

# SBIRT-Based Interventions to Improve Pediatric Oral Health Behaviors and Outcomes: Considerations for Future Behavioral SBIRT Interventions in Dentistry

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**Abstract** Dental caries is the most common chronic disease in children and is caused by poor oral health behaviors. These behaviors include high-sugar diet, inadequate exposure to topical fluorides, and irregular use of professional dental care services. A number of behavioral intervention approaches have been used to modify health behaviors. One example is based on the Screening, Brief Intervention, and Referral to Treatment (SBIRT) model, which has been widely used to reduce substance abuse in both adults and children. SBIRT is a promising behavior change approach that could similarly be used to address problematic oral health behaviors. In this paper, we will review oral health studies that have adopted SBIRT components, assess if these interventions improved oral health behaviors and outcomes, and outline considerations for researchers interested in developing and testing future oral health-related interventions in dentistry using a SBIRT approach.

**Keywords** Screening, Brief Intervention, and Referral to Treatment (SBIRT) · Behavior change · Dental caries · Randomized controlled trials · Motivational interviewing (MI) · Behavioral determinants of oral health

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## Introduction

Tooth decay (dental caries) is the most common chronic disease in children [1]. Thirty-seven percent of children ages 2 to 8 years have at least one decayed primary tooth, and permanent tooth decay rates range from 21 % for children ages 6 to 11 years to 58 % for youth ages 12 to 19 years [2]. Low-income, minority, and special needs children are at greater risk for tooth decay and poor oral health outcomes [3, 4]. Suboptimal behaviors like high fermentable carbohydrate intake and insufficient fluoride exposure are principal contributors to tooth decay, and combined with inadequate access to professional dental care services, lead to oral health inequalities that disproportionately affect vulnerable children. From a disease prevention and health equity perspective, these factors underscore the importance of interventions aimed at improving oral health behaviors [5, 6].

Screening, Brief Intervention, and Referral to Treatment (SBIRT) is an intervention approach originally developed by behavioral scientists to address substance abuse problems [7]. SBIRT integrates prevention and treatment, and involves three components. The first is risk assessment through universal screening. Common sites for SBIRT screenings include schools, community centers, daycares, emergency rooms, trauma centers, and other places where at-risk individuals cluster. The goal is to identify high-risk individuals with a screening tool or assessment. The second step is delivery of a brief intervention, which occurs immediately after screening, and provides higher-risk individuals with additional resources to help promote behavior change. The intervention can be delivered by a health professional or a lay person (e.g., dentist, physician, nurse, hygienist, assistant, community health worker). To optimize for effectiveness, interventions should be evidence-based and motivated by health behavior theories with demonstrated success in changing behaviors.

The third step is referral of individuals who are non-responsive to the brief intervention to a health professional who provides long-term, resource-intensive treatment.

There are inconsistencies between evidence-based guidelines, on the one hand, and professional recommendations and health policies on the other, regarding SBIRT. The U.S. Preventive Services Task Force recommends SBIRT as way to address alcohol misuse in adults [8]. There is inconclusive evidence on the effectiveness of SBIRT-based drug and alcohol interventions for adolescents [9, 10], mainly because of the limited number of pediatric randomized clinical trials. However, a number of pediatric-focused studies have reported benefits associated with SBIRT, including reductions in alcohol consumption or alcohol-related consequences [11–13]. Thus, the American Academy of Pediatrics continues to recommend SBIRT to address drug and alcohol use in children [14]. In addition, the Patient Protection and Affordable Care Act of 2010 has recognized the role of SBIRT approaches in disease prevention, which gives states the opportunity to make SBIRT reimbursable by Medicaid and private plans offered through health insurance exchanges [15].

SBIRT-based interventions could help to address problematic oral health behaviors, decrease dental disease rates, improve oral health outcomes, and resolve oral health inequalities. The goals of this literature review are twofold. First, we searched the literature to identify dental SBIRT-based intervention studies aimed at improving diet, fluoride exposure, or dental care use—the main oral health behaviors associated with dental caries—or reducing caries rates. Because there were few studies incorporating all three SBIRT components, we organized studies based on the SBIRT components included. Second, we assessed the extent to which the interventions improved oral health behaviors and outcomes. Based on an evaluation of these studies, we will outline considerations for researchers interested in developing and testing future SBIRT interventions.

### Screening + Brief Intervention + Referral to Treatment (SBIRT)

Researchers in Louisville, Kentucky implemented a SBIRT-based care coordinator intervention to improve dental utilization rates [16•]. From a sampling frame of 10,000 Medicaid-enrolled children ages 4–15 years who had not utilized dental care in the two years prior to enrollment in the study, 2000 children were randomly selected, of which 226 children agreed to participate and were subsequently randomized to one of two groups. The intervention consisted of a 45–60-min in-person home visit by a care coordinator. The goal of the visit was to help parents identify and overcome personal and structural barriers to dental care. The care coordinator provided pamphlets, oral care products, oral hygiene

instructions to children, transportation assistance as needed, and follow-up phone calls for dental appointments. If parents refused an in-person home visit, the intervention was delivered by telephone. Families in the control group were not contacted until after the study ended. The outcome was measured using Medicaid claims files. After one year, researchers found an increase in dental care use for children in the intervention group compared to those in the control group (43 and 26 %, respectively;  $p=0.047$ ). These study findings suggest that SBIRT care coordination programs can increase dental utilization rates for children in Medicaid.

### Screening + Brief Intervention

A 1995 study from Sweden evaluated caries outcomes associated with a public health dental clinic-based trial involving screening and brief intervention [17]. Of the 4355 12-year-old children who were eligible, 3373 agreed to participate and were screened. Based on the screenings, 1134 children with one or more decayed, missing, or filled permanent tooth surface (DMFS) or children with special health care needs (e.g., chronic disease, mental or physical disability) were classified as high-risk and randomized to one of four groups. The groups were as follows: (1) an educational letter on toothbrushing technique that was sent home; (2) information about fluoride and a prescription for fluoride lozenges; (3) semiannual fluoride varnish applications, three times during the course of one week (i.e., six times a year); and (4) personalized dental hygiene counseling, fluoride varnish applications, and cleanings. All children received sealants on at-risk second molars. Baseline data were collected and outcomes were assessed annually through age 17 years. There were no significant pre/post-intervention differences in caries increment across the four groups. One study limitation is the lack of information on the standard of care within the public health dental clinics in which the intervention was tested. The study design could have been improved by including a standard care control group with intervention components layered onto subsequent comparison groups. In addition, the specific components of the dental hygiene counseling were not specified and it is unclear if the counseling was motivated by a particular theory of health behavior change.

### Brief Intervention Only

A 2006 two-arm intervention focused on 240 South Asian immigrant mothers of children ages 6–18 months in British Columbia, Canada [18•]. Mothers in both the intervention and control groups were given an educational pamphlet and viewed an 11-min video in English or Punjabi encouraging

them to have fluoride varnish applied to the teeth of their child. Furthermore, mothers in the intervention group received 45-min of counseling based on motivational interviewing (MI) techniques, which sought to establish rapport with the parent, explain the need for behavior change, discuss behavior change options, and develop a strategy to reinforce change. Mothers in the intervention group also received follow-up telephone calls and postcards to reinforce and re-establish behavior change. Children in the intervention group children received a significantly greater number of fluoride varnish applications ( $4.1 \pm 1.0$  versus  $0.3 \pm 0.6$ ) and had lower proportions of decayed and filled tooth surfaces than children in the control group after 1 year (15.2 versus 26.0 %) and 2 years (35.2 versus 52.0 %). These findings suggest that motivational interviewing-based counseling can improve use of preventive dental care and reduce dental disease rates compared to passive health education.

A similar study conducted in Detroit, Michigan focused on 1021 low-income African American caregivers of children from birth to age 5 years [19]. The study compared oral health behaviors (e.g., toothbrushing, sugar intake, dental visits) and caries rates for children randomized to one of two groups as follows: (1) motivational interviewing (MI) counseling plus viewing a 15-min educational DVD based on Social Cognitive Theory that was developed to show parents how to keep their children from developing dental caries; and (2) viewing an educational DVD only. At 6 months and 2 years post-intervention, there were no statistically significant differences in oral health behaviors or caries rates between children in the intervention and control groups. The major limitation is that the authors provided a definition of MI based on previous studies, but the specific components of the MI counseling operationalized in the study were not clear, making it difficult to assess the quality of the behavioral component of the intervention.

### Brief Intervention + Referral to Treatment

A trial conducted in Quebec, Canada focused on 272 indigenous mothers of Cree descent and compared dental caries outcomes for children 30 months post-intervention [20]. Mothers in the intervention communities received an educational pamphlet, up to seven counseling sessions based on motivational interviewing and a “privilege card” to help facilitate dental treatment. Mothers in the control communities received an educational pamphlet. There were no significant differences in caries rates between children in the intervention and control groups.

In another study that evaluated motivational interviewing (MI) and health education (HE), 400 low-income pregnant women in rural Oregon were randomized to one of four groups [21]. The four groups were as follows: (1) prenatal

MI and postnatal MI; (2) prenatal MI and postnatal HE; (3) prenatal HE and postnatal MI; and (4) prenatal HE and postnatal HE. MI consisted of discussions with a counselor about navigating barriers to care, assembling a plan to overcome these barriers, a postpartum video, and follow-up phone calls. HE consisted of the same information provided in MI but without any discussion of the materials. Mothers and children in all four groups were referred to a dentist.

The outcome was dental utilization in both the mother and child, which was measured up to 2 months postpartum for mothers and up to age 18 months for children. There were no significant differences in dental use across the four groups for both mothers and children. One limitation is that baseline dental utilization rates for all mothers was over 70 %, which is high for Medicaid-enrolled adults. Pre-intervention screening would have allowed the program to focus on the highest-risk mothers, which may have allowed researchers to detect a difference in outcomes among the intervention groups.

A third study examined the effects of a home visitor and care coordination program in rural Virginia for Medicaid-enrolled children under age 6 in which preventive care was provided within the home and children were referred to a dentist [22]. Preventive care included fluoride varnish applications and caregiver education on proper oral hygiene and nutrition. Compared to children who did not participate in the program, those in the program were nearly three times as likely to subsequently have a dental visit (OR = 2.97; 95 % CI = 1.87, 4.74). Study limitations included a non-randomized design and no assessment of clinical outcomes.

In an oral health study conducted in Massachusetts, researchers implemented a school-based preventive care intervention and referral to treatment program for 1196 first, second, and third graders in six low-income Boston schools [23]. All children received a baseline dental examination, at which time surface-level caries was recorded. Depending on whether children were present at school, preventive care was provided by a dental hygienist and consisted of a cleaning, oral hygiene instructions, toothbrushes and toothpaste to take home, sealants, and fluoride varnish. Children requiring treatment were referred to local dentists or community health centers. The outcome was caries incidence, from baseline to 6 months, and comparisons were made for children who received preventive care at the school versus those who did not. There were significant differences across all caries incidence outcomes measures. For example, children who did not receive school-based preventive care were twice as likely to develop new caries in primary teeth as children who received preventive care at school (95 % confidence interval = 1.31, 3.06;  $p = 0.001$ ). There were a number of study limitations, including the absence of a control group and non-randomization of children. Most importantly, the regression model did not adjust for confounders that could be alternative explanations for differences in caries incidence rates (e.g., previous dental

utilization, SES, race/ethnicity, family income). For instance, children with a history of dental use may have been more likely to be present at school on the days in which preventive care was provided, thereby resulting in lower caries risk for children in the preventive care group.

## Discussion

SBIRT-based interventions have been used to address problem health behaviors like drug and alcohol abuse, but relatively fewer interventions in dentistry have used an SBIRT framework to address oral health behaviors related to dental caries. The one SBIRT intervention we identified successfully improved dental utilization rates for low-income children [16•]. The remaining six studies incorporated SBIRT components and yielded mixed results. Four of the interventions were randomized clinical trials to evaluate motivational interviewing (MI). Three of the MI interventions resulted in no improvements in dental use or caries rates [19–21] and one resulted in improved fluoride varnish use and decreased caries rates [18•]. The two non-randomized studies improved dental utilization and caries rates [22, 23]. Based on a critical review of each SBIRT intervention we evaluated, there are four issues that warrant further consideration for dental researchers interested in developing and implementing SBIRT interventions to improve oral health behaviors.

First, most interventions lacked a screening component, which can make interventions less efficient by devoting program resources to children and families who may not need them. All the interventions focused on high-risk populations within schools or communities. This is known in public health as a targeted intervention approach [24]. However, even with targeting, there remains the possibility for heterogeneity in oral health behaviors and dental caries risk within high-risk populations. In fact, lack of screening might explain why there were no statistically significant differences between children in the intervention versus control groups in four of the studies. Screening could have strengthened effect sizes in the remaining three studies and would help to ensure that only individuals in need of more intensive treatment subsequently receive intervention services. The ultimate goal is tailored interventions, in which individuals receive different versions of an intervention based on the factors that are most likely to result in behavior change. Recent findings from a systematic review of vaccine hesitancy interventions highlighted the need for tailored interventions and similar calls have been made to address a nascent problem in pediatric dentistry with topical fluoride hesitancy [25•, 26]. Future SBIRT interventions in dentistry should include specific efforts to screen individuals to confirm need and give consideration to the possibility of tailoring the intervention to meet the specific needs of individuals.

Second, most of the studies lacked specific reference to a health behavior theory or model to explain why change would be expected or how it would occur. Health behavior theory is critical in the design and evaluation of behavior change interventions [27•]. Theory can help to ensure that critical intervention components are not missing and that interventions operate through the expected mechanisms. Theory also helps to embed dental studies into the broader field of health intervention research. Even with a detailed description of the theory, an intervention may not have an effect on the outcome of interest. In the studies that were reviewed, three of the four interventions that tested motivational interviewing failed to generate significant differences. When an intervention does not result in the behavior change or disease prevention as expected, researchers can revisit the original health behavior theory that motivated the intervention and develop future iterations that address a shortcoming or missed behavioral element. Future researchers should be clear about the health behavior theory or model that is motivating the behavior change component of the SBIRT interventions.

Third, studies were missing detailed descriptions of the intervention, including fidelity monitoring procedures. Most of the interventions would be difficult to reproduce based on the information provided within the manuscript. For individuals interested in reproducing an intervention, these details are critical to ensure that essential intervention components are not omitted during implementation in a new setting. Furthermore, only two studies described steps taken to assess fidelity, which is a key feature of intervention studies that needs to be developed at the time the intervention is designed [28]. Both studies used checklists as a fidelity monitoring tool [18•, 21]. The remaining studies did not mention fidelity. Previous work on fidelity checklists suggests variations in checklist quality and inter-rater agreement when there are multiple fidelity assessors [29]. Researchers testing SBIRT interventions should publish or make detailed intervention protocols publicly available and include a priori fidelity monitoring protocols.

Fourth, there is great potential for SBIRT interventions to be implemented within clinical practice settings. Only one of the interventions was implemented in a public health dental clinic [17]. The remaining interventions were community-based or implemented within homes or schools. For instance, SBIRT-based interventions seeking to improve age 1 dental visits for high-risk children could be implemented within medical clinics during well baby visits [30]. Similar interventions focusing on toothbrushing and diet behavior change could be implemented within university- or community-based dental clinics, with individuals referred to behavior specialists or dietitians for additional treatment and monitoring. However, there are noted challenges in implementing SBIRT interventions within clinical settings that would need to be addressed [31], including disruptions to clinical workflow,

limited support from clinic staff, and lack of reimbursement by insurance companies for behavior change services to cover the costs of additional clinic staff and intervention services. In light of changes to the health care landscape that will accompany the Affordable Care Act, future research in dentistry should identify new models in which SBIRT-based programs have been successfully implemented within clinical settings and develop strategies to help overcome barriers to implementation.

## Conclusions

There are very few dental intervention studies that incorporated all three components of the Screening, Brief Intervention, and Referral to Treatment (SBIRT) model. Five of the seven studies focused on dental caries as the main outcome measure, and only two studies sought to change behaviors related to use of professional dental care services. There were no interventions focusing on diet. Study findings were mixed. Future SBIRT interventions should include a screening component to ensure that only children in need are included in the full intervention, be explicitly based on a health behavior theory or model, incorporate fidelity monitoring plans during the intervention development phase, and consider the barriers to implementing the intervention in clinical practice. These steps will help the field assess the extent to which SBIRT-based approaches are a worthwhile strategy to improve oral health behaviors, reduce tooth decay rates, improve outcomes, and reduce oral health inequalities that disproportionately affect low-income and other vulnerable children.

## Compliance with Ethical Standards

**Conflict of Interest** Josué Cuevas and Donald L. Chi declare that they have no conflict of interest.

**Human and Animal Rights and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors.

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