toothpaste. Others may need to focus on reducing their children's intake of sugary foods and beverages, particularly before bedtime. Meanwhile, a caregiver may simply need to be reminded that regular checkups are necessary even when children do not have any pain or difficulty chewing.

3. Results

Although the program provides care only four hours per week at each site (VFC and WIC), IOCP has been able to reach a significant portion of its target population earlier than planned and with higher retention levels than have been seen in dental clinics. In fact, IOCP has attended to 672 unique patients across over 1,500 visits since its inception in 2010. Slightly more than 42% of the children in IOCP have had two or more visits, and the numbers continue to increase.

As of July 2013, among those patients who have not graduated to the VFC dental clinical, IOCP maintained 138 patients as caries-free and prevented precavitated lesions from progressing in 51 patients. These successes are attributed to capturing underserved populations through proactive referrals from our community partners and case management and triage based on individual risk and by interdisciplinary clinic staff. Part of the success may also be due to positive shifts in parental and caregiver knowledge and attitudes regarding oral health.

The quality improvement measures tracked include, but are not limited to, the following:

(i) Percent of ECC patients presenting with new cavitation;

(ii) Percent of ECC patients presenting with pain from untreated decay;

(iii) Percent of ECC patients with documented caries (high, medium, and low);

Figure 5: Step 5: fluoride varnish.

Figure 6: Step 6: self-management goals.

(iv) Percent of ECC patients who had disease management visiting within the recommended interval based on risk;

(v) Percent of ECC patients with self-management goals reviewed at most recent disease management visit;

(vi) Percent of ECC patients whose risk status has improved.

The above measures have helped isolate areas for improvement in IOCP and develop disease management and prevention strategies that can be implemented on a much wider scale. We believe that long-term analysis will provide evidence showing the efficacy of IOCP in reducing the burden of oral disease, developing a strong case for expanding similar oral health disease prevention and management programs elsewhere.

4. Discussion

The integration of oral health into primary medical care can improve the continuity of care between dental and medical homes and could foster better health behaviors that could achieve and preserve good oral health, resulting in a lower disease risk [22]. As the population grows and diversifies, the oral health disparities gap will widen. At the policy level, programs that service low-income and/or minority families should be strengthened. States not currently offering adult Medicaid dental benefits should be encouraged to offer dental services, at a minimum, to its pregnant beneficiaries to prevent the vertical transmission of disease.

Coordinated community outreach is also important. More must be done to achieve consensus and acceptance within the dental community on enforcing the age-1 visit recommendation. Medical personnel, especially pediatric and obstetric professionals and allied health workers, must understand the correlation between a mother's oral health status and its impact on her child(ren), and they must also endorse and promote the age-1 visit to their patients. Community-based organizations, such as Head Start/Early Head Start (HS/EHS), Women, Infants, and Children (WIC), day care centers, and schools need to be actively engaged in educating their parent and caregiver participants on the need for regular dental checkups beginning at the age of 1. Finally, cost-effective, easily accessible, family-centered, culturally sensitive models of care are needed. The success of an Infant Oral Care Program depends on overcoming such challenges.

The IOCP is also built upon the principle that prevention of oral disease is preferable to surgical treatment. The IOCP emphasizes the need for risk assessments so that care can be tailored to the individual child's need as opposed to a one-size-fits-all approach to recall visits, fluoride varnish applications, and other preventive care. This concept, while not new, is often difficult to promote since, in many states, more traditional dental treatments generate income, while the cost effectiveness of prevention is harder to enumerate. In addition, Medicaid reimbursement rates may not cover all the activities recommended by the IOCP. Sites with existing dental clinics may see the IOCP as a program that could decrease revenue. However, the IOCP is intended to maximize resource utilization by increasing the number of patients overall for the clinic with only the more acute cases necessitating more expensive clinical chair time and where net dental home patients also increase. Therefore, mandates to change to reimbursement rates are also needed to incent dental providers to increase their acceptance of Medicaid patients and shift emphasis to preventing disease.

Dental programs need to act now to update their curriculum to provide future dentists with a skill set that can address the growing community need and provide their doctoral candidates with the opportunity to gain proficiency through community practice. Cultural sensitivity will become more critical and dental schools also need to incorporate risk assessment and preventive care programs with an emphasis equal to cavitation treatment options.

The IOCP is an easily replicable program with low start-up and maintenance costs. However, success is contingent upon establishing strong community-based partnerships in order to overcome the many biological, behavioral, and environmental differences among vulnerable populations that influence health outcomes. IOCP community partnerships were selected based on each program's close proximity to the IOCP operational site. WIC and EHS/HS were chosen because their program dynamics had a retention element already established, for example, appointments to pick up vouchers, attendance of their children, and so forth. In fact, any site can establish an IOCP and since most families accept a periodicity schedule for infant and toddler health care exams and procedures, such as immunizations, dental home visits, for example, can be offered on the same day and at the same venue as nondental appointments like Well-Baby visits.

Caries risk assessment form for ages 0 to 5 years old

Patient name: _____ I.D.# _____ Age: _____

Date: _____ Assessment date: _____

Note: any one YES in columnl signifies likely "high risk" and an indication for bacteria tests	YES = circle			Comments:
	1	2	3	
(1) Risk factors (biological predisposing factors)				
(a) Mother/caregiver has had known active dental decay in past year	YES			
(b) Bottle with fluid other than water, plain milk and/or formula		YES		Type(s):
(c) Continual bottle use		YES		
(d) Child sleeps with a bottle, or nurses on demand		YES		
(e) Frequent (> 3 times/day) between-meal snacks of sugars/cookes Starch/sugared beverages		YES		# times/day: Type(s):
(f) Saliva-reducing factors are present, including: (1) Medications (e.g., asthma [albuterol] or hyperactivity) (2) Medical (cancer treatment) or genetic factors		YES		
(g) Child has developmental problems/CSHCN (child with special health care needs)		YES		
(h) Parent and/or caregiver has low SES (socio-economic status) and/or low health literacy, WIC/early head start		YES		
(2) Protective factors				
(a) Child lives in a fluoridated community (note zip code)			YES	Zip code:
(b) Takes fluoride supplements			YES	
(c) Child drinks fluoridated water (e.g., tab water)			YES	
(d) Teeth brushed with fluoride toothpaste (peas size) at least 2 times daily			YES	# times/day:
(e) Fluoride varnish in last 6 months			YES	
(f) Mother/ caregiver understands use of xylitol gum/lozenges			YES	
(g) Child is given xylitol (recommended wipes, spray, gel)			YES	
(3) Disease indicators-clinical examination of child				
(a) Obvious white spots, decalcifications, or decay present on the child's teeth	YES			
(b) Existing restorations	YES			
(c) Plaque is obvious on the teeth and/or gums bleed easily		YES		
(d) Visually inadequate saliva flow		YES		
(e) New remineralization since last visit (list teeth):			YES	Teeth:
Child's overall caries risk* (circle):	High	Moderate	Low	
Child: bacteria/saliva test results: MS:	LB:	Flow rate:	mL/min:	Date:
Caregiver: bacteria/saliva test results MS:	LB:	Flow rate:	mL/min:	Date:

Self-management goals:

(1) _____

(2) _____

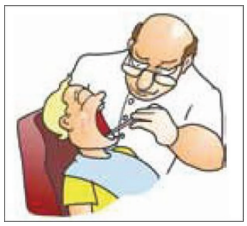
*Assessment based on provider's judgment of balance between risk factors/disease indicators and protective factors

Clinician's signature: _____ Date: _____ (updated: 8/12/12)

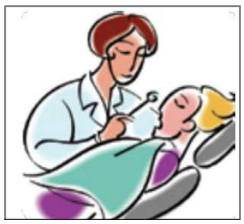
Figure 7: CAMBRA form.

Self management goals for parent/caregiver

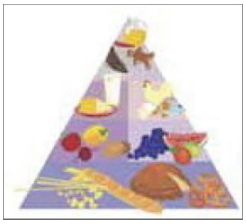
Patient name DOB



Regular dental visits for child



Family receives dental treatment



Healthy snacks

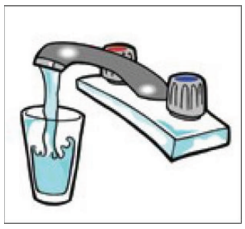
Brush with fluoride toothpaste at least 2 times daily

No soda

Less or no juice

Wean off bottle (no bottles for sleeping)

Only water or milk in sippy cups



Drink tap water

Less or no junk food and candy

Use xylitol spray, gel or dissolving tablets

Important: the last thing that touches your child's teeth before bedtime is the toothbrush with fluoride toothpaste

Self-management goals (1) _____

(2) _____

On a scale of 1–10, how confident are you that can accomplish the goals? 1 2 3 4 5 6 7 8 9 10

Signature _____ Date _____

Practitioner signature _____ Date _____

10/2/12

Figure 8: Self-management goals.

This strategy, combined with outreach and services provided by organizations similar to Early Head Start, Head Start, and WIC, can facilitate and has facilitated access to culturally sensitive oral health care screening, education and services for low-income and vulnerable populations by simplifying the entry process and linking it to other services that they are already utilizing with regularity.

5. Conclusion

IOCP effectively coalesces a multidisciplinary care team to establish a model for a new generation of healthcare providers and social service staff, all of whom will have the capacity to address the oral health needs for patients of all ages and backgrounds. Subsequently, this could reduce current disparities in oral health care access and disease among vulnerable populations that include children and low-income and/or minority families. Programs similar to the IOCP are important to the future of dental care to increase entry points for accessing care and to provide appropriate training for general dentists and other pediatric providers. Designed to complement existing medical and dental primary clinical settings, the IOCP provides a low-cost alternative to providing a dental home to a young population of children prior to the onset of dental disease which may require intervention in a full clinical environment. There is evidence based results on the success of utilizing community-based, social service partnerships in close proximity to the proposed operational site to increase patient early age recruitment and retention in a disease prevention management model such as the IOCP. The IOCP also importantly functions as a training opportunity for both dental and nondental professionals to increase experience, training, proficiency, and acceptance in treating very young children, aged 0–5 years, and keep their healthy teeth healthier.

However, multidisciplinary collaboration is not enough; as noted, care must also be culturally sensitive as critical factor in care. Professionals, both dental and nondental, need to begin to understand the importance of achieving and maintaining good oral health as an integral part of total health in order to address the emerging oral health crisis. To prepare for these changes, dentists and the providers with whom they collaborate will need to know how to best serve their patients using an individualized, age-appropriate, and risk-based approach to care and practice applying their knowledge in the community.

Conflict of Interests

The author declares that there is no conflict of interests regarding the publication of this paper.

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Clinical Study

Comparing Health Promotion Programs in Public Dental Service of Vantaa, Finland: A Clinical Trial in 6–36-Month-Old Children

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Objective. The study assessed whether the new family-based programs in health promotion or the training of dental professionals had an impact on the colonization of mutans streptococci (MS) in young children. *Material and Methods*. The participants were children born in 2008 and inhabitants of Vantaa aged 24–36 months. The families with first-born children were invited to a questionnaire study. Vantaa was categorized into three matching areas, which were randomly assigned to different programs. New counseling methods were trained. The routine program used earlier served as the control group. The children born in 2006 served as a historic control. The outcome measure was the presence of MS. Statistical method was logistic regression. *Results*. Colonization of MS was found only in few children born in 2006 or 2008; 15% and 11%, respectively. Within the 2008 birth cohort, the addition of parental counseling did not improve the routine program. Instead, the father's advanced level of education ($P = 0.044$) and the child's reported the use of xylitol at least three times a day ($P = 0.014$) associated with negative MS scores. *Conclusions*. The routine program and training of the professionals seem to reduce the proportion of children with MS more than adding parental self-care to oral health programs.

1. Introduction

A three-year health promotion project was started in the Vantaa PDS in 2006. The main reason for the project was that the oral health of children and adolescents had been deteriorating. For prevention of early childhood caries, the oral health promotion was started earlier than before by giving health advice to expecting parents. In addition, the training of modern methods in counseling was targeted at the professionals involved in children's oral health care. The main aim of the project was to delay the transmission of mutans streptococci (MS) from parent to child. The present study was initially started in order to evaluate the achievements of the project.

Oral health promotion in early childhood includes preventive work aimed at expecting families, babies, and young children. According to results from recent studies, this also seems to be effective and justified [1–3]. The Scottish Intercollegiate Guidelines Network recommends that programs of oral health promotion should be available to parents during pregnancy to reduce early childhood caries, and that the counseling for parents and their preschool children should start before the age of three [4]. The Finnish current care guideline for caries control emphasizes early childhood health promotion and acquisition of favorable oral health habits [5]. Oral health counseling in early childhood increases the knowledge of parents and decreases the incidence of early childhood caries [6]; the counseling is particularly important in areas with a high prevalence of caries.

Dental plaque is a biofilm that is naturally found on the teeth. MS are transmitted mainly from caregivers to children in early childhood and they colonize tooth surfaces, but they can also be present in the edentulous mouth of a young child on soft tissues and tongue [7]. High proportions of MS may

be considered biomarkers of rapid caries progression [8], and in young children, the colonization of MS in saliva or plaque is connected to increased risk of caries [9]. Colonization of MS in early childhood has been connected to the lower socioeconomic status of families [10]. In the early risk-based approach, preventive counseling and individual caries-controlling measures can be carried out in time and have been found to be health-effective and cost-effective [1].

It is important how the health information is delivered. Patients benefit more from interactive methods in counseling instead of the traditional professional-oriented method. The transtheoretical model (TTM) [11] helps to determine the individual level of decisional balance and to focus on individual conversation and goal setting in counseling. In the TTM, the intention to take action in changing health behavior increases from the stage of precontemplation to contemplation and preparation. In the action stage, patients have already accepted the new health habits but they are still at risk of relapsing. Understanding the fluctuations between stages of change may also decrease the frustration of the counselor if the patient is not ready to change his/her behavior or has a relapse. In the method of motivational interviewing (MI) [12, 13], the feeling/meaning reflections, change talk, and goal setting are the core elements. By means of empathy, congruence, and positive regard, which create a feeling of acceptance, patients are free to make changes in their behaviors [14]. Patients seem to benefit from combining the TTM and MI [15]; the health care professional can give individual counseling tailored to each patient's stage of change.

We hypothesized that the training of dental professionals could improve the quality of the counseling, raise the level of commitment, and give them a new kind of perspective on oral health counseling in early childhood. Health promotion programs with clinical advice aimed at the parents themselves might commit the families to maintain their children's good oral health.

The present study assessed whether the new family-based programs in oral health promotion or the training of dental professionals had an impact on the colonization of mutans streptococci in young children, when the other protective factors were controlled for.

2. Methods

2.1. Study Settings. The study took place in the public dental service (PDS) of Vantaa, Finland, in 2008–2011. The routine oral health program in use earlier was compared with two new programs, carried out at children's routine oral health visits from 6 to 36 months of age. There were 28–35 dental hygienists or in-service trained dental nurses (professionals) involved in children's counseling during the study, and they were trained to use the new oral health programs and novel methods in counseling. The professionals were not blinded to the group of children but the interpretation of the children's MS test results was blinded. The ethical committee of the hospital district of Helsinki and Uusimaa gave ethical approval for this study. The identifier in ClinicalTrials.gov is NCT01854502.

2.2. Randomization. The five operational areas of the Vantaa PDS were categorized into three study areas that were socioeconomically as comparable as possible. The two western areas were previously known to be better off than the eastern areas; therefore, two of the areas were selected to include both western and eastern areas of Vantaa, and the central area formed the third area. These three matched areas were randomly allocated to three study groups, F (oral hygiene and fluoride), X (proper diet and xylitol), and C (control), by drawing lots.

2.3. Subjects and Recruitment. The subjects in this study were the children born in 2008 ($n = 2715$) and inhabitants of Vantaa aged 24–36 months. Additionally, the first-born babies of the 2008 birth cohort were invited to join the questionnaire study when the baby was 2–4 weeks old. The invitation letter included an informed consent form for the parents on behalf of the minor, and 804 (82%) of the first-born babies joined the study (Figure 1). The first-born babies were selected in order to control the confounding effects of the number of siblings and the order of the child in the family. There were seven pairs of twins and the child with the higher social security number from each pair was withdrawn from the questionnaire study. If the child moved away from Vantaa ($n = 144$) or did not attend public dental care ($n = 6$), he or she was lost to follow up. In connection with the invitation to the two-year examination, the parents were sent a questionnaire concerning their own background information and the health habits of their child. Additionally, the children born in 2006 ($n = 2673$) and inhabitants of Vantaa aged 24–36 months served as a historic control group. They were categorized retrospectively for data collection according to the same areas as the children born in 2008, but were not given any special interventions.

The calculations of sample size were based on the hypothesis that 30% of two-year-olds have MS in dental plaque [16]. The 2008 birth cohort consisted of 2715 children, while the estimated number of first-born babies was 1208, calculated from the number of first-born babies in 2006 in Vantaa. To obtain an absolute risk reduction of 10%, which was considered clinically significant, about 726 children needed to be recruited into the questionnaire study. We exceeded this number of patients during the inclusion period; parents of 804 children accepted the offer to participate and signed the informed consent form of the study on behalf of their child. The estimated amount of dropouts was 18%, and the observed amount was 20%.

2.4. Training. The dental professionals involved in the counseling of young children were given training for the study and also to improve the quality of oral health promotion in the PDS of Vantaa. The training to perform MS plaque testing was organized in small groups in eleven daycare centers for young children in 2007. The training on how to interpret the results was arranged and repeated in several separate sessions, because the dental professionals first informed the parents of their own estimate of the test result. Thereafter, the parents were informed if the MS score was altered after the

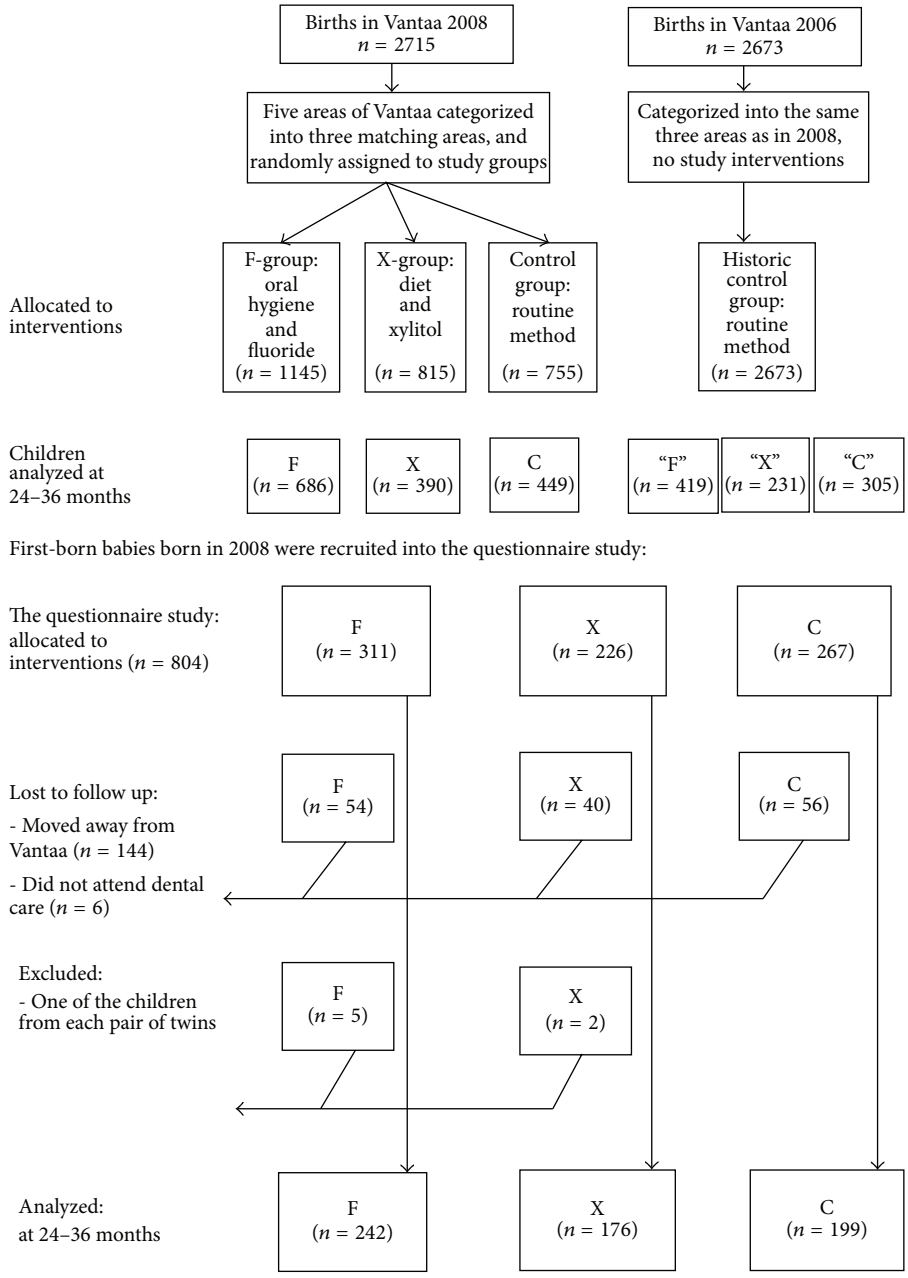

Figure 1: The flow chart: those allocated to interventions, those recruited into the questionnaire study, and those analyzed.

judgment of the author (IA) who interpreted all tests for the present study blinded. In order to maintain the reliability of MS testing, the author responsible for interpreting all tests was trained by 100 MS plaque tests with a senior researcher (KP) in the beginning of 2008. The tests were randomly selected from the 1000 test that had been performed. In case of differences of opinion, these were discussed, with the emphasis on avoiding the overregistration of colonies.

The dental professionals were trained to use the new oral health programs for the study groups F and X through lectures and written instructions [17]. The transtheoretical model (TTM) [11] was selected as the theoretical framework, and the stages of change were combined with the method of motivational interviewing (MI) [12, 13] in preventive counseling of all programs.

The training on how to observe dental decay and control the progression of caries lesions was arranged in a one-day session prior to the children's two-year visits in 2009. The session was followed by individual exercises in groups of three participants in the dental clinics of primary schools. The dental professionals were given individual feedback on their observations of dental decay and the use of counseling methods at the end of each exercise. The information from all sessions was repeated later in a one-afternoon session.

2.5. Interventions. The oral health interventions were carried out at children's routine oral health visits from 6 to 36 months of age for all the children visiting the PDS. The first visit was at the age of 6–12 months. About ten percent of the children were assessed to have a high caries risk and they had an extra visit at the age of 18 months. The risk factors that were agreed upon by a team of dental professionals included visible plaque or caries on child's teeth, sugary drink as a thirst-quencher, bedtime feeding, special health care need [18, 19], parent's nonchalant attitude to dental care, serious social problems in the family, or an immigrant family background [20]. The following visit for all children was at the age of 24–36 months.

The children were treated in the same way in all groups. The main differences between the groups were that in group F the parents were given counseling on their own oral hygiene, and in group X the parents were given counseling on their diet, whereas in the routine program, there were no interventions for the parents. The new family-based oral health promotion programs for the study groups F and X were created by a team of dental hygienists and dentists.

The routine program in use earlier in the Vantaa PDS included comprehensive advice on children's oral health. The counseling included regular oral hygiene, that is, tooth brushing with fluoride-containing toothpaste twice a day, starting from the appearance of the first tooth. It also included advice on a healthy diet with proper timing and composition of meals, avoiding sugary snacks, as well as a recommendation to use xylitol products on a regular basis, 5 grams per day. In order to delay the transmission of MS from mother to child, the parents were advised to avoid tasting from the child's spoon, to avoid cleaning the child's pacifier in their own mouth, and to use xylitol products regularly. Each child was given a toothbrush on the first visit and a brochure containing information about oral health care at home.

In group F (oral hygiene and fluoride), on the child's first visit to the PDS, the parents were given counseling on how to brush their own teeth. Tools for cleaning the interdental spaces of the parent were shown, and he or she was given a toothbrush, one tube of fluoride toothpaste, and samples of dental floss, sticks, or interdental brushes. Goals for cleaning the teeth of both parent and child were set together and written down in a form that was given to the parent. On the child's second visit at the age of two years, the dental hygienist brought up these goals again and encouraged the parent to follow them.

In group X (diet and xylitol), the special elements added for the parents were a properly timed and healthy diet and the regular use of xylitol. On the child's first visit, the parent was asked to fill in a one-day diary concerning his or her own diet. The dental professional pointed out the frequency of meals and snacks and discussed the related pH drop, as well as suggesting the use of 5 grams of xylitol per day. A packet of xylitol mints (Xylisuu, Fennobon Oy, PL 4, 00941 Helsinki) was given to the child and some samples of chewing gum, sweetened only by xylitol, to the parents. Pictures demonstrating the sugary contents of some snacks and soft drinks were shown from an illustrated catalog. Goals for maintaining oral health were set together and entered in a form. On the child's dental visit at the age of two years, the goals were reviewed and the parents were encouraged to follow them.

During the present study, each of the 28–35 dental professionals carried out the counseling individually. One of the authors (IA) read the recordings in the electronic patient database to find out how thoroughly the interventions had been implemented and recorded in groups F and X. Individual variation was found; in some cases the interventions and/or registrations may have been incomplete.

2.6. Clinical Examinations and MS Determination. The children, accompanied by their parents, were clinically examined in various health clinics of the Vantaa PDS. The dental hygienists or the in-service trained dental nurses working in the clinic performed the examinations. The information from them including the number of decayed teeth or teeth with distinct visual changes in enamel corresponding to ICDAS [21] values 2 to 6, was recorded on the database.

Plaque testing of the two-year-olds was started in Vantaa in January 2008. The tests were carried out at the children's regular two-year visits. The recommended age for testing was 2–2.5 years, and the inclusion limits were 24–36 months. The presence of MS was determined by the Strip Mutans Dentocult SM test (Orion Diagnostica Oy, P.O. Box 83, 02101 Espoo, Finland). The MS tests were taken from plaque because when assessing caries risk in young children, apparently the sensitivity and specificity are better in plaque testing than in saliva testing [9]. Samples of plaque were obtained using four separate microbrushes and applied on the strip from four predestined tooth surfaces: the interdental spaces and the gingival margin of upper incisors, upper molars, lower incisors, and lower molars. The strips were incubated at 35–37°C for a minimum of 48 hours. The incubators were calibrated every six months. The dental professionals dried and interpreted the strips according to the manufacturer's instructions and informed the parents by letter or by phone of the test result. The dried strips were then sent to one of the authors (IA) who interpreted all MS tests blinded.

2.7. Data Collection and Management. The data were retrieved from the patient records and the database of the questionnaires. The scores 0–3 of MS tests were dichotomized into MS 0 (negative) and MS 1+ (positive). Incidence of caries, including the number of decayed teeth and teeth with distinct visual changes in enamel, was dichotomized as 0 for no caries and 1 for the other values. To enable a blind set-up in the comparison of birth cohorts, the MS tests taken from January 2008 to June 2009 and a random sample of 800 tests taken in 2009-2010 were reinterpreted, mixed up in random order with all tests carried out in 2011, and used for the present analyses. The dental professionals collected the questionnaires and sent them to the author (IA) who entered the information into the database.

For the families of the questionnaire study, mother's and father's ages were dichotomized into younger (born 1980 or later) and older (born before 1980), and parental levels of education as basic (basic, vocational, or high school) and advanced (college or university degree). Parents' habits

Table 1: First-born children, born in 2008, in comparison with the 2008 and 2006 birth cohorts; percentages of negative MS scores in 24–36-month old by group.

	First-born children born in 2008		The 2008 birth cohort		The 2006 birth cohort*	
	Total *n*	%	Total *n*	%	Total *n*	%
MS score negative (=0)	617	91	1525	89**	955	85**
F group (oral hygiene and fluoride)	242	91	686	87	419	83
X group (diet and xylitol)	176	89	390	88	231	89
Control group	199	92	449	93	305	86
P		0.658		**0.011**		0.129

*The same areas where the 2008 birth cohort was given interventions.
**$P = 0.011$.

of cleaning the child's pacifier in their own mouth and tasting food from the child's spoon were dichotomized into 0 (seldom or never) and 1 for the other values. The child's reported health habits of tooth brushing and fluoride use were dichotomized into 1 (at least 2 times/day) and 0 for the other values. Having snacks between meals was dichotomized into 0 (seldom or never) and 1 for the other values, and xylitol use into 1 (at least 3 times a day) and 0 for the other values. The child's use of probiotics was dichotomized into 0 (not at all) and 1 (used for one month or more).

2.8. Data Analysis. The main outcome measure of the study was the colonization of MS bacteria in the dental plaque of the children aged 24–36 months. The MS values were cross-tabulated and compared by cohort and intervention group. Within the questionnaire study, the parental information and the child's reported health habits were cross-tabulated by intervention group. The association of parental information and child's reported health habits with MS were analyzed using univariate logistic regression analyses. Multivariate logistic regression analyses with manual backward elimination were also used. All independent variables for which the regression coefficient did not reach statistical significance were eliminated one by one. Intervention group and area (three matched areas in Vantaa) were included in regression models as confounders. The statistical software used was PASW statistics 20.0, and the level of statistical significance was set at $P < 0.05$.

3. Results

On average, 60% of the families visited the PDS when the child was six months old. At the two-year examination, the percentages were 66 and 76% in the 2006 and 2008 birth cohorts, respectively. The MS tests were taken from 57% in the 2006 birth cohort, from 77% in the 2008 birth cohort (including the first-born children), and from 95% in the questionnaire study of first-born children.

In the 2008 and 2006 birth cohorts, colonization of MS was found only in few children (Table 1). A positive trend was found between the 2006 and 2008 birth cohorts in relation to the MS score; the percentages of negative MS scores were 85 and 89%, respectively, ($P = 0.011$). The lowest scores for MS in the 2008 birth cohort were found in the control group ($P = 0.011$) (Table 1). Altogether, 4% in the 2008 birth cohort and 5% in the 2006 birth cohort had experienced caries, no missed or filled teeth were found.

In the questionnaire study of first-born children, 52% were boys, 48% girls, and thirty children (5%) were not tested for MS. No group differences were found in the MS colonization. In oral health habits, two group differences were found: the parents tasting food from the child's spoon and the child's frequency of using xylitol products. In the F group, 61% of parents reported not having tasted food from the child's spoon compared to 48% and 55% of groups X and C, respectively, ($P = 0.041$), while 56% of children in the X group were reported to have used xylitol at least three times a day compared to 48% and 42% in the F and C groups, respectively, ($P = 0.029$). The reported frequency of tooth brushing twice a day was about 60%, and about half of the children were reported to have had snacks between meals seldom or never (Table 2). The parents of 38 children did not return for the two-year questionnaire, and six of these children were not tested for MS either.

The advanced education level of mother ($P = 0.006$) and father ($P = 0.026$), child's tooth brushing ($P = 0.031$), as well as child's use of xylitol at least three times a day ($P = 0.006$) associated with negative scores in the MS test. In multivariate analysis, father's advanced education level ($P = 0.044$) and child's xylitol use at least three times a day ($P = 0.014$) remained in the final model. No associations were found between the presence of caries and the parent- or child-related factors (Table 3).

No serious adverse effects of using xylitol products were detected during the study. The parents reported some adverse effects; in 11 cases, parents reported that the child did not want to or was not able to chew xylitol mints or chewing gum. In 21 cases, parents reported gastrointestinal complaints; these included flatulence, diarrhea, and, in one case, constipation. In two cases, these symptoms were reported to have disturbed the child only in the beginning of xylitol use.

4. Discussion

The observed reduction in the proportion of MS-colonized children between the 2006 and 2008 cohorts suggests that the training and supporting of professionals may have clinical

Table 2: Parental background information and child's reported health habits in first-born children at the age of 24–36 months; percentages within groups.

	Total *n*	Oral hygiene and fluoride F	Diet and xylitol X	Control C	*P*
Parents					
Mother born before 1980	644	56	66	60	0.088
Father born before 1980	625	71	76	72	0.462
Mother's advanced education level	601	62	70	69	0.148
Father's advanced education level	575	51	54	58	0.269
Parents have not cleaned child's pacifier in their own mouth	597	94	95	95	0.738
Parents have not tasted food from child's spoon	611	61	48	55	**0.041**
Mother's use of xylitol at least 3 times/day	605	19	20	16	0.563
Child					
Tooth brushing at least 2 times/day	613	65	59	58	0.293
Fluoride use at least 2 times/day	613	65	60	59	0.394
Snacks between meals seldom or never	609	49	49	56	0.234
Xylitol at least 3 times/day	613	48	56	42	**0.029**
Use of probiotics products	558	58	46	54	0.062

Table 3: Results of the logistic regression models of parent- and child-related factors on the presence of MS among first-born children at the age of 24–36 months with intervention group and area as confounders.

			MS score negative		
	Crude OR	*P*	OR	95% CI	*P*
Mother born before 1980	0.67	0.153			
Father born before 1980	0.77	0.407			
Mother's advanced education level	0.44	**0.006**			
Father's advanced education level	0.48	**0.026**	0.51	0.27–0.98	**0.044**
Parents have not cleaned pacifier in their own mouth	0.49	0.175			
Parents have not tasted food from child's spoon	0.86	0.614			
Mother's use of xylitol at least 3 times/day	0.89	0.764			
Child's tooth brushing at least 2 times/day	0.53	**0.031**			
Child's fluoride use at least 2 times/day	0.61	0.096			
Child's snacks between meals seldom or never	0.91	0.750			
Child's use of xylitol at least 3 times/day	0.41	**0.006**	0.41	0.20–0.84	**0.014**
Child's use of probiotic products	0.72	0.290			
Gender (male = 1)	0.74	0.281			

benefits. The finding that there were no group-related differences within the 2008 cohort indicates that the addition of parental self-care to the comprehensive routine prevention in early childhood does not further improve the results. The findings of the multifactorial analyses suggest that father's education level and child's xylitol use associate with child's negative MS scores.

The prevalence of MS colonization, as well as of dental caries, in two-year-olds was lower than anticipated on the basis of earlier findings in Finland [16]. The favorable result in the control group most probably indicates that our matching was not as successful as we hoped; within a more homogenous first-born children sample, this difference did not exist. The low incidence of caries is most probably the main reason for our not finding any outstanding differences between the programs in relation to caries. An additional reason may be the fact that the training was given to all the dental professionals, not only to those involved in the

new programs. This kind of training improves the skills and knowledge of personnel, and most probably increases the quality of care given, but inevitably reduces program-related differences. The present finding is, however, in line with studies in Belgium [22], in Finland [10], and in Sweden [23] in which oral health intervention programs did not result in a significant reduction in caries prevalence.

In the 2008 birth cohort, the number of families that visited the PDS when the child was two years old was higher compared to the historic control group, the 2006 birth cohort. Thus, the 2008 birth cohort probably included a larger share of families with children at high risk of caries, a fact that should have changed the main outcome measures in the 2008 birth cohort for the worse. However, the 2008 birth cohort turned out better than that of 2006; at two years of age, there were more negative MS scores in the birth cohort of 2008 than in 2006. A sensitivity analysis was performed to assess whether the results may have been biased because of missing data. In the best case scenario, if all missing MS scores had been negative, there would be no difference between the cohorts. In the worst case scenario, if all missing MS scores had been positive, the difference (19%) between the cohorts would be statistically significant. In a third scenario, we hypothesized that the percentage of negative results in the missing cases of both cohorts would resemble those in the fathers' basic level of education (84%). In that scenario, the difference (2%) between the cohorts was statistically significant, although clinically minimal ($P = 0.018$).

The finding that father's advanced education level associates with the child's negative MS scores is in line with Ersin et al.'s [24] study of early childhood caries. In their study, the mother's lower level of education was a strong risk indicator for the colonization of caries-related micro-organisms. In the study of Meurman et al. [10], early colonization of MS was found to be associated with the socioeconomic status of the family. A systematic review of parental influence on the development of dental caries in children aged 0–6 years old [25] suggests that lower socioeconomic status are associated with higher prevalence or severity of caries in young children, and that the low level of parental education is associated with a higher risk for caries. In the present study, most of the univariate associations were found with the education level of both parents but, in multivariate analysis, father's education level proved to be more important than mother's education level.

In the present study, there were two group-related differences found in oral health habits; the lower proportion of the habit of tasting food from the child's spoon by parents in group F, and the child's reported higher use of xylitol products in group X. The findings are in accordance with the programs used; in program F, the procedure of pointing out the biofilm on the parents' teeth might have increased their awareness of having contagious bacteria in their mouth. In program X, the discussion on the frequency of meals and snacks, and the related pH drop might have motivated the parents to use xylitol also for their children. The benefits of xylitol in oral health promotion have been shown in numerous studies starting from the 1970s. According to The European Food Safety Authority [26], a total daily dose of 2-3 grams of chewing gum sweetened with 100% xylitol at least three times per day after meals is required for clinical effect. The first-born children in the questionnaire study use xylitol products very often, especially those of fathers with an advanced level of education. The use of xylitol products is common in Finland, and the use has been promoted for years; at the present, it is a generally accepted smart habit [27]. According to the present study, the use of xylitol three times a day is quite well tolerated by children.

The MS testing continued for almost four years, which constituted a risk for the reliability of the main outcome measure. For this reason, all the first-year tests and a large proportion of other tests were reinterpreted for the present analyses, randomly mixed up with all the last-year tests. This enabled a blind set-up in the comparison of birth cohorts, and increased the reliability of the results.

In the 2008 birth cohort, 77% of the children that visited the PDS were tested for MS in comparison with 95% of first-born children in the questionnaire study. The high proportion may be the result of a study effect, concerning the parents of first-born children, as well as the dental professionals involved.

In this study, we wanted to create something new for the interventions; in addition to counseling on children's oral health, we also wanted to advise the parents themselves, with the intention of promoting the oral health of the whole family. This addition of the parental aspect was not found more effective than the routine program. According to the opinions of the dental professionals, the parents accepted the interventions well. Before the implementation of this study, the dental professionals were given a great deal of instruction in several aspects of oral health promotion, including introducing the use of the transtheoretical model and motivational interviewing, and training in their use was arranged [17]. Within the organization, the efforts added to the counseling of young children may have increased respect for early childhood oral health promotion and the professionals responsible for it; this might also have had an effect on their attitudes towards the work. This is in line with the study of primary nurses' performance, which emphasizes the role of supportive management [28]: a higher level of supervisory support for the nurses resulted in higher performance at the workplace compared to the performance of the nurses receiving a lower level of support. The managers were found to be important [29] in supporting the nurses to create a culture of shared responsibility of evidence-based work, and to achieve a real change process in patient's education.

In conclusion, the present findings suggest that training and supporting the professionals in health education is more important than adding parental self-care to programs for young children. Instead of a program effect, the father's advanced education level and the child's use of xylitol were found to be associated with negative MS scores in the child. The counseling of young families might be best carried out by the routine program; focusing only on the few main issues of the child's oral health promotion.

Conflict of Interests

The authors do not have any direct financial relation with the trademarks mentioned. The authors alone are responsible for the content and writing of the paper, and they have no conflict of interests.

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Research Article

Long-Term Effectiveness of Parent Education Using the "Baby Oral Health" Model on the Improvement of Oral Health of Young Children

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Purpose. To determine the long-term effectiveness of comprehensive education given to parents and caregivers with respect to the incidence of preventable oral diseases, utilization of dental services, and retention of knowledge related to oral health. *Methods.* Group presentations on oral health were conducted for caregivers of infants ($n = 161$) using an interactive audio-visual aid. Followup occurred at 18 months. A comparison group ($n = 181$) was enrolled from the same community groups. Chi-square and Fisher's exact tests were used to analyze findings. *Results.* There was a difference in caries incidence, knowledge levels of caregivers, and utilization of dental services ($P < 0.05$) when comparing the SGB to the SGFU. *Conclusions.* One-time exposure to parent education using a comprehensive interactive audio-visual aid has an effect on reducing caries incidence and increasing dental utilization. While most knowledge is retained by parents, there is some attrition in the information retained over an 18-month time period. This emphasizes the importance of repeated reinforcement of the same concepts over a shorter time span.

1. Introduction

Providing comprehensive education to caregivers for the promotion of good oral health in their children is now termed as anticipatory guidance. Anticipatory guidance, as defined by Nowak and Casamassimo [1], is the "process of providing information about children to their parents by alerting them to impending changes, teaching them their role in maximizing their children's developmental potential, and identifying their children's special needs." Traditional preventive strategies have been implemented after deleterious habits have progressed, and these strategies have shown to be limited in their success rate over long periods of time [2, 3]. The timely manner in which this information is given to caregivers is a crucial point in this education strategy.

Anticipatory guidance has been used in the medical community in its campaign to encourage each patient to have a medical home. A medical home is an approach to providing comprehensive primary health care that is easily accessible, culturally sensitive, and family centred in a compassionate manner [4]. Studies of the medical home have shown that having a regular source of medical care has decreased the utilization of hospital emergency facilities [5]. The literature has also shown that having a preventive dental visit by the age of one increases future preventive visits and decreases future restorative and emergency room visits [6].

Traditional preventive strategies have shown an increase in knowledge and attitudes with dental education, but this has not translated into changed behaviour patterns in the long term [3]. In contrast there are other reports of successful health education programs. For example, a randomized controlled study of the effects of a pedagogical device targeted to prevent hypoglycemia proved to be a cost-effective educational tool [7]. The development of an anticipatory guidance model via a comprehensive audio-visual aid was achieved by Alsada et al. [8].

The aim of the study was to determine the long-term effectiveness of our anticipatory guidance model. Specifically, we determined and compared three outcomes: (1) the long-term retention of knowledge; (2) access of dental care by

the caregivers for their children; (3) the incidence of preventable oral diseases such as dental caries.

2. Materials and Methods

The two-cohort study was approved by the research and ethics committees of the University of Toronto. The anticipatory guidance model used in the study was an interactive presentation that included use of a DVD termed "Baby Oral Health" in a community-oriented setting. This DVD was designed as a tool to provide comprehensive education regarding infant oral health in high-risk populations. Unlike existing education materials, this aid provides a comprehensive, self-directed, and evidence-based approach to the promotion of infant oral health. The topics of the video included the role of a healthy pregnancy, stages of tooth development, early childhood caries (baby bottle tooth decay), trauma, nutrition, oral hygiene, fluoride, oral bacteria, nightly feeding habits, oral habits, the first dental visit, and regular dental visits. This video was developed and previously tested in a pilot project for its effectiveness in infant oral health education [8]. The presentations were performed by one dentist at city-operated child care centres or Ontario Early Years Centres in Toronto.

To assess infant oral health knowledge, each caregiver was asked to complete a questionnaire relating to the presentation. This questionnaire was edited from the questionnaire used in the pilot study [8]. There were two types of data collected to assess the effectiveness that the intervention had on preventable oral diseases. The first was the dental screening performed by one dentist in the knee-to-knee position. An overhead light and examination gloves were used. Caries was defined as visibly cavitated lesions. The second was the completion of an assessment form to review any high-risk behaviour. Topics covered in the assessment form included demographics, birth history, diet and nutrition, fluoride, oral habits, injury prevention/trauma, oral development, oral hygiene, and dental visits. In order to determine the model's effect on dental utilization, each caregiver was provided a referral form which listed paediatric dentists in their vicinity.

Caregivers voluntarily participated in the study based on information provided by the directors of participating centers to various parent groups. Any and all parents with appropriate age children or expectant parents who consented to participation in the study were enrolled. There were no exclusion criteria as this program is intended for all parents with young children.

The schematic below outlines the study design; arrows denote the statistical comparisons made:

Study group: enrolled at baseline (n = 161; SGB) ⇔ Study group followup at 18 mo (SGFU)

⇕

Comparison group ⇔ Enrolled at followup (CG)

For the study group at baseline (SBG; n = 161), the assessment forms were completed by the caregiver prior to the start of the presentation. The anticipatory guidance presentation was delivered. The caregivers completed the questionnaire immediately after the presentation, and then their children participated in the dental screening. The study group was followed up after an 18-month time period (SGFU; n = 161). The follow up consisted of the caregiver completing the identical assessment form and questionnaire that they had originally filled. As well, the subjects were given a second dental screening.

The comparison group (CG; n = 181) was enrolled from the same centres used to enroll the study sample population but did not receive the anticipatory guidance presentation before data collection. The multiple choice questionnaire was completed at the beginning of the presentation session in order to determine the level of dental knowledge prior to any anticipatory guidance given by the researcher. After completion of the questionnaire, the dental screening for their children was completed. The presentation was provided at the end of the visit in order to provide anticipatory guidance without biasing the results of the data.

Summary statistics were computed using SAS version 9.2 for the study and comparison groups from the questionnaire and assessment form data. Chi-square tests and Fischer's exact tests were used to analyze data between the study group and the comparison group with regard to knowledge retention, presence of caries, and utilization of dental services.

3. Results

The study group at baseline (SGB) consisted of 161 children. This cohort completed the study and was designated (SGFU; n = 161). The children's ages ranged from 0 to 31 months, the mean age being 17.6 months. Nine children included in the study group were not born at the time of the initial data collection. The study group followup (SGFU) consisted of 161 children. The mean age for the SGFU was 35.7 months, with an age range from 16 to 49 months. The comparison group (CG) was enrolled based on an age range that would be approximately comparable to the SGFU and consisted of 181 children. The mean age for the CG was 34.2 months, with an age range from 12 to 54 months.

As a measure of dental knowledge, a multiple choice questionnaire was administered to the caregivers of the study group at baseline (SGB), at followup (SGFU), and to the comparison group (CG). Using Chi-square and Fischer's exact test, each question on the multiple choice questionnaire was analyzed comparing the SGB with the CG as well as the SGB with the SGFU. The questionnaire responses revealed that in 20 of 23 questions, the SGB had a higher percentage of correct answers than the CG. The questions that showed a significant differences between the SGB and the CG pertained to the following topics: timing and frequency of oral hygiene practices, all questions related to fluoride, transmission of bacteria, breastfeeding, providing a safe home environment, and timing of the first dental visit.

Knowledge retention level of the study group at the follow-up period compared to their knowledge retention at baseline revealed a general trend for some loss of knowledge retention over the 18-month period. There was no significant loss of knowledge in the SGFU at a 5% significance level over the 18-month study period for 15 out of the 24 questions. The questions which showed a significant loss of knowledge over

Table 1: Chi-square analysis of caries in the SGFU and the CG.

	No caries	Caries	*P* value
SGFU	151	10	0.0001
CG	148	45	

There is a significant reduction in caries incidence among children whose families attended the "Baby Oral Health" model of anticipatory guidance.

the 18-month time period were related to the following topics: timing of the first tooth, time required for toothbrushing, swallowing toothpaste, fluoridated water, transmission of bacteria, the role of breastfeeding in causing tooth decay, and timing of the first dental visit.

To determine the effectiveness of the anticipatory guidance model on preventable oral diseases, two methods of data collection were used. The first measure was the dental screening which included a record of visible caries, nonnutritive sucking habits, and trauma. Statistical analysis could only be performed for caries since the incidences were too low for other preventable oral conditions, such as trauma or nonnutritive sucking habits (NNSH). There was a significant difference on caries between the SGFU and the CG ($P = 0.0001$; Table 1). The control group at the end of the follow-up period had a caries prevalence of 6% as compared to 24% in the comparison group.

The second determinant for the effectiveness of this anticipatory guidance model on preventable oral disease was the assessment of high-risk behaviours. The results of the assessment form are shown in Table 2. Dental visits by caregivers: there was a higher percentage of caregivers in the SGFU (56.3%) that had themselves seen a dentist in comparison to the caregivers in the SGB (34.8%) and the CG (46.5%). Night time feeding practices: there was a dramatic decrease in the percentage of participants in the SGFU (16.1%) who allowed night time feeding for their children as compared to the SGB (40.4%) and the CG (47.8%).

The third objective of the study was to determine if anticipatory guidance had an effect on utilization of dental services. Chi-square analysis was performed on data gathered from the assessment form, in particular, the question related to having seen a dentist in the past. The follow-up answers of the study group compared to those of the comparison group are shown in Table 3. The results showed that there was a significantly higher degree of utilization of dental services by the study group participants as compared to those in the comparison group ($P = 0.02$). Of the 89% of the study group at baseline that had not utilized dental services, many responses were given as to the reason. The most frequent response given for the caregivers of the study group and the comparison group was that they were advised by a health care professional to go at a later age of their child (27.4% and 31.8%, resp.).

4. Discussion

4.1. Comprehensive Anticipatory Guidance Model. An exhaustive review of the literature determined that there are no other audio-visual aids which discuss the full realm of anticipatory guidance topics for infant oral health. The unscripted, interactive aspect of the presentation was also beneficial to targeting the specific concerns of each group of caregivers and kept them engaged in the presentation. For example, presentations that included infants less than 12 months of age emphasized timing of tooth eruption. For groups with toddlers, proper home and car safety standards were emphasized. Previous studies have shown that tailored preventive education may have a longer impact than methods that are uniform [2].

4.2. Followup. The study group baseline (SG) was contacted via telephone after an 18-month time period. Approximately 10% of caregivers that were contacted were not interested in continuing with the study because their child was already under the care of a dentist consequent to our initial presentation. While this was a negative aspect to data collection, it was a positive note for the ultimate goal of the study, that is, to increase dental utilization.

4.3. Utilization of Dental Services. The results of this investigation showed that being advised by a health care professional was the most popular reason for not taking their child to a dentist. This highlights the issue that nondental health professionals need to be educated about the timing of the first dental visits for infants, so that the public receives a uniform message from all health professionals. Considering the limited number of paediatric dentists, it is important for the general dentist to provide access to this young patient population. General dentists should, at least, be comfortable screening children of this age group to assess their risk and determine their need for care by a paediatric dentist. Education programs have begun to address this issue at the undergraduate level and reinforce the importance of first dental visit at or before the child's first birthday.

4.4. Reduction in Early Childhood Caries. We saw a significant reduction in the incidence of caries in children whose parents were exposed to anticipatory guidance only once. The caries prevalence of 24% in the comparison group is approximately similar to those reported by public health, establishing this population as one at risk for dental disease. An even greater degree of reduction would have been noted with an intermediate recall at a 6–9 month time point. This observation is based on a much larger ongoing study which shows that children who are caries free are seen to be less likely to be brought back by their parents for routine follow-up visits at these free clinics. Reduction in the incidence of preventable oral disease is the ultimate goal of our model of anticipatory guidance and true test of its effectiveness.

4.5. Questionnaire Responses. The results showed that the SGB generally had more knowledge than the CG and that the SGFU generally had some loss of retention of that knowledge. It is interesting to note that the questions that showed a significant difference between the SGB and the CG were very similar to the questions that showed a significant loss of

Table 2: Summary of data collected from assessment form for the SGB, CG, and SGFU.

Questions asked	SGB		CG		SGFU	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Pregnancy problems	13.2	86.8	11.1	88.9	12.9	87.1
Full term	78.4	21.6	90.7	9.3	90.3	9.7
Illness	14.6	85.4	18.2	81.8	12.5	87.5
Medications	9.7	90.3	4.3	95.7	6.3	93.8
Dental visits by caregiver	34.8	65.2	46.5	53.5	56.3	43.8
Breastfeeing	78.3	21.7	92.8	15.2	90.6	9.4
Nighttime feeding	40.4	59.6	47.8	52.2	16.1	83.9
Cup drinking	73.9	26.1	78.3	21.7	93.8	6.3
Special diet	10.0	90.0	7.0	93.0	0	100
Snacking	77.3	22.7	95.5	4.5	96.9	3.1
Fluoridated water usage	69.9	30.1	66.7	33.3	96.9	3.1
Bottled water usage	48.3	51.7	54.3	45.7	40.6	59.4
Fluoridated toothpaste	26.0	74.0	45.7	54.3	43.8	56.3
Pacifier	27.8	72.2	21.4	78.6	18.8	81.3
Digit habit	27.5	72.5	12.8	87.2	25.0	75.0
Walking	71.4	28.6	91.5	8.5	96.9	3.1
Injury	7.7	92.3	4.3	95.7	18.8	81.3
Teeth present	90.0	10.0	97.7	2.3	100	0
Teething problems	22.4	77.6	14.3	85.7	18.8	81.3
Clean mouth	78.9	21.1	91.5	8.5	90.6	9.4
Use of toothbrush	66.7	33.3	91.5	8.5	90.6	9.4
Use of toothpaste	57.5	42.5	90.7	9.3	83.9	16.1
Use of floss	6.3	93.8	21.4	78.6	15.6	84.4

Table 3: Chi-square analysis of dental utilization in the study group at followup and the comparison group.

	No dental visit	Dental visit	*P* value
Follow-up group	91	70	0.020
Comparison group	150	31	

There is a significant difference between utilization of dental services between the groups.

knowledge when comparing the SGB to the SGFU. Although it must be acknowledged that parents and caregivers who consented to volunteering in the study could be reasonably be assumed to be more motivated than those who did not, the loss of knowledge retention over the fairly long study period of 18 months demonstrates the attrition in recall of information and highlights areas of the presentation that need further clarity and reinforcement. Additionally, the loss in knowledge also demonstrated the reliability and validity of the questionnaire instrument used in this study and our previous study [8]. Some of these multiple choice questions showed no significant difference between the SGB and the CG and/or the SGFU, and some questions showed no loss of retention when comparing the SGB to the SGFU ($P = 1.00$) which suggests that caregivers may be receiving information about these topics from other sources.

4.6. Dental Screening. The gold-standard for caries detection would have been a complete intraoral examination with mirror, explorer, overhead lighting, and radiographic examination if deemed necessary. However, Beltrán et al. [9] found in their evaluation of two methods for assessing oral health status that visual screenings gave data comparable to that produced from visual-tactile examinations. Screenings are used to seek out high-caries risk children and direct them to a dentist for further care; its purpose is not to replace a comprehensive oral examination.

4.7. Cost Effectiveness. The use of existing community-oriented programs is a cost effective method of delivering anticipatory guidance to caregivers of infants and increasing access to dental care [10]. This model of delivering anticipatory guidance is more cost-effective than one-on-one counseling initiatives which are the most costly in terms of manpower, time, and financial resources, given the relatively few individuals that can be counseled. The model presented here may be a gateway program to allow parents to receive knowledge and learn whether their child is considered high risk and is in need for a dental visit [11] or for the modification of daily hygiene routines. The model of anticipatory guidance used in this study is cost effective as very few personnel and personnel hours are required to deliver the program. The widespread use of this model can be achieved and leads

to an increase in access to care for certain under serviced populations.

4.8. Study Limitations and Recommendation for Future Use. The language barrier was one limitation of the study. It is important to note that populations that cannot communicate fluently in English are likely the same populations that find it difficult to access care in the dental community. The audio-visual aid used in this study has been translated in to French, Spanish, and Arabic. It is recommended that the audio-visual aid be translated into many other languages and that multilingual personnel be trained to present this anticipatory guidance model. A second limitation to the study is access to dental services. It may have been helpful to give caregivers a list of private and public dental offices that are in their community.

5. Conclusions

(1) There is some attrition in the retention of oral health knowledge over an 18-month time period suggesting that repeated reinforcement of the same principles and concepts might be advisable over a shorter time span.

(2) A one-time exposure to anticipatory guidance has a positive effect on dental utilization. This underscores the importance of this model as a gateway into the dental system.

(3) One time exposure to anticipatory guidance has an effect on caries incidence which underlines the importance of the timing of the model. This model, ideally, should be presented to the caregivers when the child is predentate.

(4) This model of anticipatory guidance can provide long-term effectiveness in promoting the oral health of young children.

Conflict of Interests

The author declares that there is no conflict of interests regarding the publication of this paper.

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Research Article

Outcome of a Community-Based Oral Health Promotion Project on Primary Schoolchildren's Oral Hygiene Habits

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The aim of this study was to evaluate the effect of a school-based intervention project conducted in a mid-sized Finnish city, Laukaa on schoolchildren's oral health behavior. *Material and Methods*. In the intervention, all children received dental education and some of the 7–12-year-old schoolchildren received individual tooth brushing instructions by a dental nurse in 2009-2010. Parents were present at the instruction sessions. In 2009 and 2010, all the children answered a questionnaire or an oral hygienist on their oral health behavior without identification. *Results*. Tooth brushing frequency increased significantly among the schoolchildren between the years 2009 (61.2%) and 2010 (65%) ($P < 0.05$); more so among younger children (7–10-year-olds) compared to the older ones (11-12-year-olds). The 2010 results showed a slight trend of decreasing tooth brushing frequency by age both among girls and boys. Younger children got significantly more often parental help or reminding. The girls brushed their teeth significantly more frequently (71.9%) than boys (57.0%). *Conclusions*. Our findings indicate that oral health intervention can be beneficial on health behavior especially for children at low grades. All children, 11 to 12 years of age, especially boys, need continuous health promotion.

1. Introduction

According to a WHO survey conducted in 2005/2006, Finnish schoolchildren's tooth brushing frequency was one of the lowest in Europe [1]. Thirty-seven percent of Finnish 11-year-old boys and 55% of girls reported brushing their teeth more frequently than once a day. The figures were similar among 13- and 15-year-olds (boys 35% and 39% and girls 55% and 61%, resp.). All values were clearly below the European mean values: 11-year-olds 56% and 67%, 13-year-olds 55% and 69%, and 15-year-olds 54% and 74% for boys and girls, respectively. Only children in Lithuania, Greece, Turkey, and Malta brushed their teeth more seldom than the Finns. Children in Switzerland and in Finland's neighboring country Sweden brushed their teeth most often [1]. There are no statistics of tooth brushing frequency of children at lower grades.

The time of eruption of molars, particularly the first permanent molars, is considered as a time of high caries risk for decaying [2–4]. It has been reported that intensive dental care at eruption time has resulted in reduction in the amount of visible plaque, need for sealants and fillings, and consequently, amount of frequent recalls. An example of an excellent outcome of oral health promotion comes from Nexø, Denmark. In Nexø, a community-based program was designed and launched during period 1987-1988 to improve oral health by focusing on nonoperative caries treatment of children and adolescents aged 0–18 years and improving their self-care, that is, tooth brushing, especially at times of tooth eruption [4]. DMFT values in the Nexø community have sunk well below the national average during the past decades, that is, after the intervention started [5, 6]. The total costs of the dental services decreased approximately by 15% during the

period from 1987 to 1999 [6]. In Finland, after a community-based oral health intervention on schoolchildren, a survey revealed that tooth brushing frequency, knowledge, and attitudes of schoolchildren in terms of oral health improved. However, it was concluded that to have an optimum outcome, oral health promotion should be a continuous process rather than a short-term intervention [7].

In Finland, dental care is free up to the age of 18 and children are invited to regular examinations by a dentist or a dental assistant or an oral hygienist at individual recall intervals. After the recession in the 1990s, resources for oral health promotion in the municipalities were limited. However, in a mid-sized Finnish city Laukaa, authorities wanted to still keep on prioritizing oral health promotion, and in 2008, the city launched a still on-going health education project the "Tooth Brushing School." The "Tooth Brushing School" was based on ideology and methods used in Nexø. The aim of the project was to have all children less than 12 years of age and their parents/care givers living in Laukaa attend the "Tooth Brushing School." In addition, in all Laukaa schools, oral health lessons were, and still are, organized every year with a specific theme. The themes have varied from healthy diet to dental caries. Examples of earlier themes are *Snacking; The Little Ones Follow the Big Ones' Example;* and *Good for Mouth, Good for You*. The oral health section of the municipal health services of Laukaa has also introduced its own hamster mascot, the *HAMSU* hamster ("HAMpaat ja SUu," meaning "teeth and mouth"). The hamster appears in educational materials and on posters at the health center. There is also a website (http://www.hamsu.net/) where children can get more information about dental care together with their parents.

The aim of this study was to evaluate the outcome of a community-based oral health promotion project based on an individual as well as a public approach on schoolchildren's tooth brushing and other oral health behaviors. We hypothesized that schoolchildren's tooth brushing habits can be influenced by lessons at school and simple individual instructions, especially if the parents become involved.

2. Material and Methods

2.1. Oral Health Education. During the school year 2009-2010, an intense oral health promotion was carried out among all schoolchildren in Laukaa, Finland. The project was conducted by the oral health section of the Laukaa municipality. All children had dental education at school emphasizing mainly regular and careful tooth brushing. Some children in Laukaa, Finland had been invited to "Tooth Brushing School" in the summer of 2008 and even more of them during the school year 2009-2010. In Finland, all children under 18 years of age are entitled to dental care without charges by the municipality of their residence. The municipalities are required by the state to promote oral health. All expenses of this project were covered by the municipality of Laukaa.

In the "Tooth Brushing School," children were first asked about their oral habits and then given a chance to "inspect" their own teeth using a hand mirror assisted by a dental assistant (PN). Children were demonstrated what a clean tooth looks and feels like and taught how to clean surfaces covered with plaque. If a child's oral habits were fine, they visited the "Tooth Brushing School" only once. In other cases, the child came to the "Tooth Brushing School" as often and as many times as needed, sometimes even every other week. Children were accompanied in the brushing school by their parents, who heard and saw what their children were taught.

Table 1: The total number of school children and number and proportion of the respondents in oral health surveys in 2009 and2010 in Laukaa, Finland.

Year	Number of respondents and total number schoolchildren *n*/total *n* (%)		
	Grades 1–4	Grades 5-6	Total
2009	702/1.029 (68.2)	483/525 (92.0)	1.185/1.554 (76.3)
2010	833/1.074 (77.6)	450/493 (91.3)	1.293/1.567 (82.5)

2.2. Questionnaires. In the autumn of 2009, all children who were not absent from school answered a questionnaire on their oral health behavior. Children in grades 1 and 2 assisted by their parents answered the questionnaire at home and children in grades 3–6 at school. Teachers dealt out and collected the forms. A total of 1,185 out of 1,554 children (76%) answered the questionnaire (Table 1). In the analyses, the children were divided into two groups according to their grades: children in grades 1–4 and children in grades 5-6.

In the autumn of 2010, again all children who were not absent from school were asked to answer a questionnaire on their oral health behavior again. Out of 1,567 children, 1,293 (84%) answered this questionnaire. To compare the answers of the same groups of children in 2009 and 2010, for the analyses, the children were divided into two groups according to their grades: children in grades 2–5 and children in grade 6. The questionnaires in either year included no identification (IDs) of the children.

The questionnaires had been developed in the community and had not been validated. The questionnaires were similar to children in all grades. In 2009 and 2010, there were eight variables in the questionnaire with seven response alternatives describing the frequency of the behavior. The alternatives varied from "*three to four times a day or more frequently*" to "*less than twice a month or never*." Questions in 2009 were "*How often do you brush your teeth; How often do you use dental floss; How often do you use tooth pick; How often do you use fluoride toothpaste; How often do you use nonfluoride toothpaste; How often do you use fluoride tablets; How often do you use xylitol products*;" and finally, "*How often do your parents help you with tooth brushing*?" In 2010, gender and school grade were also included in the questionnaire. A new question was "*Do your parents remind you of brushing your teeth*?" The alternatives given were "*yes*", "*no*," and "*I do not know*." The following questions of 2009 were not included in 2010: "*How often do you use non-fluoride toothpaste*" and "*How often do your parents help you with tooth brushing*?"

The question "How often do you use xylitol products?" was divided into two different questions as follows: "*How often do you use xylitol lozenges" and "How often do you use xylitol chewing gum*?"

2.3. Statistical Issues. The answers were recorded into two categories as follows. Brushing frequency was recoded into those brushing at least twice a day and the rest. Use of dental floss was recoded into those flossing at least 2-3 times a week and the rest. Use of fluoride toothpaste was recoded into those using it at least twice a day and the rest. Fluoride tablet use was recoded into those using them once a day and the rest. Use of any xylitol products, gum, or lozenge was recoded into those using them at least three to four times a day and the rest. Parental help was recoded into those children who were helped daily and the rest.

The answers to the questionnaire in 2009, and 2010 were compared using cross-tabulation. In 2009, the data had been collected combing the children in classes 1–4 and 5-6. In the year 2010, the class of each respondent was registered. To compare results in 2009 and 2010, the compared classes were 1–4 → 2–5 and 5-6 → 6. Those in class 7 attend a secondary school and did not participate in this study in 2010. The main results on oral health behaviors in 2009 and 2010 as well as in different grades in 2010 were presented graphically. Also, oral health behaviors of different groups were analyzed by cross-tabulation. Statistical significance of the differences between the groups was evaluated using Chi-squared test. Difference between the groups was considered statistically significant at P levels <0.05. Effect of different background factors was evaluated using binary logistic regression analysis, 95% confidence intervals. Goodness of fit of the model in these data was tested using Hosmer and Lemeshow test. SPSS (version 20.0, SPSS, Inc., Chicago, IL, United States) was used for the statistical analysis and for producing graphics.

2.4. Ethics. The data did not contain any personal identification of the patients; therefore, neither consent from the patients nor children, nor approval of an ethical committee was needed (Practices for Research Permits, Oulu University Hospital, Finland, 2009).

3. Results

Tooth brushing and flossing frequency as well as use of fluoride tablets increased significantly among the schoolchildren during the study period 2009 and 2010 ($P < 0.05$). Frequency of using fluoride tooth paste practically remained the same (60.5% in 2009 versus 60.9% in 2010) (Figure 1). Both in 2009 and in 2010, younger children brushed their teeth and used fluoride toothpaste more frequently than the older ones (Figure 2). However, the older children (grades 5-6) used significantly more frequently dental floss and had fluoride tablets than the younger ones (grades 1–4) ($P < 0.05$) (Figure 2). The older children also used significantly more often xylitol products than the younger children did ($P = 0.001$). Children in lower grades got significantly more often daily parental help in tooth brushing in 2009 (21.4%), and parents reminded them of tooth brushing in 2010 (76.4%) significantly more often than older children (2.6% and 57.2%, ($P < 0.001$)).

The results in 2010 showed a slight trend of decreasing tooth brushing frequency by age (Table 2) both among girls and boys when investigated grade by grade. Nevertheless, use of dental floss, fluoride tablets, and xylitol lozenges increased until decreasing again between the grades 5 and 6. Significantly bigger proportion of children in the upper grades (55.3%) reported using xylitol chewing gum two times a day or more often compared to children in the lower grades (43.0%) ($P < 0.001$). Overall, girls brushed their teeth twice a day (72.0%) significantly more often than boys (57.3%). Girls also used toothpaste, dental floss, and xylitol gum significantly more often than boys ($P < 0.05$). Boys had significantly more often parental guiding than girls in every age group ($P < 0.05$).

According to the results in 2010, low tooth brushing frequency (daily or less frequently) was significantly affected by male gender and age (poorer towards grades 5-6). Tooth brushing education had a small impact on tooth brushing frequency, whereas parental reminding can be considered protective for children in lower grades (Table 3).

4. Discussion

Tooth brushing frequency increased significantly among the schoolchildren between the years 2009 and 2010, which shows that even a simple intervention targeted to groups and individuals of schoolchildren can be beneficial on their health behavior. Tooth brushing frequency increased more among younger children than among older children. We can also see a slight trend that tooth brushing frequency declines towards grades 5 and 6 among both girls and boys compared to younger children. Oral health habits of girls seem to be better than those of boys. These findings support the idea that oral health intervention should be given to all children but have focus on older children, especially boys. Education should be consistent, as suggested by Tolvanen et al. 2010 [7].

School health surveys are carried out in Finland every other year. In the 2008/2009 survey, 43% of 14–16-year-olds reported brushing their teeth twice a day or more often; the results show a slight improvement compared with the 2004/2005 survey (40%) [8]. Both in 2009 and in 2010, tooth brushing frequencies in Laukaa are well above those national averages, but again school-health surveys present mainly habits of older school-children. And it may well be that also in Laukaa the figures of this study group could be worse when the children grow older, if their oral health habits keep their worsening course even after grade 6. Anyhow, reason for delightful situation among the grades 2–6 in 2010 may be the beneficial effect of the years of oral health education organized in the Laukaa community on children's oral health. It has also been shown that municipalities which have stated goals and have a strong focus on caries prevention have improvement in caries experience data compared to communities without such strategies [9].

Over 1,000 children answered the questionnaire in 2009 and in 2010. The numbers are big and the response rates exceed 70% of the total age group in both years.

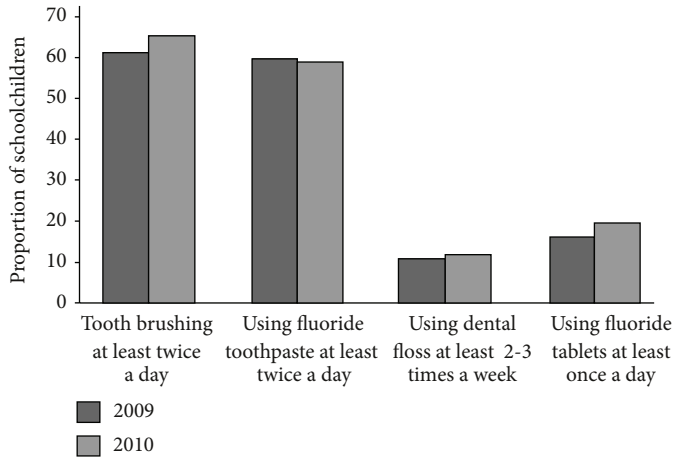

Figure 1: Self-reported oral hygiene habits before and after the intensive period of oral health promotion of schoolchildren.

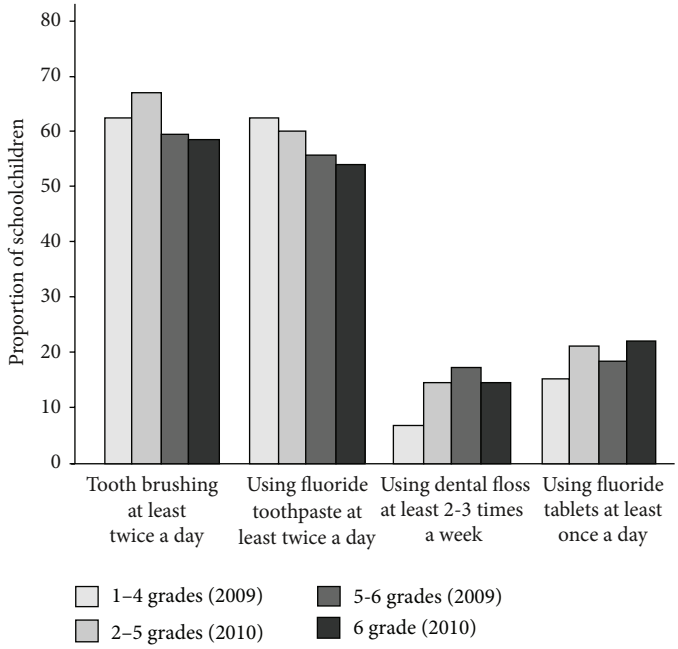

Figure 2: Oral hygiene habits of 1–4 and 5-6 grade pupils in 2009 and 2–5 and 6 grade pupils in 2010.

Table 2: Self-reported oral health behaviors of boys and girls in different grades of elementary school in Laukaa, Finland, 2010.

Grade	Tooth brushing ≥ 2 times/day		Use of fluoride tooth paste ≥ 2 times/day		Parents reminding of tooth brushing daily		Use of dental floss ≥ 2-3 times/week		Use of fluoride tablets daily		Use of xylitol chewing gum ≥ 3-4 times/day		Use of xylitol lozenge ≥ 3-4 times/day	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
1	71.8	60.0	69.2	58.2	88.9	91.8	0.0	0.0	9.6	13.5	17.2	15.5	10.4	10.1
2	67.0	68.0	64.8	66.0	90.5	92.7	1.0	3.1	10.6	16.7	20.8	11.5	16.0	6.2
3	76.4	62.8	68.9	53.8	56.2	60.6	17.3	15.4	21.0	25.6	34.3	29.3	16.0	17.6
4	78.7	48.5	67.8	41.1	62.9	64.3	27.0	10.5	30.2	22.5	34.1	29.2	11.5	20.9
5	75.4	52.5	62.9	49.0	59.3	64.4	24.8	14.0	20.7	19.1	43.2	31.7	9.4	18.0
6	63.6	52.7	61.5	47.2	41.8	64.2	20.4	7.7	17.9	25.5	33.0	21.8	11.0	11.3
Total	72.0	57.3	65.8	52.6	66.8	73.2	14.8	8.2	17.9	20.4	30.4	23.0	12.3	13.8
P	**<0.001**		**<0.001**		**0.040**		**<0.001**		0.244		**0.003**		0.263	

High-response rate and big study group are strengths in this study. It is likely that some children were off school on the day the questionnaire was answered or sent home. Information about the number of children unable or refusing to answer the questionnaire was not available nor were the possible causes for refusals. This study is practice-based and was originally not designed to be a research. Therefore, the questionnaire used had not been validated and similar forms were used for children of different ages. This is a shortcoming in the present study. The children in grades 1 and 2 filled the forms at home with the help of their parents which makes the results more reliable for them. Even if parents may not be aware of their children's fear [10], they can be expected to know about 1st and 2nd graders tooth brushing habits. A deficiency of this study is also the lack of IDs of the respondents which hinders comparing results on the survey in 2009 and 2010 at individual basis, as well as having information on attendance in oral health promotion program at individual basis. Furthermore, it would have been valuable to compare DMFS or CPI values from patient records because the questionnaire does not tell anything about the quality of brushing, which is another main point besides frequency that "Tooth Brushing School" seeks to improve. Unfortunately, patient records contained no information of participation in "Tooth Brushing School" and again no IDs were collected, and thus oral health data could not be collected. Therefore, the effect on oral health could not be analyzed like it has been done in Nexø.

In our study, boys were lazier brushers than girls (57.2% and 72%). This supports the findings of the Finnish school health survey [8] and Kajaani, another city with a long history of continuous oral health promotion [11]. In Kajaani, 74% of 12-13-year-old girls and 66% of 15-16-year old girls reported brushing their teeth at least twice a day. For boys in those age groups, proportions of those brushing their teeth twice a day were 58% and 51%, respectively [11]. These brushing frequencies are well in accordance with our results. This again speaks for oral health promotion; low profile projects can be effective, when resources are limited for big ones.

It is interesting that the proportion of those using toothpaste twice a day is lower than the proportion of those brushing their teeth twice a day. It can be speculated why children do not always use toothpaste when brushing their teeth. According to Marinho et al. 2003 [12] and Axelsson et al. 1994 [13], it is beneficial for schoolchildren to brush their teeth twice a day with fluoride toothpaste. Here, it may be possible that not all children understood the question in the questionnaire about using fluoride toothpaste correctly. In the 2009 questionnaire, there were separate questions on the use of fluoride toothpaste and non-fluoride toothpaste, which could have confused children. In the 2010 questionnaire, the non-fluoride toothpaste alternative, however, was erased because most of the toothpastes in Finland contain fluoride. Therefore, the responses can be considered reliable.

Adair et al. 2004 [14] showed in their study that children whose parents had favorable attitudes towards controlling their children's tooth brushing had favorable oral health habits. In the present study, in 2009, a year after the "Tooth Brushing School" intervention started, children in grades 1–4 got significantly more often parental help than older children. Parental help may improve the level of oral hygiene and thus provide long-lasting benefits for the child. Unfortunately, the same question was not used in the 2010 questionnaire, and thus we cannot compare the responses in the two years. In 2010, 66.8% of the girls and 73.2% of the boys were reminded of brushing their teeth daily by their parents. In every age group, boys were more often reminded about tooth brushing by their parents than girls. According to Poutanen et al. 2007 [15], the parents' role model is extremely important to children and its effect is slightly stronger on boys than on girls. Children in grades 1–4 were significantly more often reminded about tooth brushing than children in grades 5-6. One explanation for this difference may be that children in grades 1-2 answered the questionnaire at home with their parents and children in grades 3–6 at school. The effect of parental reminding can be considered most effective for children in the low grades.

Table 3: Binary logistic regression analysis on the ODDs by gender, grade at school, received tooth brushing education, and parental reminding on low tooth brushing frequency (daily or less frequently).

Variable	OR	95% CI		P
		Lower	Upper	
Male gender	1.94	1.491	2.512	**<0.001**
Classes 5-6	1.39	1.049	1.833	**0.022**
Tooth brushing education	0.83	0.635	1.083	0.170
Parental reminding	0.69	0.503	0.956	**0.026**

Hosmer and Lemeshow κ^2 = 3,554, df = 7, P = 0.829.

Xylitol products are commonly used in Finland. Over 30% of the children in Laukaa used xylitol products at least 3 to 4 times a day. Use of xylitol products was more common among older children and girls than younger children and boys. Regular use of both xylitol gum and candies is reported to reduce caries occurrence by about 50% compared with the control group [16]. Xylitol chewing gum has been shown to be equally effective with sealants in caries prevention [17]. Advantages of xylitol products are that they are freely available and can be bought without prescription. Use of xylitol is also cost-effective because it does not require oral health resources.

Analyzing an outcome by any oral health promotion project targeted to children is challenging; was the improvement or deterioration in oral health habits only coincidence, or caused by something else going on in the society, or simply by the growing age of a child? However, this should not hinder the health professionals from promoting oral health. To be effective, the promotion should not be only one project, but rather an on-going process like the one reported in Nexø. The confounding factors on oral health behavior were not analyzed here.

5. Conclusions

In conclusion, this study gives interesting information about oral health habits of 7–13-year-olds, when most of the

previous studies in Finland and elsewhere have been conducted among older children. It can also be concluded that oral health promotion to schoolchildren is beneficial for their health behavior. Our findings emphasize a need of booster-programs targeted to 11-12-year-olds and especially boys. It is also noteworthy that intervention may be more effective on younger children (7–10-year-olds) compared to older children; maybe because of the activity of the parents, which should not be neglected as a resource in oral health promotion.

Conflict of Interests

The authors declare that they have no conflict of interests.

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Review Article

A Proposed Model for Infant and Child Oral Health Promotion in India

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Dental caries is an increasing burden in the developing countries. A proper budgetary allocation for treating dental diseases in an enormous population such as India is impractical, where resources are inadequate for major health challenges such as malnutrition and gastrointestinal and respiratory infections in children. An integrated, directed population approach targeting children is much needed. The existing machinery of successful public health campaigns such as the "Pulse Polio" and the "Mid-Day-Meals Scheme" of the Government of India can be used for oral health promotion for children. India has about 300 dental colleges and countrywide branches of the Indian Dental Association that can provide manpower for the program. An innovative, large-scale "Fit for School" program in Philippines is a model for an integrated approach for children's health and has proved to be cost-effective and viable. A model for oral health promotion in infants and children of India, combining age-specific initiatives for health education, nutrition, hygiene, and fluoride use, is proposed. The model could be implemented to evaluate the oral health status of children, knowledge and knowledge gain of the community health workers, and acceptability and sustainability of the preventive programs (fluoride varnish and preschool and school tooth brushing) pragmatically.

1. Introduction

Oral diseases are the commonest chronic diseases and are amongst the most expensive diseases to treat [1, 2]. Although oral health can be regarded as a fundamental human right, inequalities in oral health continue to exist globally [1]. Rich countries witnessed a marked reduction in the experience of dental caries in children and young adults during 1970 and 2000 [3]; however, in the developing countries, owing to the westernized diets and the consumption of sugar, dental caries increased during the same period [4].

The effect of untreated caries on the growth and well-being of children often remains ignored [5]. Children having poor oral conditions are three times more likely to remain absent in schools due to dental pain and also perform poorly in studies [6]. Oral diseases affect the quality of life of children and account for pain, impaired aesthetics, recurrent infections, eating troubles, sleeping difficulties, emergency visits to dentists and hospitals, poor ability to learn, insufficient nutrition, and improper growth and development [2]. Dental caries affects children socially as well as psychologically. Furthermore, treating dental caries in children is expensive due not only to the direct costs of treatment but also the indirect costs such as the time taken off by the parents to take the child to a dentist [5].

In the developing countries, millions of children die every year of preventable diseases as the scarcity of resources deprives them a basic package of preventive healthcare. Therefore, restoring decayed teeth remains well out of the reach of these countries due to the budgetary constraints, which means that more than 90% of the caries remains untreated. This calls for an integrated preventive approach for oral and general health [7]. Dental health is an integral aspect of general health. Oral diseases and other chronic diseases have "common risk factors" [1, 8]. In order to improve the population dental health effectively, a broadly based health promotion strategy should be devised based on the common risk factor approach [3].

2. The Population: India

India is the second most populous country in the world [9]. The technological and economic growth over the past

few decades in India has been phenomenal [10]. However, India ranks low in the Human Development Index (134th among 182 countries in the year 2009) due to inadequate investment in health and education and poor living standards [11]. According to the government estimates, 29 percent people in India are below poverty line; moreover, a more sensitive index such as the *Multidimensional Poverty Index* (*MPI*) measures more than 55% of the Indians as poor [10]. In India, the private sector is responsible for the majority (71.6%) of the healthcare while the public sector accounts for 26.7% and external funding constitutes 1.7% [12]. Like many other developing countries, India has a huge burden of chronic noncommunicable diseases in addition to the continuing challenge of infectious diseases [11]. A high infant and child mortality rate (14.5% are infant deaths <1 years, 3.9% are deaths of 1–4 years children, 18.4% are deaths of children of 0–4 years, and 2.7% deaths of 5–14 years) and staggering high malnutrition (48%) are reported in a recent publication of the Central Statistics Office Ministry of statistics and Program Implementation, Government of India [13].

National Oral Health Survey and Fluoride Mapping was a comprehensive epidemiological investigation carried out by the Ministry of Health and Family Welfare, Central Government of India in the years 2002-2003 [14]. Important summary findings of the same are as follows.

There was a high caries experience across all age groups in India, with a high proportion of untreated decayed teeth (d/D) in children. The presence of the filled (f/F) component was negligible. In the 5-, 12-, and 15-year-old children, the prevalence of dental caries was 51.9%, 53.8%, and 63.1%, respectively [14, 15].

The report further stated that there was a skewed distribution of dental caries and the Significant Caries (SiC) Index was two or more times higher than dmft/DMFT levels. The mean dmft/DMFT scores for ages 5-, 12-, and 15-year-old children were 2.0, 1.8, and 2.4, respectively, and the corresponding SiC scores were 5.5, 3.0, and 4.1. There were no significant differences on the basis of gender. The population in rural India experienced more caries. The report also indicated a need for early treatment and prevention of dental caries in the population as the disease levels increased with advancing age [14].

3. Considerations for Developing a Model for Infant and Child Oral Health Promotion in Rural India

Most chronic diseases and oral conditions stem from the same risk factors which need to be controlled [8]. The challenge of infectious diseases in India is formidable and the causes of infections are poorly understood by people such as the open field defecation, inadequate sanitation (leading to contamination of drinking water), and poor hygiene practices [11]. The two strategies adopted by the government, the "selective disease control," and "the ad-hoc outbreak control" often prove inadequate to limit the infectious diseases, particularly due to the lack of modern public health approaches of prevention [11]. The burden of noncommunicable diseases in India is enormous and the chronic diseases account for 53% of total deaths [16]. Diarrhoea, pneumonia, and insufficient nutrition continue to affect the health of children adversely [17].

Poor nutrition can be a cause as well as an effect of poor oral health [5]. The Western World has benefitted from the widespread use of fluoride dentifrices and population approaches such as water fluoridation that has resulted in decline in dental caries [3]. The current caries trend in India demands a robust prevention policy for the control of dental caries [14]. A "directed population" approach based on geographic targeting (rural areas in each district) and targeting on the basis of schools (government run and aided) in these rural areas can be the taken up to devise a strategy for oral health promotion.

It is needless to reemphasize that an ideal model for the oral health promotion in rural India should be cost effective, acceptable, sustainable, and aiming at overall health promotion. Moreover, a preventive program targeting children in deprived communities integrating oral health with general health (for the prevention of diarrhoea and respiratory infections and improving nutrition) has to be evidence based.

India adopted a primary healthcare approach as a result of the Alma Ata Declaration in 1978. There exists a wide network of primary health care centers and community health workers in rural India. In the recent past a few health promotion policies of the Government of India have been widely publicized and have also led to significant developments in the health scenario. These policies can be studied and regarded as the foundation for the development of an oral health promotion model. Two national public health programs are discussed in Sections 4 and 5.

4. "Mid-Day-Meals Scheme"

The "Mid-Day-Meals Scheme" was launched in India on 15th August (the day celebrated as the Independence Day) in the year 1995 by the Central Government of India. In a declaration, the government mandated free cooked meals made of 100 grams of cooked wheat or rice to all children in public schools across all states. The Supreme Court of India directed all the schools that had not implemented the program to do so within six months in the year 2001 [18]. The program is based on the fundamental "right to food" and continues to be the largest nutritional program in the world. The program saw a few significant revisions in the years 2004 and 2007 such as the children of upper primary schools (grade VIII-X) and providing additional nutrients [19]. The objectives of the "Mid-Day-Meals Scheme" are increasing school participation, preventing classroom hunger, facilitating healthy growth of children, using the opportunity to inculcate good habits such as hand washing, fostering social equality, enhancing gender equality, and offering psychological benefits [20].

A report evaluating the success of this program stated that for a cost as low as three cents per child per school day, it reduced the protein deficiency by 100%, calorie deficiency by

30%, and Iron deficiency by 10% and also reduced hunger and Protein-Energy Malnutrition [18].

5. "Pulse Polio" Campaign

Before the launch of the Global Polio Eradication Initiative by in the World Health Assembly (WHA) 1988, polio crippled an estimated 200,000 children in India each year. Despite launching the polio eradication initiative in 1995, as recently as in 2009, India reported close to half the cases reported globally. However, in 2012 India achieved a milestone of passing one full year without recording any polio case; as a result India has been removed from the list of polio endemic countries. The success story was written by millions of frontline workers—vaccinators, social mobilizers, community workers, health workers, religious leaders, influencers, and parents—in often difficult circumstances and environments [21].

The pulse polio has been upheld as an immensely successful public health campaign, publicised widely and implemented thoroughly. There exists an infrastructure of local community health workers (Anganwadi workers) who work under the district and Taluka health and education authorities. The campaign also made use of the wide network of primary health care centers throughout the country for the successful monitoring and control of the campaign [21].

The lesson learnt from the above-mentioned two public health campaigns is that for a national health promotion program to become successful, a combination of planning at the top level and implementation at the local level is imperative.

Although there has not been an example of an effective oral health promotion program integrated with the overall health promotion in India, a program that has caught attention in the recent times is the "Fit for School" program that is currently underway in Philippines [22, 23]. This program can be considered as a model program and replicated in the rural Indian scenario. Described below are the important aspects of the program.

6. "Fit for School" Program

A school health program in Philippines currently in place for 630,000 children (2010) and targeting six million children in the next three years is based on the partnership between the Department of Education (Ministry) and local governments with the support of German Development Corporation and GlaxoSmithKline [22, 23].

The program has three essential components: hand washing, tooth brushing with a fluoride toothpaste (i.e., specially made available), and periodic deworming. It involves the participation of Parent-Teacher Community Association (PTCA: a prerequisite for implementing the program), teachers (in a supervisory role), the school principals (to ensure that the activity takes place and the consumables are available and to communicate with the school nurse and the PTCA), and a school nurse (for monitoring twice in a year). The costs for one toothbrush, 60 mL toothpaste, soap, and two, deworming tablets are 0.5 Euros per year [22].

7. Potential for Infant and Child Oral Health Promotion

The literature supports the promotion of hand washing in developing countries as a cost-effective measure in reducing diarrhoeal deaths [24]. Furthermore, hand washing alone is reported to lower the respiratory infections by 16% [25].

The literature also reports that a key to success of a health program is the participation of stakeholders in it. The partnerships of parent teacher associations in schools, local professional groups such as the dental bodies, social organizations, and public health schools are essential for the successful implementation of an oral health program [26].

Schools are an effective platform for the promotion of oral health because they cover a significantly large population (one billion) across the world [27]. The concept of Health Promoting Schools of the World Health Organization has met success through implementation in schools and influenced knowledge and behaviours of children [28]. A holistic approach for child health in India based on the health promotion in preschools and schools for children between 3 and 16 years of age can be conceptualized to integrate oral and general health of Indian school children particularly in the deprived communities.

There has not been a national oral health program for the rural (as well as the urban) India till date. Hence, as mentioned earlier, one has to look for an evidence of other successful public health campaigns in recent times to understand how to develop a model in terms of developing policies, making use of existing public health plans, using the currently available manpower and resources and promoting it well across the country crossing most barriers. An oral health promotion program can have three components: health education, fluoride use, and nutrition.

Education of community health workers using appropriate tools can be taken up as a step in the development of the infant and child oral health promotion program. Utilization of existing machinery that made successful the pulse polio campaign in India for the infant and child oral health promotion can be a pragmatic strategy. Already, initiatives have been taken for using the machinery towards routine immunization coverage of children. Adding an oral health component to early childhood health promotion can be a practical approach. A tool developed at the University of Toronto, a DVD-video containing evidence-based information about infant oral health care and prevention containing comprehensive anticipatory guidance in the areas of pregnancy, oral development, teething, diet and nutrition, oral hygiene, fluoride use, acquisition of oral bacteria, feeding and oral habits, causes and consequences of early childhood caries, trauma prevention, early dental visits, and regular dental visits, can be adapted with necessary translation, modification, and validation for this purpose [29]. Also, print material in the local languages can be developed for the purpose. Fluoridated toothpastes and fluoride varnishes

Table 1: Model for infant and child oral health promotion agewise initiatives.

Age group	Settings	People to engage with	Scope, components and tools
0–2 years	Primary healthcare centers, Anganwadi branches	Anganwadi workers (direct contact), parents (indirect contact)	Oral Health Education: for Anganwadi workers using a DVD on infant oral care and for parents using printed booklets
2-3 years	Primary healthcare centers, Anganwadi branches	Anganwadi workers and parents (direct contact)	Oral Health Education: for parents using printed booklets Fluoride varnish program in mobile dental van/or dental satellite centers
3–6 years	Preschools	Preschool teachers and parents (Parent-Teacher Associations)	Tooth-brushing program with fluoride toothpaste in combination with the Mid-Day Meals Scheme and hand washing
6–16 years	Schools	School teachers and parents (Parent-Teacher Associations)	Tooth-brushing program with fluoride toothpaste in combination with the Mid-Day Meals Scheme and hand washing

have been proved to be effective in caries reduction [30]. For the manpower required to train the community health workers and fluoride varnish applications and initiating the preschool and school tooth brushing programs, dental colleges across the country can participate. There exist close to 300 dental colleges in India. In the recently upgraded curriculum of dentistry by the Dental Council of India, emphasis is given on public health dentistry (wherein the interns need to be engaged in community programs for a period of three months). Each college has between 40 and 100 interns in each academic year; all together comprising a sizable manpower that can be utilized for the task. Also, most dental colleges have satellite dental centers and mobile dental vans for community outreach programs which can be utilized, too. The academic staff of the dental colleges can avail of the research opportunities through the program and be helpful in monitoring the implementation and evaluation. The members of local branches of Indian Dental Association can be helpful in the propagation of the initiative.

Proposed below is a model for the infant and child oral health promotion in rural India based on the considerations discussed above.

8. Model for Infant and Child Oral Health Promotion in Rural India

The model for the Infant and Child Oral Health Promotion in Rural India can include activities specific to age groups. The program for children up to age 6 years can be divided into three age-categories based on the age groups.

8.1. Age Group 0–2 Years. The community health workers in India are in continuous contact with the families for routine immunizations of children and provision of healthcare and government aid. An upstream approach to educate these workers (using audiovisual tools) so that the information reaches the masses (verbally as well as in print) can be initiated. These community health workers also have access to the health records of all children, which can be valuable.

8.2. Age Group 2-3 Years. Most children would have a complete primary dentition during this period and thus are in the best position to benefit from 6 monthly fluoride varnish applications (twice during the year). The community health workers can assist parents bring the children to Anganwadi branches or the primary healthcare centers for fluoride varnish application programs. The fluoride varnish applications can be carried out in these settings or a mobile dental van by engaging the interns of nearby dental schools. A voluntary support of the local branch of the Indian Dental Association is also desirable.

8.3. Age Group 3–6 Years and 6–16 Years. The preschool and school programs can involve a combination of previously discussed programs "The Mid-Day-Meals Scheme" that runs mandatorily in all the public schools across the country and two components (hand-washing and tooth brushing) of the "Fit for School" program that is underway in Philippines.

The details of the program are summarized in Table 1.

Recommendations of the proposed model are based on the five principles of the Ottawa Charter, which are relevant even 25 years after their first appearance [31].

The program demands "building public policies" such as a directive from a local government (from the Taluka Panchayat or a district authority). It further needs "creation of supportive environments" for the purchase of consumables at subsidized rates (by means of partnerships with industry) and to overcome practical barriers (e.g., cultural). It calls for "strengthening community action" by the active participation of the stakeholders (for instance, an active role of the parents in the parent teacher association). Moreover, it seeks to "develop personal skills" of the community health workers, local dentists in terms of leadership and teaching, which can help sustain the program in a self-reliant manner. It also asks for "reorientation of health services" only to a minimum, only for the supervisory and quality control of the intervention through periodic health monitoring, audits, and so forth.

9. Monitoring and Evaluation

Health programs are complex and often dynamic rather than static. "A health program is an interaction of health

concerns, program elements and its positive and negative drivers" [32]. The planning, monitoring, and evaluation of the proposed program must take into consideration the steps outlined in the "planning cycle," such as identifying needs, assessing resources, determining priorities, setting goals and objectives, implementing the program, and evaluating the program [26].

Success of the model discussed above can be evaluated on the basis of both the process evaluation and clinical outcome evaluation. For the purpose of monitoring, a team of experts (academicians in Public Health Dentistry from dental colleges) and local members of Indian Dental Association can be built.

The success of the proposed program will depend on the achievements in the measures of oral and systematic health. This program provides an opportunity to assess the following outcome measures.

A reduction in caries increment and improvement in oral health status can be considered as the long term oral health measures. Reduction in diarrhoeal and respiratory infections and improvement in the nutritional status of the children can be regarded as the systemic health measures. Also, whether the reduced hunger, improved nutrition, and health have any influence on the school attendance and performance of children can be evaluated. The improvement in the knowledge, attitude, and behaviours of the children and their families can also be the measures of interest. In practical terms, the cost-benefit analysis and viability of the program need to be considered among the other measures.

It could be possible to include a research component with the following outcome measures for the oral health promotion evaluation.

(i) indexes: dmft/DMFT, SiC, pufa/PUFA, Early Childhood Oral Health Impact Scale (ECOHIS) for 5- and 12-year-old children (WHO index ages),

(ii) assessment of knowledge and knowledge retention in Anganwadi workers, school teachers, and parents (using prevalidated questionnaires),

(iii) acceptance to and sustainability of fluoride varnish program in 2-3 year-old children (through qualitative assessment),

(iv) acceptance to and sustainability of the program of preschool and school tooth brushing with fluoride toothpaste in 3–16-year-old children (through qualitative assessment),

(v) comparison of dental attendance pre- and postprogram (based on health records).

10. Limitations

The structure of the program demands participation of central, state, and local governments to develop policies and give directives. In a country like India, this can be a challenge due to the sheer size of and diversities within the country and priorities before the government/s and differences in political wills in different regions. There also exist cultural and social differences, which may pose challenges. Shortage of water, particularly in draught affected areas, can be a problem for setting up hand washing and tooth brushing stations that need water supply.

The program is aimed at improving health of the children in the deprived communities. The real shortcoming of the program could be that it may not be sufficient to tackle the causes of the ill health of the children beyond the school settings. Whether it extends the benefits of the practices of hygiene beyond the boundaries of school, whether the improper sanitation and contaminated drinking water supplies continue to be the reasons for poor health statuses of children, and whether these reasons will in turn mask the success of the program will be the pragmatic challenges for the program. Furthermore, the rural India is deprived of government funded dental services, which means that people would not be able to seek dental care in spite of increased awareness and need. Moreover, propagation and monitoring the program needs building a network of leaders. Lack of experience and incentives to run the program may affect the initiation and sustenance of the program.

Public-private partnership could be a way to overcome the challenges anticipated in the implementation of the model. A need for encouraging the pharmaceutical industry and the social sector to take greater responsibility to support the public health system and health research in India has been identified [33]. The same will be necessary to bring this model to reality in terms of its potential scope and magnitude.

11. Conclusion

11.1. "Think Globally, Act Locally." Large population, diversities within the country, staggering high malnutrition and infectious diseases in children, growing concern of noncommunicable diseases and dental diseases, and poor investments in health are the considerations while developing a model for oral health promotion in infants and children. The model discussed here is a practical, cost-effective, evidence-based, directed population approach for oral health promotion in infants and children, aiming at overall health promotion (an integrated approach) suggesting the use of the existing machinery of the recently successful public health campaigns in India and the manpower of the widespread network of dental colleges and branches of Indian Dental Association. Although it can be challenging to bring it to reality, the model perhaps has a potential to bridge the gap between the enormous need of and miniscule effort in the oral health promotion targeting infants and children.

Conflict of Interests

The author does not have a direct financial relation with the trademarks mentioned in the paper. There is no conflict of interests.

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Research Article

Evaluating Two Oral Health Video Interventions with Early Head Start Families

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Poor oral health in early childhood can have long-term consequences, and parents often are unaware of the importance of preventive measures for infants and toddlers. Children in rural, low-income families suffer disproportionately from the effects of poor oral health. Participants were 91 parents of infants and toddlers enrolled in Early Head Start (EHS) living in rural Hawai'i, USA. In this quasi-experimental design, EHS home visitors were assigned to use either a didactic or family-centered video with parents they served. Home visitors reviewed short segments of the assigned videos with parents over an eight-week period. Both groups showed significant prepost gains on knowledge and attitudes/behaviors relating to early oral health as well as self-reported changes in family oral health routines at a six-week followup. Controlling for pretest levels, parents in the family-centered video group showed larger changes in attitudes/behaviors at posttest and a higher number of positive changes in family oral health routines at followup. Results suggest that family-centered educational videos are a promising method for providing anticipatory guidance to parents regarding early childhood oral health. Furthermore, establishing partnerships between dental care, early childhood education, and maternal health systems offers a model that broadens potential reach with minimal cost.

1. Introduction

The U.S. Surgeon General released the *Report on Oral Health in America* in 2000 celebrating progress in improving overall oral health nationwide; the report also identified a "silent epidemic" of poor oral health that disproportionately affects vulnerable populations [1, 2]. Low-income children living in rural communities are especially vulnerable to systemic limitations in accessing oral health services including: (1) a lack of access to care—for example, financial, geographical; (2) decreasing numbers of dental providers in proportion to families who need services; (3) a lack of continuity of care involving obstetricians, pediatricians, family physicians, and, for children with special health care needs, specialists; and, (4) low levels of parent and family oral health literacy [1, 3–9].

Poor oral health in early childhood can compromise the functional capacity of children to eat, sleep, and learn to speak properly [1]. Moreover, it can lead to mouth pain, inappropriate use of over-the-counter medications, reduced concentration in preschool and school, missed days of school and parental work, expenses associated with childcare or unpaid work leave, overreliance on emergency department resources, cost of hospital admission, and morbidity from general anesthesia, and, in extreme cases, cause infection that reaches the brain resulting in early death [1, 8, 10]. Finally, poor oral health in early childhood has been linked to greater risk of poor oral health later in life; adults with poor oral health have increased risk for coronary heart disease [1, 11].

Given these realities, preventing poor oral health in early childhood has become a major emphasis of national and state

entities concerned with child health and wellbeing [10, 12]. Because infants and toddlers are not able to care for their own oral health, parents and caregivers play a pivotal role in supporting early oral health—by establishing positive oral health care family routines, implementing proper nutrition, ensuring appropriate amounts of fluoride, and taking children to the dentist by age one [13, 14]. The prevalence of early childhood caries suggests that parents and caregivers lack information about the importance of early oral health and preventing poor oral health [15]. Research on national initiatives, including the Office of Head Start Dental Home Initiative, identifies parent/caregiver education on oral health as a key component in making positive impacts on young children's oral health [16–18]. Developing effective preventive educational "upstream" solutions for oral health can ameliorate social and economic costs to families and communities (cf. Seale and Casamassimo [8], Brown [19], Chasnoff [20]).

This leads to the question of how to most effectively provide parent education and anticipatory guidance. Research on parent education demonstrates that video interventions are more effective than printed pamphlets effecting positive changes in short-term attitudes and reported behaviors and in long-term retention [21]. Adult education research suggests that peer-to-peer approaches, building on social learning theories (cf., Bandura [22, 23]), are more effective in achieving increased knowledge and positive changes in attitudes and behaviors than lecture-based, didactic educational strategies [22, 23]. Social learning theories posit that adults learn best from messages delivered by people whom learners can relate to, emphasizing cooperative learning and peer sharing (e.g., as discussed by Clements and Buczkiewicz [24], Sloane and Zimmer [25], Broadhead et al. [26], Ayala et al. [27], and Leonard-Bartone and Rogers [28]).

The *Baby's First Smiles: Pass It On* video provides an alternative to didactic approaches by integrating peer-to-peer strategies with family-centered approaches (cf. family-centered Medical Home [29, 30]). Medical Home family-centered care, originally developed in the U.S. to effectively serve children with special needs and their families, has now been adopted by the American Academy of Pediatrics for all children [31–34]. The medical home and subsequently the dental home models promote respect for parents as first teachers of and experts on their children, positive family-professional partnerships, and effective community collaboration [30, 31, 34–36]. This enhanced relationship between parents and providers is a key aspect of quality care for young children and their families [35, 36].

Early Head Start (EHS) provides programs to low-income families with young children totaling approximately 150,000 pregnant women and children age birth to three nationwide [37, 38]. For this research in Hawai'i, we engaged EHS home visitors, often seen by families as friends and trusted allies, to share oral health videos with family participants and other family members making the video intervention a more personal, interactive experience. Following the families' video intervention with the home visitor, we asked family participants to share the videos with family members, friends, and community circles employing a peer-to-peer "pass it on" strategy based on trusted personal relationships.

The Pacific island state of Hawai'i has some of the worst child oral health outcomes in the United States partly due to a lack of fluoridation in community water, lack of a state-sponsored dental sealant program, legal limitations preventing dental hygienists from administering fluoride varnish without the direct oversight of a dentist, and shortage of dental providers who accept Medicaid patients [39, 40]. Hawai'i is one of four states in the U.S. with the poorest Medicaid reimbursement to physicians for early dental care (dental exam, anticipatory guidance, and fluoride varnish application) to children under three years of age [40]. Hawai'i is one of five states that received an "F" in an ongoing national assessment of dental health and access to care for disadvantaged children [40].

This evaluation compared family responses to two different approaches to oral health video interventions implemented by Early Head Start Home Visitors for low-income families with young children living in rural Hawai'i: (1) a state-of-the-art didactic video, *Baby's Oral Health*: *Pregnancy Through Childhood* (BOH) produced by the School of Dentistry, University of Toronto [41, 42]; and, (2) *Baby's First Smiles*: *Pass It On* (BFS) produced by Webfish Pacific, LLC [43]. This research hypothesized that family-centered, peer-to-peer videos would be more effective than didactic, lecture-based videos in achieving positive changes in family knowledge, attitudes and behaviors related to young children's oral health among families with young children living in rural Hawai'i.

2. Materials and Methods

2.1. Oral Health Education Videos. This research project compared two video interventions related to oral health education for parents and caregivers of young children. Table 1 provides a descriptive comparison of the two videos used in the evaluation, and Table 2 lists the titles of topics in each of the videos.

2.2. Participants. Participants were 104 parents of children enrolled in one of two EHS programs serving rural areas of the islands of O'ahu and Hawai'i (the state of Hawai'i is an island chain that includes seven major populated islands; Hawai'i island (aka the Big Island) has the largest landmass while O'ahu has the largest population). The recruitment pool included all families who had been active in EHS for at least four months and were not expecting to move out of their program's service area during the study period. Ninety-one parents (87%) completed the intervention and posttest interviews. Seventy-six parents with posttest data (86%) also participated in a followup interview. Roughly two-thirds of participants lived on O'ahu (68%) and one-third lived on Hawai'i. Among those participants that completed both pre- and posttest interviews, 53% saw the BFS video and 47% saw the BOH video. Almost all participants (96%) were mothers; the sample also included two grandmothers and two fathers. Forty-five percent of families were of Native Hawaiian/Pacific Islander heritage, 27% were of mixed ethnicity, 14% were Asian American, 6% were Caucasian, and less than 4% each

Table 1: Features of the *Baby's Oral Health* and *Baby's First Smiles* videos.

	Didactic video Baby's Oral Health (BOH)	Family-centered video Baby's First Smiles (BFS)
Duration	19 min.	26 min.
Age Range	Prenatal through elementary	Prenatal through age three
Messaging	(1) Research-based messages, best practices (2) Lecture format (3) Offscreen narrator for entire video (4) Script written based on didactic points written in a dentist's voice	(1) Research-based messages, best practices (2) 1st person interview format of families with young children and family-centered professionals (3) Interviewee messages and strategies emerged from interviews (parents provided 70% of messages, dentists provided 30% of messages) (4) Emphasis on peer-to-peer learning (5) Emphasis on child development and family context (6) Emphasis on life-long consequences
Visuals	(1) High quality video capturing visual examples of the messages from offcamera narrator	(1) High quality video capturing interviews with multiple parents and family-centered pediatric dentists including visual examples of the messages covered in interviews that focus on parents, families, and young children (2) Interviews with families conducted in their homes and show daily routines (3) Animations begin every topic

Table 2: Topical organization of video content.

Didactic video Baby's Oral Health (BOH) University of Toronto School of Dentistry	Family-centered video Baby's First Smiles (BFS) Webfish Pacific, LLC Early Childhood Oral Health Initiative
(1) The role of a healthy pregnancy in the development of baby teeth	
(2) Stages of development of baby teeth	(1) What the tooth fairy forgot to tell us!
(3) Healthy nutrition for healthy baby teeth	(2) Starting early
(4) Oral hygiene	(3) Healthy mouths
(5) Benefits and proper use of fluoride	(4) Junk mouths
(6) Source of bacteria in the mouth	(5) Family matters
(7) Night feeding habits	(6) Healthy eating
(8) Early baby tooth decay	(7) Going to the dentist
(9) Oral habits	(8) Community partners
(10) Prevention of injuries (home, play area, and car safety)	
(11) The baby's first dental visit	
(12) Regular dental visits	

were Latino, Native American, or African American. Slightly more participants were married (46%) than single (45%) and 8% were separated or divorced. Twenty-four percent of households spoke a foreign language at home. The modal level of education was a high school diploma or GED (38%) while 15% had less than a high school education, 33% had some college experience, and 13% had a college degree.

Participants had an average of 2.45 children overall, and 1.30 children in the age range served by EHS. Most families (74%) had one child enrolled in EHS, 23% had two children in EHS, and 3% had three enrolled children. Fifty-two percent of the EHS children were boys and 48% were girls. In terms of age distribution, 11% were younger than six months, 16% were 6–12 months, 43% were 13–24 months, and 29% were 25–36 months.

2.3. Procedures. Initial discussions were held with all three EHS programs in the state of Hawai'i; one program was not able to participate during the intended time period of the study. Eligible staff participants were home visitors with six or more months experience in their position and who had a caseload of six or more families living in rural communities. Nineteen home visitors (100% of those eligible) agreed to participate. A quasi-experimental design was used where home visitors from both EHS programs (and all the families they served) were randomly assigned to use either the BOH or BFS videos.

Home visitors received a three-hour training session. Content included background information on risk factors for poor early oral health, viewing the assigned video, practice showing video topics on portable DVD players, and

instructions for following the research protocol. Home visitors were asked to use the assigned video with all consented families they served. For the purpose of intervention design, each video was divided into eight segments lasting four to seven minutes in duration. The segments were to be shown on an overlapping schedule: segment 1 on week one, segments 1 and 2 on week two, segments 2 and 3 on week three, and so forth. Home visitors were asked to complete the series within eight to ten weeks. During the video intervention period, home visitors continued to implement the ongoing EHS protocol. How and when to incorporate the video during each home visit was left to the home visitor's discretion. To minimize differences in presentation, home visitors were asked to simply play the video and to provide only brief answers to any questions from family members. Home visitors were asked to refrain from showing the nonassigned video or from designing and implementing any supplementary curriculum. When each family had completed the video series, the home visitor was asked to give the participant a copy of the assigned video and encourage the family to share the video with other parents in their social circle.

At the time EHS home visitors were trained, all families were served via a home visiting model. However, both EHS programs had preexisting plans to offer a group-based option to enrolled families. Overall 11 families (12%) decided to move to the group format. To maintain equivalence across home and group formats, staff were asked to show the videos one-on-one to families who opted for group services; this was done either before or after regularly scheduled program activities.

Home visitors were provided with DVD players, assigned DVD videos, and recruitment and record-keeping materials. Home visitors kept a viewing log for each participating family. Logs were submitted to the research team on a monthly basis; the team was also available for consultation via email at any time. Pre- and posttest structured interviews were conducted in person with each participant by a research team member who was blind to the participants' condition. Research team members obtained informed consents from family participants on first contact at the time of the pretest. Posttest interviews were conducted within two weeks of completing the video series. A telephone followup interview was conducted six to eight weeks later. Compensation of $25 per interview was provided to participants; home visitors received a gift of an educational video on early childhood development, and the EHS programs received a combination of cash and material donations worth about $1,000.

2.4. Measures. Interview items developed for this study were partly adapted from pediatric and dental research and reviewed by the project's dental advisors [12, 15, 16, 41, 44, 45]. Pre- and posttest interviews included four sections: family demographic characteristics (10 items), oral health knowledge (21 items—see Table 3), and oral health attitudes and behaviors (25 items—see Table 4). The posttest interviews also included a consumer satisfaction scale (8 items—see Table 5). At followup, parents were asked whether their family had made any changes in nutrition habits, oral health routines, or dentist visits, and whether they had shared the video with others (4 items—see Table 6).

Table 3: Sample pre- and posttest knowledge questions—multiple choice, 21 items total.

(1) Cleaning baby's mouth after feeding should begin
(a) At birth
(b) After the baby is a year old
(c) After the first tooth comes in
(d) After the baby starts eating solid foods
(2) White spots on a child's teeth means
(a) The child is drinking too much milk
(b) The teeth are not getting clean enough
(c) The teeth will be protected from cavities
(d) The child is eating too much cheese
(3) Giving a baby fruit juice in a bottle at night
(a) Fights bacteria in the mouth
(b) Increases the chances for cavities
(c) Prevents cavities
(d) Prevents white spots from forming on the teeth
(4) Permanent teeth
(a) Are more important than baby teeth
(b) Do not form beneath the gums until the baby teeth fall out
(c) Are not affected by the baby teeth
(d) Form beneath the baby teeth before a child is born
(5) The amount of fluoride a child needs
(a) Depends on the child's age
(b) Depends on the kind of toothpaste they use
(c) Is the same for all children
(d) Is the same as adults
(6) Plaque is
(a) A film of bacteria on teeth
(b) A film that protects teeth from cavities
(c) A film that prevents teeth from yellowing
(d) Holes in the teeth that cause cavities

The 21 oral health *knowledge* items were presented in a multiple-choice format. Items were written to address the content areas of dental development and professional care (e.g., the role of baby teeth, use of fluoride, and recommended age at first dental visit), family routines in oral hygiene (e.g., wiping gums), and nutrition related to oral health (e.g., effects of different drinks and snacks on preventing/causing tooth decay). The total number of items answered correctly was used to measure overall knowledge. Internal consistency was adequate; coefficient alpha was 0.73 at pretest and 0.78 at posttest. See sample items in Table 3.

The 25 oral health *attitudes/behavior* items were answered using a Likert scale format (1 = *strongly disagree* to 5 = *strongly agree*). Again, content was designed to address dental development, family routines in hygiene, and nutrition. However, the focus was on attitudes and concrete behaviors. Items were reverse coded when needed so that a high score indicated responses supportive of good oral health. Items were summed to form an overall score. Coefficient alphas were 0.82 and 0.88 at pre- and posttest, respectively. See items in Table 4.

The six satisfaction items were answered on a five-point Likert scale (1 = *strongly disagree* to 5 = *strongly agree*). Coefficient alpha was 0.94.

3. Results and Discussion

3.1. Results. Descriptive statistics for pretest, posttest, and followup data are shown in Table 7. At pretest, parents had the least knowledge about the significance of white spots on the teeth, the development and role of primary teeth, and the recommended age to start flossing and dental checkups (items ranged from 25% to 58% correct) [46–48]. (While there may be a lack of scientific evidence in dental research indicating that flossing teeth prevents cavities, the American Dental Association advocates that flossing "is an essential part of any oral health care routine" and "recommends flossing at least once a day to achieve optimal oral health" [46], and scientific research in early childhood and brain development has firmly established that learning positive behaviors early has long-term benefits [47–49].) Parents were most knowledgeable at pretest about the role of sugar and starches in promoting caries, the need to brush children's teeth, and the need to wipe a baby's gums (items ranged from 84% to 93% correct). Matched pairs t-tests were used to test for the main effects of change over time. Knowledge scores increased significantly from pretest (mean = 15.19 or 72% correct) to posttest (mean = 16.98 or 81% correct), $t_{(91)} = 1.79$, $P < 0.0005$, Cohen's $d = 0.52$. Significant gains were also found for the attitude/behavior scale, (means = 103.70 and 107.02 at pre- and posttest, resp.), $t_{(90)} = 3.31$, $P < 0.0005$, and $d = 0.31$. The relative effect sizes (about one-third and one-half standard deviations, resp.) suggest that changes in knowledge were greater than changes in attitudes/behavior.

Group comparisons were conducted to test the hypothesis that the family-focused BFS video would be more appealing to parents and more effective. To adjust for each parent's level of pretest knowledge and attitudes, data were analyzed using a one-way analysis of covariance, with video as the between subjects factor and pretest score as a covariate. (The initial analytic plan was to use multilevel modeling, to account for the nesting of parents under EHS staff. However, preliminary analysis revealed that the intraclass correlation coefficients were close to zero, indicating that there was no need to model shared variance due to EHS staff.) There were no significant group differences on knowledge or attitudes/behavior at pretest, although there was a trend in the direction of BFS parents having higher pretest knowledge scores. Controlling for pretest knowledge, there were no posttest differences in knowledge scores, $F_{(1,88)} = 0.01$, $P < 0.91$, and $d = 0.02$. The BFS group had higher scores for oral health attitudes/behaviors at posttest, $F_{(1,88)} = 3.96$, $P < 0.05$; this effect was modest in magnitude, $d = 0.27$.

A two-group analysis of variance was used to test for group differences at posttest on consumer satisfaction and for group differences at followup on changes in oral health behavior. The BFS group had higher satisfaction scores (means = 34.35 and 36.83 for BOH and BFS, resp.), $F_{(1,89)} = 7.50$, $P < 0.007$, and $d = 0.57$. BFS families also reported a higher number of changes in family oral health routines, nutritional practices, and dentists visits (means = 2.09 and 3.27 changes, resp.), $F_{(1,76)} = 5.82$, $P < 0.02$, and $d = 0.55$.

A content analysis was conducted on parents' open-ended responses. When asked to list the types of changes their family had made since watching the videos, the most common changes mentioned were (a) increased frequency, duration, or attention to brushing children's teeth, (b) decreasing intake of sugary foods, snacks, and drinks, (c) increasing consumption of fruits and vegetables, (d) increasing the frequency of flossing children's teeth, and (e) increases in actual visits or the intention of taking the child to the dentist. Some changes

Table 4: Pre- and posttest attitudes/behavior items—5 point Likert Scale, 25 items.

(1) Parents/caregivers need to clean (wipe or brush) their baby's mouth at least twice a day.
(2) Children should watch parents/caregivers brush their teeth at least once a week.
(3) I have asked my dentist about the amount of fluoride young children need.
(4) Parents/caregivers need to provide a variety of food to their children so their children are more likely to try new foods.
(5) I would feel comfortable wiping a baby's gums.
(6) I feel that it is important for a pregnant mom to go to the dentist to take care of her own teeth.
(7) It is good when parents/caregivers reach out to trusted friends for information about the oral health of a young child.
(8) I have talked to a dentist about when to start flossing young children's teeth.
(9) I believe children should be served fresh fruits every day.
(10) I believe parents can prevent their children from having cavities.
(11) I am uncomfortable when I see someone giving soda to a young child.
(12) When parents/caregivers brush their teeth twice a day, their children are more likely to brush their teeth twice a day.
(13) New mothers/parents/caregivers can get support by talking to other new mothers/parents/caregivers in making sure their child's teeth and gums stay healthy.
(14) I feel that taking a child to the dentist when they are very young helps them not be afraid of the dentist.
(15) I prefer to give juice to a young child all through the day because it is good for them.*
(16) Parents/caregivers need to give appropriate amounts of fluoride to their children depending on their age.
(17) I would put a baby to bed with a bottle that has only milk in it.*
(18) Parents/caregivers need to look in children's mouths for white spots on their teeth at least once a month.
(19) I believe a child's first dental visit should be when they feel pain in their mouth.*
(20) I brush my own teeth at least twice a day.
(21) I believe children need help in tooth brushing until they are seven years old.
(22) I feel a young child's first visit to the dentist should be after they are two years old.*
(23) I avoid going to the dentist whenever I can.*
(24) Parents/caregivers need to take children to the dentist every six months.
(25) My goal is to give young children fewer sweet drinks and foods.

*Indicates reverse order for Likert scale scoring.

Table 5: Posttest consumer satisfaction—5 point Likert scale, 8 items.

(1) The oral health videos appealed to me.
(2) The oral health videos emphasized that all members of the family need to be involved in our children's oral health routines.
(3) I could relate to the people in the videos.
(4) I learned a lot from the videos about caring for my baby's mouth starting from birth.
(5) I would recommend these oral health videos for use in Early Head Start programs.
(6) I would recommend these oral health videos to the following:
(a) family members
(b) friends
(c) neighbors

Table 6: Followup survey items on self-reported behavior—4 items.

(1) Is there anything different about your family's oral health practices and routines now that you have seen the videos?
(a) Nothing is changed
(b) Something is changed—What changed? (List up to 4 changes)
(2) Is there anything different about your family's eating habits now that you have seen the videos?
(a) Nothing is changed
(b) Something is changed—What changed? (List up to 4 changes)
(3) Is there anything different about your family's schedule of going to the dentist now that you have seen the videos?
(a) Nothing is changed
(b) Something is changed—What changed? (List up to 4 changes)
(4) With how many people have you shared the oral health videos?
(a) No one
(b) 1-2 people
(c) 2–4 people
(d) 5–9 people
(e) 10 or more people

that were mentioned only by the BFS group included parents or siblings serving as role models of oral hygiene, increasing water consumption, increases in the parents seeing the dentist, attention to fluoride, and changes in bottle feeding. These group differences are consistent with the content of each video series, that is, the BFS series suggests that children should watch their parents brush and floss and mentions repeatedly the importance of fluoride.

3.2. Discussion. The early childhood period is one of relatively untapped potential for setting positive lifelong oral health practices and preventing later oral health problems. However, access to parents for the purposes of anticipatory guidance is often limited, particularly parents of infants and toddlers. Parents of very young children may be unaware of the need for early oral hygiene and dental examination schedules. If a family lacks dental insurance, there may be few opportunities for a child to receive dental screening unless such services are provided in their childcare, preschool, or elementary school settings.

Parent education via short, realistic videos is a low-cost and potentially engaging avenue for disseminating information. Visual media also have the advantage of being effective regardless of levels of literacy among the target population. Results of this study suggest that educational videos can be effective, at least in the short term. Parents of children age birth to three showed small but statistically significant increases in knowledge, attitudes, and self-reported family oral health practices after seeing segments of the BOH or BFS video series over an eight-week period.

Two questions regarding the delivery of media-based anticipatory guidance are (a) does the presentation style of the video itself make a difference, and (b) how can more families be exposed to video-based education? In terms of presentation style, the results of this study indicate that a family-centered approach (BFS) is more effective than the more traditional didactic approach (BOH). A didactic approach focuses on facts and suggested practices, with narration provided by professional voice-over and/or by interviews with authority figures. While visuals may still be realistic and engaging, the tone tends to be more formal and the audience is positioned as the recipient of the experts' advice. A family-centered approach is still research based, but the tone is more informal, and peers act as messengers who share their personal experiences and strategies for implementing what the experts suggest should be done. In this experimental

Table 7: Means and standard deviations for study measures.

Variable	Time	Group					
		BOH		BFS		Total	
		Mean	SD	Mean	SD	Mean	SD
Knowledge	Pre	15.30	3.38	15.08	3.51	15.19	3.43
	Post[a]	17.09	3.19	16.87	3.65	16.98	3.42
Attitudes/behaviors	Pre	102.91	9.93	104.42	10.08	103.70	9.98
	Post[b]	104.81	9.30	109.00	11.92	107.02	10.91
Satisfaction	Post	34.35	4.54	36.83	4.11	35.66	4.47
Number of changes	Followup	2.09	1.93	3.27	2.26	2.77	2.19

[a]Covariate adjusted posttest means = 17.01 and 16.95 for BOH and BFS, respectively.
[b]Covariate adjusted posttest means = 105.46 and 108.42 for BOH and BFS, respectively.

study, we found that didactic (BOH) and family-focused (BFS) styles resulted in similar gains in factual knowledge. However, the family-focused video (BFS) resulted in higher consumer satisfactions and greater parental attitudinal and self-reported behavioral change. This suggests that the family-focused style is more effective.

Delivery strategies for anticipatory guidance are a second key consideration. While short videos such as the ones used in this study are inexpensive and feasible for use in pediatric dental practices and medical clinics (where parents can watch video segments in the waiting area), the model followed in this study was to capitalize on the use of an existing system of early childhood service providers. In this study, we asked Early Head Start (EHS) home visitors and group leaders to disseminate the video to the families they serve. This model has the potential to reach many more children, especially those who are not already receiving early pediatric dental care. In the U.S., over 150,000 low-income children enroll in EHS on an annual basis [49]. Over 6.4 million infants and toddlers and their mothers receive nutritional subsidies and education through the Women, Infants, and Children (WIC) program, and roughly one million children three through five years of age receive preschool services through Head Start [16, 50]. The majority of states in the U.S. now offer targeted or even universal public preschool [51]. Programs like EHS, WIC, Head Start, and state-funded preschool provide a fruitful avenue for accessing parents of young, at-risk children. In other countries, organizations with widespread reach may include national childcare and preschool programs, maternal and child health nurses, and home visitors.

In addition to the number of children served, relying on early childhood educators and maternal and child health care providers as a conduit of information has other potential benefits. These personnel (especially early childhood educators) often have close and long-term personal relationships with the children and families they serve. There is a level of trust and knowledge of child development that allows for open discussion, individualized advice, and followup. There is also the element of time, where teachers and home visitors are not working within a schedule of short appointments and long waiting times. In early childhood settings, attending the program is already part of the family's regular routine, and there is also the expectation that staff work actively to support parents' positive influence on the child's overall development and wellbeing.

This study has several limitations. First, the BFS and BOH videos differed on characteristics such as overall length and some aspects of informational content as well as presentation style. For this reason, differences cannot be attributed solely to the didactic versus family-focused presentation style. The sample size was modest and was taken from a small geographic area. Most importantly, outcomes were all based on parent report, and no objective measures of changes in family behavior or children's oral health were collected. Finally, the followup period was relatively short. However, the results provide an informative first step in developing new materials and dissemination models for educating parents about early oral health.

4. Conclusions

Family-focused educational videos are a promising method for providing anticipatory guidance to parents of infants, toddlers, and preschoolers regarding early childhood oral health. Furthermore, supporting partnerships among dental care and early childhood education and maternal health systems represents a model that offers wide potential reach with minimal cost.

Ethical Approval

This research project was conducted with the understanding and consents of participants. The University of Hawai'i at Mānoa Committee on Human Subjects reviewed and approved all consent forms, research plans, and research instruments.

Disclosure

Lynn B. Wilson, PhD, served as Principal Investigator and Program Director for these grant activities. Barbara DeBaryshe, PhD, and Malkeet Singh, PhD, served as Research Advisors. Sharon Taba, MED, served as Early Childhood and Medical Home Consultant.

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Research Article

Chapter Oral Health Advocates: A Nationwide Model for Pediatrician Peer Education and Advocacy about Oral Health

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Objective. (1) To describe an innovative program training US pediatricians to be Chapter Oral Health Advocates (COHAs). (2) To provide insight into COHAs' experiences disseminating oral health knowledge to fellow pediatricians. *Patients and Methods*. Interviews with 40 COHAs who responded to an email request, from a total of 64 (62% response). Transcripts were analyzed for common themes about COHA activities, facilitators, and barriers. *Results*. COHAs reported positive experiences at the AAP oral health training program. A subset of academic COHAs focused on legislative activity and another on resident education about oral health. Residents had an easier time adopting oral health activities while practicing pediatricians cited time constraints. COHAs provided insights into policy, barriers, and facilitators for incorporating oral health into practice. *Conclusions*. This report identifies factors influencing pediatricians' adoption of oral health care into practice. COHAs reported successes in training peers on integrating oral health into pediatric practice, identified opportunities and challenges to oral health implementation in primary care, and reported issues about the state of children's oral health in their communities. With ongoing support, the COHA program has a potential to improve access to preventive oral health services in the Medical Home and to increase referrals to a Dental Home.

1. Introduction

Dental caries is the most common chronic disease of childhood and significantly impacts children's well-being [1]. Among US children aged from 2 to 5 years of age, more than 25% have caries, a prevalence which appears to be on the rise [2]. Yet, young children, particularly those who are low-income, encounter substantial barriers accessing dental care for prevention or treatment of dental caries. Meanwhile, primary care physicians (PCP) who care for children in the US, specifically pediatricians and family physicians (and in some settings, nurse practitioners and physician assistants), have unique opportunities to deliver oral health anticipatory guidance and implement dental caries primary prevention at frequent well-child-care visits early in a child's life. Infants, young children, and their parents will likely see their PCP as many as 13 times before they have ever visited a dentist, and more children have ready access to primary medical care than to dental care, particularly if they are publicly insured [3].

Studies indicate that, with training, physicians can effectively deliver preventive oral health services [4, 5]. In an effort to encourage PCPs to further their involvement in oral health as a means to diminish oral health disparities among children, 44 out of 50 US states now reimburse PCPs to provide preventive oral health care services to Medicaid-enrolled children. However, until recently, most pediatricians have lacked formal training in oral health [6, 7] that would

allow them to effectively deliver these services and bill for them.

Acknowledging the impact of dental disease on children's health and the unique role that pediatricians can play in addressing oral health beginning in infancy, the American Academy of Pediatrics (AAP) added oral health promotion to its strategic plan in 2006 and set about developing plans to educate US pediatricians about oral health using a train-the-trainer model. Funding for these efforts was provided by a grant from the American Dental Association Foundation. The result was the Chapter Oral Health Advocate (COHA) program, in which 1-2 representative pediatricians were recruited from each AAP chapter to become peer-to-peer educators—called COHAs—for fellow pediatricians in their state or AAP chapter (larger states have multiple chapters). COHAs were trained at the Chapter Advocacy Training on Oral Health (CATOOH), a 1.5-day course held 3 times (2008, 2009, and 2010) at AAP headquarters in Elk Grove, Illinois, USA. Following the CATOOH, COHAs implemented (or refined) an oral health preventive program within their own practices and then disseminated the model to their fellow pediatricians and other pediatric providers using strategies and techniques they had learned during the CATOOH and, subsequently, within their own practices.

This study describes participants' experiences during the CATOOH and subsequent implementation during activities as COHAs. We were specifically interested in roles that COHAs assumed and the opportunities and challenges that COHAs faced in their efforts to disseminate oral health knowledge and skills to other pediatricians. We intend that findings from this project will (1) allow refinement, expansion, and replication of the COHA program; (2) increase awareness of pediatric oral health issues that arise in primary care practice; (3) describe factors that influence pediatricians' willingness and abilities to adopt oral health into their routine and practice; (4) inform future models of physician peer training and advocacy that could be applied in other countries and to other areas within health care.

2. Methods

2.1. COHA Recruitment. The AAP recruited 20 volunteer pediatricians to attend the first CATOOH in 2008. Fifteen more COHAs were trained in 2009 and 36 in 2010. At the time of the interviews (during March 2011–February 2012), there were 64 COHAs from 50 states and US territories. The COHA program is ongoing and COHAs remain active in their roles and continue to expand their knowledge around oral health and increase their level of advocacy for children. COHAs are not paid and do not receive any funding from the AAP for their activities.

2.2. Training. A steering committee of pediatricians, dentists, and staff from the AAP and the American Dental Association (ADA) planned the CATOOH, which included didactic, interactive small group and hands-on sessions. Most of the faculty were pediatric dentists. Design of the CATOOH was based on principles of adult learning and evidence that a combination of didactic and interactive CME activities is substantially more effective than didactic sessions alone in promoting behavior change [8]. The 2008 CATOOH covered basic oral health science, fluoride, oral health risk assessment, prevention and anticipatory guidance, oral health reimbursement, and hands-on practice in oral examination and fluoride varnish application. In 2009 and 2010, the agenda was supplemented with presentations from previously trained COHAs about lessons learned and best practices and with a session on billing (see Table 1 for 2010 CATOOH agenda). In addition to attending the CATOOH, COHAs completed an online oral health training program, called *Protecting All Children's Teeth*, which was developed by pediatricians and dentists working together with the AAP ("PACT" is available at: http://www2.aap.org/ORALHEALTH/pact/index-cme.cfm). They also received directed readings, supply lists, resources for peer and patient education, and a list of state dental contacts.

At the end of each CATOOH, participants completed a commitment-to-change contract that specified at least 4 training sessions per year would be done by each COHA. Additionally, individual COHA goals included working with state Medicaid programs around PCP oral health reimbursement, educating residents and other trainees about oral health, link with oral health coalitions, and improving medical/dental relationships. After each CATOOH, the AAP offered technical assistance and organized an electronic listserv for COHAs to share ideas, strategies, and support and for research updates and announcements.

2.3. Qualitative Evaluation. The AAP and the University of Washington Institutional Review Boards (IRB) approved this project. A semistructured script was used with questions in the following categories: motivation to become a COHA, previous oral health experience, perceptions about the CATOOH, activities undertaken as a COHA, facilitators and barriers encountered by COHAs, and recommendations for the future.

All 64 COHAs were contacted by email and invited to participate in this study. After the initial email, 2 other emails were sent to nonrespondents. The first 8 interviews were conducted in person during a COHA Advisory Council meeting and the remainder by telephone. Consent to audiotape each interview was obtained. Interview duration ranged from 15 to 70 minutes. Each audiotape was reviewed, the content wase categorized into themes, and representative quotes was selected. To reduce bias, the interviewer (CWL) was not involved with planning or implementation of the CATOOH or the COHA program. Findings, including themes and representative quotes, were presented, and feedback about accuracy and completeness was elicited from the CATOOH Steering Committee and COHA Advisory Council.

3. Results

3.1. Subjects. Forty COHAs responded and were scheduled for an interview (62% responses after 3 emails). There were 9 men and 31 women. Participants had graduated from medical

Table 1: 2010 CATOOH agenda (November 5-6, 2010) and session type (didactic, interactive, or practical).

Introduction, target audience and learning objectives, and pretest
General sessions
(1) The tooth and nothing but the tooth: why are we here? (d)
(2) The importance of early oral health (d)
(3) Introduction to oral health risk assessment and fluoride varnish application (i)
(4) Hands-on workshop—oral screening examination, risk assessment, and fluoride varnish application (p)
(5) Fluoride modalities and their appropriate use (i)
(6) Oral health prevention and anticipatory guidance (i)
(7) Building collaborative relationships to ensure patients' access to a Dental Home (i)
(8) Strategies for reaching out to colleagues and changing behavior (i)
(9) Making the commitment and signing the "commitment-to-change" contract (i)
(10) Overcoming barriers: COHAs in action. (i)
(11) You can do it! Where do we go from here? (i)
Concurrent session
(1) Billing and payment for oral health services (i)
(2) Quality improvement, *Bright Futures*, and recertification (i)
(3) Triage and Dental Home options (i)
Posttest, evaluation

d: didactic format, i: interactive, and p: practical (hands-on).

school an average of 17 years prior to the interview (range 4 to 44). Approximately one-quarter of subjects were in private practice, one-quarter practiced at a community health center or Federally Qualified Health Center, and one-half were academic pediatricians. Most COHAs practiced in suburban or urban locales while approximately 10% worked in rural settings.

3.2. Motivations to Become a COHA. Approximately two-thirds of interviewees had previous oral health involvement prior to becoming a COHA. These individuals volunteered to be COHAs because of their interest in oral health, which usually was motivated by their patients' oral health problems and difficulties accessing dental care. The other third of COHAs had no previous oral health experience, but most were involved with their local AAP chapter and/or other advocacy activities such as "Reach out and Read [9]." Some of those interviewed confessed an initial lack of interest in oral health prior to attending the CATOOH, as this participant stated, "I really wasn't that interested (in oral health) but when they asked for volunteers to be a COHA, no one volunteered so I figured, 'Ok, I'll go. It's a trip to Chicago. . . .'" However, the COHA training proved influential and this same individual went on to say, "I came out of the 2008 CATOOH and was really excited about (oral health) and I was on fire about how we could do this with pediatricians."

3.3. COHA Roles and Activities. Towards the goal of optimizing children's oral health, COHAs advocated pediatricians' role to be that of providing preventive oral health anticipatory guidance, screening for caries risk and dental disease, applying fluoride varnish to children at high risk for dental caries, and facilitating access to a Dental Home.

3.3.1. Peer-to-Peer and Other Outreach Roles and Activities. Almost all of the interviewees met their goal of conducting at least 4 oral health training sessions per year and most did more. In general, COHAs felt the on-site training that they provided to other pediatricians and their staff was well received. As fellow pediatricians, COHAs were uniquely able to relate to those that they were training but COHAs also acknowledged that each pediatric practice is different, and thus, an individualized approach to training was necessary. For example, in some practices, the pediatrician applies the fluoride varnish whereas, in other practices, fluoride varnish application is delegated to another health care provider, such as the medical assistant. In addition to academic detailing and on-site training, COHAs used other ways to reach out to pediatricians in their state/chapter to provide education, usually by email or presenting grand rounds at their hospital or area medical schools. Some COHAs were able to make a greater impact by focusing time and energy at a state government level, for example, meeting with state Medicaid directors to advocate for PCPs' reimbursement for oral health services and for expanded access to dental care for poor and low-income children.

3.3.2. Unique Academic COHA Roles and Activities. Academic COHAs, meaning those who work at universities and their affiliated medical centers and who typically have both clinical and educator roles, explained that their positions allowed them more time to spend on oral health activities than clinicians in private practice since it was expected that they would be involved in community projects, outreach, and trainee education. Most academic COHAs provide pediatric medical care for a disproportionate share of children with special health care needs, publicly insured and uninsured children. They also had regular contact with medical students

and residents. There were common lessons that academic COHAs sought to impart to trainees: (1) oral health is part of well-child-care; (2) oral health prevention is easy to do; (3) it is important for pediatricians to partner with dentists in their community.

Additionally, academic COHAs gave resident noon lectures about oral health, developed a continuity clinic oral health curriculum, and incorporated an oral health module into the residents' community and/or advocacy rotation. These COHAs reported that residents had little difficulty incorporating oral health into their visits with patients. Interviewees attributed residents' ease with oral health to a few factors including that residents have additional time to spend with patients and that residents are still in the process of developing their routine. Referring to oral health, one COHA said, "Residents just do it if you tell them to."

3.4. Facilitators to Successful COHA Activities. Although there was variation in the infrastructure in place to support COHAs, most COHAs listed 5 factors that enabled their success as COHAs: (1) the CATOOH; (2) support from the AAP, fellow COHAs, and others; (3) personal experience implementing oral health into their practice; (4) relationships with dentists; (5) reimbursement for oral health services.

3.4.1. The CATOOH. Interviewees made overwhelmingly positive comments about their COHA training. In addition to knowledge gained at the CATOOH, COHAs learned from other COHAs' successes and failures, were given valuable resources like flip charts to use when educating fellow pediatricians, and developed strategies for developing collaborative relationships with dentists, expanding pediatrician involvement in oral health and optimizing billing for these services. Furthermore, the lectures and discussions with dentists at the CATOOH helped COHAs appreciate the expertise of their dental colleagues and made dentists in general seem "more approachable." The most valued aspects of the CATOOH was the "hands-on" aspect of the training, meaning that COHAs were able to examine and apply fluoride varnish to actual children. COHAs found their experience at the CATOOH to be empowering as this COHA said, "All of a sudden it hit me. This is a doable, cost-effective thing."

3.4.2. Support from the AAP, Fellow COHAs, and Others. COHAs, whether they were new to oral health or previously involved, came away from the CATOOH highly motivated to promote oral health involvement among fellow pediatricians and to improve the oral health of children. It was important, COHAs expressed, to maintain this momentum upon return to the COHA's home states and to have a forum for "ongoing collaboration and exchange of ideas." To that end, after each CATOOH, the AAP national office maintained regular contact with the COHAs. COHAs also worked with their local AAP chapter and stayed in touch with fellow COHAs via the listserv. Through these interactions, COHAs could avail themselves of expert assistance when problems or questions arose and were able to share resources and ideas. Most COHAs commented positively on the support they received from their local AAP chapter and its executive director who often helped with outreach and legislative contacts, as one COHA explained, "(The executive director) did a lot so that I could focus on outreach rather than organizing."

Some COHAs worked in communities and states where there was a preexisting oral health coalition with whom they could work and rely on for additional support. In settings with limited resources, a few COHAs applied for small grants, usually from foundations, to offset the costs of some of their oral health activities. One COHA used Americorp volunteers, who helped in developing and maintaining detailed online and printed lists of local dentists' contact information, accepted insurance plans, and wait times for new appointments.

3.4.3. Personal Experience Implementing Oral Health Services. After returning from the CATOOH, COHAs focused their initial efforts on incorporating oral health into their own practice and, in the process, learned a variety of lessons, as this comment reflects:

> Once you have done about 20 to 30, it becomes part of your routine. You are not clumsy anymore. . . (You need to) do it whether you are running behind or not. Otherwise you are only going to do it on days when it easy.

COHAs believed that their "insider" perspective provided them with ease and credibility in talking to fellow pediatricians and helped them be more positive about the process of integrating oral health into primary care as these quotes reveal:

> On paper it looks complicated. You need a pediatrician who has done it to make it doable.

> At first it takes you 3-4 minutes, but if you incorporate oral health into the history and the oral screening exam into your physical and then put the fluoride varnish on while you're examining the child's mouth, then you're done and it takes 60 seconds once you are used to it.

COHAs without prior oral health experience seemed to have a better sense about how the average pediatrician might be resistant to undergoing oral health training and adopting oral health into his/her practice. For example, one COHA remarked "If you don't know anything about (oral health), then you don't understand the magnitude of the problem and you don't know how easy it is, so you just think you can't add one more thing to your plate." When COHAs had overcome such barriers personally, they felt they were more effective in encouraging other pediatricians to become involved.

3.4.4. Relationships with Dentists. Some COHAs practiced in areas where dentists were already involved in training physicians about oral health, giving the opportunity for COHAs to participate and provide the pediatrician perspective.

For example, one COHA who partnered with a dentist for such presentations noted:

> The dentist knows the science but he does not really know how a pediatric office works and what are going to be the barriers for pediatricians. When our state Medicaid program tried to roll this out without pediatrician involvement, none of the pediatricians was really sure they wanted to do it because, (after the dentist's presentation), the pediatricians did not know what would be involved, couldn't see how easy it was (because there was no hands-on demonstration), and that billing would be easy for the (pediatrician's) billing staff.

Additionally, most COHAs met with local dentists to discuss their role as a COHA and, in doing so, were also able to explicitly address fears that PCPs were "going to be practicing dentistry." COHAs found that dentists were more supportive than expected once they found out that the pediatricians were focused on caries primary prevention in infants and young children (whom general dentists are often uncomfortable seeing, COHAs said). Meeting with dentists as a COHA allowed the pediatrician-dentist relationship to expand into a more collaborative one in which COHAs felt greater ease referring patients to and consulting dentists about specific cases. Positive experiences with dentists gave COHAs greater confidence in educating fellow pediatricians about the importance of children having a Dental Home. Even in settings in which access to regular dental care was limited, almost all of the COHAs had developed and shared strategies with fellow pediatricians for obtaining urgent dental care for their patients with acute dental problems. To that end, COHAs each knew a few dentists whom they could call upon for dental emergencies or more urgent treatment needs, as this COHA described:

> When I see rotten teeth, I call the dentist and make the appointment for the family. (When I ask them personally), they will never turn me down.

3.4.5. PCP Oral Health Services Reimbursement. In most states, COHAs could rely on the fact that "the hook is that it is a procedure that pediatricians can do and get paid for." The reimbursement was particularly attractive in states such as Washington and North Carolina, where Medicaid payment to PCPs for delivering oral health services ranges from $50 to $70 per encounter. However, the average payment is $15–$25 and most state Medicaid programs only reimburse for fluoride varnish application. Oral screening, risk assessment, and family education are expected but in most states not paid separately.

3.5. Barriers to COHA Activities. COHAs encountered 3 levels of barriers related to oral health dissemination to fellow pediatricians: (1) personal professional barriers that interfered with achievement of goals they had set for themselves; (2) policy and colleague-level barriers, in the form of pediatrician reluctance to undergo training about oral health; (3) community-/patient-level barriers, which affected pediatricians' abilities to optimally address their patients' oral health needs.

3.5.1. Personal Professional Barriers. The most often cited personal barrier faced by interviewees was lack of time to accomplish the activities they envisioned for themselves as COHAs. The economic climate may have worsened this situation for some COHAs who had acquired more clinical duties or lost administrative time as their respective institutions dealt with budget shortfalls. The majority of COHAs had little or no funding and few resources. When asked what would help them do more, COHAs typically replied, in one form or another, more time, more money, and more help.

3.5.2. Policy and Colleague-Level Barriers. Fellow pediatricians would sometimes decline COHAs offer to conduct an office-based training, citing limited time and being overwhelmed with other demands. As one COHA put it, "They worry about the 1500 other things we have to do for *Bright Futures* (guidelines for health supervision)." There were other concerns among pediatricians, including some of the COHAs themselves, surrounding reimbursement for oral health activities and fluoride varnish application being only available for Medicaid-insured children. Although low-income children are considered at higher risk for dental disease, some COHAs stated that they wanted delivery of oral health services to be based on individual need, regardless of a child's insurance and were "uncomfortable doing it for one population and not another." Logistically, it was often challenging to identify and direct services only to Medicaid-insured children in offices that served a mix of privately and publicly insured children (which is the norm for pediatricians in private practice in the US). There were also unique, state-specific barriers that made incorporating oral health into pediatricians' practices more challenging. For example, some states required that PCPs undergo oral health training in person with a dentist in order to qualify for Medicaid reimbursement. This requirement imposed burdens of time away from practice, need to travel, and lack of physician perspective.

3.5.3. Community-/Patient-Levels Barriers. COHAs and their fellow pediatricians encountered barriers to educating families about oral health. In some communities, there was limited oral health literacy, which hindered families seeking regular professional dental care and practicing home oral hygiene. However, the main barrier to optimizing their patients' oral health was limited access to quality professional dental care, as this COHA described:

> Part of the (COHA) program is to encourage (pediatrician) referral to dentists and the standard question (from the pediatrician) is, "To whom do I refer?" And you do not always have an answer.

Barriers to dental care access for Medicaid-insured children were reported commonly. Most COHAs described that, within their communities, privately insured children typically went to pediatric dentists in private practice, but such care

was unavailable to lower-income children because these dentists did not accept Medicaid. More often than not, low-income children received dental care at community health centers or increasingly, at for-profit dental clinic chains that were geared exclusively towards Medicaid-insured children. COHAs expressed concerns, which were based upon comments made by their patients' parents, about what seemed to be lower quality of dental care delivered at some of these chain clinics.

4. Discussion

This is the first paper to describe a national program of peer-to-peer physician education and advocacy about oral health. The previous literature reported that pediatricians perceive preventive oral health as within their purview [7] and that PCPs are capable of delivering preventive oral health services [10], described state's efforts at oral health integration into primary care [4, 11, 12], and demonstrated that PCP efforts result in improved oral health among their patients [10]. However, past efforts to train pediatricians about oral health have been limited to single states and have not always included pediatricians in the planning and delivery of educational programs. In this project, COHAs from every chapter were recruited for a national training program with the expectation that they would return to their home state and educate/train fellow pediatricians to deliver preventive oral health services, thus allowing for more widespread, standardized, and rapid dissemination. Furthermore, pediatricians were involved in developing and revising the CATOOH, and COHAs learned from one another's experiences. Utilizing pediatricians to train other pediatricians was considered essential because COHAs uniquely understood how pediatric practices function and how pediatricians could incorporate oral health into their routines.

COHAs provided at least 4, and sometimes substantially more, oral health training sessions per year to fellow pediatricians, as well as at grand rounds and local conferences. COHAs' original goals expanded and evolved once they returned to their home state and better understood the needs of their fellow pediatricians and children within their state. For some COHAs, this meant focusing more on their efforts on state-level advocacy or on promoting collaborative relationships with dentists. It was harder than anticipated to get practicing pediatricians to make time for training. Because of this, COHAs sometimes had to rely on strategies other than traditional academic detailing to reach fellow pediatricians (e.g., emailing pediatricians about web-based oral health training opportunities). Yet, COHAs then lost the advantage of a personal visit during which they could facilitate hands-on training. Resources that could allow COHAs to expand their efforts might include funding for administrative support and outreach efforts and assistance in developing alternative training strategies to accommodate PCPs' limited time.

These COHAs formed the eyes and ears for the status of children's oral health within their communities. They often encountered disparities in access to quality dental care that deserved further attention. Collectively, COHAs could bring attention to these issues, but they need to know how to quantify and direct their concerns. Furthermore, a number of COHAs had access to preexisting data, such as Medicaid claims and other reports, which, with additional technical assistance, would allow for tracking of oral health outcomes.

Pediatric residents' adoption of oral health was viewed as successful by the COHAs who supervised them. Ideally, having an established oral health routine when one finishes residency means that such routines will be sustained. Family Medicine is farther along in this process than any other medical specialty; their residents complete formal, standardized education in oral health as a required part of their training [13].

Finally, COHAs made important inroads in developing collaborative relationships with dentists in their communities, a process that was encouraged by positive interactions with dentists during the CATOOH. Such interdisciplinary relationships enhance professional learning, improve patient care, and ideally, promote improved access to dental care for children. When it was difficult for pediatricians' patients to access dental care, it was more challenging for pediatricians to fully implement preventive oral health into their practices. This was because pediatricians lacked any place to refer patients for ongoing dental care or when oral health problems were identified on screening examination. Partnering with programs such as Washington's ABCD (Access to Baby and Child Dentistry) [14], which trains dentists to care for young children and provides enhanced Medicaid reimbursement to do so, would satisfy the critical link of a professional dental care referral source that PCPs need to be truly effective in promoting oral health for all children.

It is important to acknowledge the limitations of this work. While employing qualitative methods allowed themes to emerge that otherwise might not have been considered in a traditional survey, the time-consuming nature of the interview may have discouraged some COHAs from responding. A response rate of 62% is reasonable for surveys of physicians but those who did not respond may have had different experiences or perspectives that are not reflected in this paper.

5. Conclusions

This paper describes a novel nationwide effort to train pediatricians to be oral health peer educators and advocates. It also provides insight into the varying roles COHAs played and the opportunities and challenges that COHAs and their fellow pediatricians encountered integrating oral health into well-child-care visits. Some barriers identified in these interviews are modifiable, such as by streamlining training requirements for PCPs to bill Medicaid for oral health services, whereas other barriers are more difficult to overcome, for example, time constraints among PCPs. Nevertheless, COHAs and their fellow pediatricians found that, once initiated, providing oral health services takes less time than anticipated and delivers a valuable service to their patients. Difficulty finding a Dental Home for patients who lack private dental insurance or cash to pay out-of-pocket is a known barrier to promoting

preventive oral health within pediatric practice [11]. However, results from this study point to the potential for national- and local-level collaboration between dentists and physicians as a means to expand interdisciplinary education and collegiality, as well as to expand access to professional dental care for all children.

Though COHAs largely felt their efforts in reaching out to and training their peers had been successful, the increasing time pressure in pediatric practice creates a need for the most efficient training strategies; these could include use of social media, web-based resources, oral health prompts in the electronic medical record, and incentivizing training by pairing maintenance of certification with oral health quality improvement efforts. The relative ease with which pediatric residents adapted to implementing oral health services highlights the need for focused efforts in medical school and residency to ensure that new physicians receive sufficient didactic and clinical training in oral health.

This paper, focused on training and implementation, is the first in a series looking at the impact of the COHA program. Results provide insight into factors that bear consideration when asking physicians to incorporate preventive oral health care into medical practice. These include the importance of (1) pediatrician involvement in designing and delivering oral health educational programs; (2) beginning oral health education early in medical training; (3) individualizing the approach for each physician practice; (4) expanding oral health surveillance and advocacy capacities; (5) incorporating dental partnerships into every level of implementation. Applying the lessons learned in this study along with ongoing technical and financial support, the COHA program holds promise to further improve access to preventive oral health services in pediatric medical practices, diminish oral health disparities, inform oral health policy, coordinate state-level oral health surveillance and quality improvement initiatives, and enhance referrals and collaboration with dental professionals.

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