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Preventing Childhood Caries: A Review of Recent Behavioral Research

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Abstract

The etiology of dental caries reflects a complex interplay of biochemical, microbial, genetic, social and physical environmental, and health-influencing behavioral factors. This review updates the literature on the efficacy of behavioral approaches to caries prevention for children up to 18 y of age. Included were studies of behavioral interventions implemented at individual, family, and community levels that assessed results in terms of reductions in caries increments. Only those reports published since 2011 were considered. Outcomes were variable, although motivational interviewing, which involves individuals in decisions about oral health within the context of their respective life circumstances, proved effective in 3 of 4 reported studies, and more definitive trials are underway. Recommendations for future research include examinations of the cost-effectiveness of interventions, as well as work focused on understanding the mechanisms underlying oral health behavior change and variables that may mediate or moderate responses to interventions.

Keywords: behavioral intervention, school based interventions, motivational interviewing, community based interventions, oral health promotion, behavior change

Introduction

Dental caries is one of the most challenging diseases faced by children globally (Bagramian et al. 2009; Do 2012), and efforts continue to identify prevention strategies to limit the burden of this disease at both individual and population levels. Interest in behavioral interventions stems from the understanding that most preventive strategies require action on the part of the individuals who would benefit—action that may not occur naturally and therefore must be actively motivated in some way. This review provides an update on recent work examining the efficacy of behavioral interventions for reducing caries in children.

The etiology of childhood dental caries involves a complex interplay of microbial, genetic, biochemical, social and physical environmental, and health-influencing behavioral factors (Fisher-Owens et al. 2007; Adair et al. 2012). *Streptococcus mutans* has long been considered the main etiologic agent of dental caries (Tanzer et al. 2001), but multiple microorganisms have been implicated, and current thinking is that these act collectively to initiate and extend the disease process (Simón-Soro and Mira 2015), especially when supported by a high sugar environment that lowers oral pH (Beighton 2005; Adair et al. 2012). In perhaps the strongest statement to date about the role of sugar, Sheiham and James (2015) recently asserted a dose-response relationship, saying that "the only critical factor that determines the caries process in practice is sugar." Accordingly, many recent preventive interventions emphasize maintaining a favorable oral environment and a healthy biofilm by restricting sugar consumption, maintaining adequate levels of oral fluoride, and ensuring effective oral hygiene practices (Beighton 2005; Marsh 2006; Adair et al. 2012). Genetic/molecular evidence also suggests that caries in children is largely attributable to vertical transmission of the microorganisms from mothers (Caufield et al. 1993), and this has been the impetus for prevention strategies aimed specifically at reducing behaviors implicated in this transmission. For younger children especially, the role of parents and primary caregivers is critical for caries control (Adair et al. 2012). Within this context, maternal/parental education, attitudes and beliefs, and other psychosocial factors represent important mediators and moderators of parents' oral health behaviors on behalf of their children (Reisine and Douglass 1998; Harris et al. 2004; Finlayson et al. 2007; Kim Seow 2012; Leong et al. 2013).

Reviewing caries experience within and across populations internationally, Do (2012) concluded that relative population positions with respect to caries experience have reversed since 1980; that is, caries has "changed from a disease of affluence to a disease of deprivation," he explained. Caries has declined significantly overall, but socioeconomic inequalities increasingly define differences observed among groups. Epidemiologic

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studies confirm the strong relationship of socioeconomic status to caries risk (Petti 2010; Hooley et al. 2012; Schwendicke et al. 2015). Lee and Divaris (2014) described socioeconomic status as the most important "upstream" determinant of poor oral health in children because of its role in health behaviors, environmental exposures, and health care utilization. Economic deprivation directly affects dental care access and quality of diet—variables that are both significantly associated with childhood caries (Gao et al. 2010). Social structure and social environments also are known to influence health behaviors and the causal pathways associated with poor oral health in early life. According to Watt (2007), most interventions to improve oral health are based on the assumption that if individuals acquire relevant knowledge and skills, they will alter their behavior to maintain good oral health. He and others (Do 2012; Lee and Divaris 2014) assert, however, that policy changes to address socioeconomic determinants ultimately will be required to affect children's oral health.

Behavior Change Theories and Approaches

Behavioral interventions to reduce caries have been based on a variety of behavior change theories and approaches—most often, social cognitive theory and the related health beliefs model and theory of planned behavior, self-determination theory, and motivational interviewing (MI).

Social cognitive theory addresses individuals' learning that occurs by observing others within the context of social interactions, experiences, and outside media influences (Bandura 1986), emphasizing the roles of cognitive processes, including self-efficacy perceptions and outcome expectations. Social cognitive theory has been applied to oral health in studies focused on improving toothbrushing and flossing (e.g., Tedesco et al. 1992) by focusing attention on individuals' capacity to make changes in oral hygiene behaviors and their expectations for success. Social cognitive approaches also have been used to assess parental beliefs about toothbrushing, to increase parents' confidence and their perceptions of the importance of brushing, and to develop self-efficacy for toothbrushing skills for parents of young children, (e.g., Gilinsky et al. 2011; Huebner and Milgrom 2015).

The health beliefs model is a value-expectancy theory that assesses the value that individuals place on the desire to avoid illness and stay well, combined with their belief that health action can prevent illness (Glanz et al. 2008). Health beliefs model–guided perceptions have been useful in promoting oral hygiene behaviors such as brushing and flossing. Applying this theory to the prevention of dental caries in young children suggests that the primary caregiver must believe that the child is susceptible to dental caries, that oral health is important, that caries can be prevented, and that ensuring good oral health practices can help to prevent caries (e.g., Hollister and Anema 2004).

The theory of planned behavior focuses on relationships among attitudes, intentions, and behavior. The theory is extensively applied in the field of health communication and has considerable empirical support (Ajzen and Madden 1986). The theory of planned behavior has been used in models for predicting flossing, toothbrushing behaviors, and dental checkups (e.g., Anderson et al. 2013).

Self-determination theory (Deci and Ryan 2000) underscores the importance of individual engagement and responsibility in undertaking change. It suggests that health behavior change is most effectively achieved in autonomy-supportive contexts, in which "significant others offer choice, provide a meaningful rationale, minimize pressure, and acknowledge the target individual's feelings and perspectives" (Ryan and Deci 2000). The self-determination model of change has been used to bring about change in oral health behaviors, such as oral hygiene aimed at decreasing plaque and gingivitis (e.g., Halvari and Halvari 2006).

Although not a theory per se, MI is a behavior change approach that was originally used in treating addictive behaviors and has since been more broadly used and frequently manualized within a variety of health contexts. It employs social and cognitive principles and is perhaps most closely related to self-determination theory. MI provides supportive guidance for choosing behavioral goals and strategies, rather than directing those choices. The approach is designed to be respectful and nonconfrontational toward the participant and to help individuals resolve discrepancies between their values and their behaviors (Miller and Rollnick 2012). Weinstein et al. (2004) first reported successful use of MI in an oral health context, applying it to influence the caries-preventive behaviors of mothers on behalf of their children.

Methods

In this review, we examine research published since 2011 on behavioral interventions to reduce dental caries in children. Studies reporting behavioral interventions were included as available in electronic databases, including MEDLINE via PubMed, Ovid Med, Google Scholar, and Web of Science. The search terms were (*behavioral interventions* AND *oral health; behavioral interventions* AND *dental caries; oral health interventions in schools; Motivational Interviewing* AND *oral health; oral health* AND *community interventions*).

Inclusion criteria for the search were 1) reports published between 2011 and 2015; 2) studies that used dental caries as an outcome measure; and 3) studies that included children ≤18 y old with primary, permanent, and/or mixed dentition.

Results

A total of 18 published studies on behavioral interventions (Table) provided outcomes data or described protocols for ongoing interventions to reduce the occurrence of dental caries in children. The interventions have been categorized as school-, family-, and community-based interventions. In addition, we reference several studies that do not strictly meet the review criteria but suggest important considerations or new directions.

Table. Behavioral Interventions: 2011 to 2015.

Study	Population; Age	Intervention	Health Behavior Strategy	Longest Interval Measured	Effect on Oral Health Behaviors	Significant Effects on Dental Caries
			School-based interventions			
Frazão (2011)	Low-income Brazilian; 5 y	Clinical trial: buccolingual cross-brushing, OHE, supervised fluoridated toothpaste	Information and skill training	18 mo	Not measured	Lower caries increments for boys in first permanent molars
Nammontri et al. (2013)	Thai; 10 to 12 y	Clinical trial to enhance SOC	SOC	3 mo	Increased SOC and oral health–related quality of life	No effect
Agouropoulos et al. (2014)	Low/medium socioeconomic status Athens, Greece; 2 to 5 y	Clinical trial: FV + OHE + oral hygiene instructions	Information and skill training	2 y	Not measured	No effect
			Family-based interventions			
Ismail et al. (2011)	Low-income African American; up to 5 y	Pragmatic randomized trial: MI	MI	2 y	Improved behaviors checking for precavities, ensuring bedtime and twice-daily brushing	No effect
Harrison et al. (2012)	Cree indigenous community in Quebec; at birth	Cluster-randomized pragmatic trial: MI	MI	2 y	Not measured	No main effect; S-ECC lower for children in test group
Plutzer et al. (2012)	Low-income South Australia; 6 to 7 y	Randomized controlled trial: MI	MI	5 y	Not measured	Caries increment lower in intervention group: 33% vs 42% in comparison group
Chafee et al. (2013)	Low-income Brazilian; at birth	Cluster-randomized trial: dietary recommendations	Dietary Information	3 y	Not measured	No main effect: S-ECC was lower for children of mothers who remained exclusively at the same health center
Wagner et al. (2014)	Low- and middle-income Austrian; 5 y	Case-cohort study: OHP and dental counseling with mothers	MI	5 y	Toothbrushing at younger age, used fluoride toothpaste, fluoride salt, and supervised toothbrushing more often	Caries prevalence lower for intervention group
			Community-based interventions			
Slade et al. (2011)	Low-income Australian Aboriginal; 18 to 47 mo	Community randomized controlled trial: FV + dental health promotion at community level with diverse activities	Information and skill training	2 y	Not measured	Lower caries increment by 3.0 surfaces per child
Ramos-Gomez et al. (2012)	Low-income Hispanic; at birth	Randomized clinical trial: combination of maternal CHX + child FV and oral health counseling	Information and skill training	3 y	Not measured	No effect
			Ongoing clinical trials			
Merrick et al. (2012)	Low-income Indigenous children South Australia; at birth	Dental care + FV + MI + anticipatory guidance	MI	3 y		Measuring caries outcomes
Arrow et al. (2013)	Urban population Western Australia; at birth	MI + anticipatory guidance	MI	3 y		Measuring caries outcomes
Gao et al. (2013)	Chinese community in Hong Kong; 3 y	CE; CE + MI; CE + MI + risk assessment	MI	2 y		Measuring caries outcomes
Milgrom et al. (2013)	Low-income rural Oregon; at birth	MI + HE	MI	5 y		Measuring caries outcomes
Broughton et al. (2013)	Low-income Maaori; at birth	Dental care for pregnant women + FV for children + MI	Information and skill training	3 y		Measuring caries outcomes
Batliner et al. (2014)	Low-income American Indian; 0 to 3 mo	MI	MI	3 y		Measuring caries outcomes
Quissell et al. (2014)	Low-income American Indian; 3 to 5 y	FV + OHP for children and parents	Information and skill training	2 y		Measuring caries outcomes
Hull et al. (2014)	Low-income Hispanic; 5 to 7 y	OHE	Information and skill training	2 y		Measuring caries outcomes

Abbreviations: CE, conventional education; CHX, chlorhexidine; FV, fluoride varnish; HE, health education; MI, motivational interviewing; OHE, oral health education; OHP, oral health promotion; S-ECC, severe early childhood caries; SOC, sense of coherence.

School-based Interventions

School-based caries prevention interventions usually encourage children to establish and maintain effective oral health routines, often providing supervised brushing and training in hygiene skills that may not be learned at home. Our review identified only 3 studies of school-based programs that met review criteria (Frazão 2011; Nammontri et al. 2013; Agouropoulos et al. 2014), and none definitively demonstrated efficacy of the programs for preventing caries.

Frazão (2011) focused narrowly on first molar surfaces in testing whether buccolingual cross-brushing of erupting first molar surfaces by specially trained dental assistants could improve results of a school-based supervised toothbrushing program. Results were positive only for male participants, although the total effect of the intervention may have been masked by the unusually robust control intervention, which involved oral health education, dental plaque staining, and directly supervised toothbrushing with fluoride toothpaste, as well as indirect supervision on an ongoing basis.

A school-based trial was conducted in medium and low socioeconomic areas of Athens, Greece, with children aged 2 to 5 y who were at high risk for caries; at baseline, 37% had experienced caries (Agouropoulos et al. 2014). The intervention used biannual fluoride varnish applications, along with hygiene instructions twice yearly and daily supervised brushing with fluoridated toothpaste (1,000 ppm). Caries increments after 24 mo did not differ from that of a control group, however.

Nammontri et al. (2013) conducted a unique school-based cluster-randomized trial in Thailand, testing the effect of an intervention to enhance sense of coherence—a psychosocial attribute that reflects the degree to which individuals perceive their life challenges to be meaningful and, specifically, the degree to which they are able to understand and manage challenges such as oral health problems. Although sense of coherence scores, oral health–related quality of life scores, and oral health beliefs improved for children in the control group, the trial did not result in a difference in dental caries increments (DMFT).

Family-based Interventions

Research related to oral health knowledge and oral health behaviors of mothers/primary caregivers demonstrates that maternal bacterial load influences bacterial acquisition in children, whereas colonization is mediated by oral health practices and eating habits (Leong et al. 2013). This suggests that regular toothbrushing and use of fluoridated toothpaste can be protective against caries, even in the presence of poor diet and high bacterial loads. Most family-based interventions are designed to support mothers in minimizing risk behaviors or promoting protective behaviors through education or counseling. We identified 5 studies using family-based interventions; 4 of these utilized MI.

Harrison et al. (2012) conducted a cluster-randomized pragmatic trial testing an MI approach for mothers in a Cree population in Quebec. Nine communities were randomized into test and control groups; 274 Cree mothers who had recently given birth or were between 12 and 34 wk pregnant were enrolled. After 2 y, caries increments were not lower for the intervention group, but decay in the dentin and pulp was reduced, suggesting that the intervention may have helped to slow the development of severe caries (Harrison et al. 2012).

Two studies showed long-term effects for MI in reducing caries in preschool children. Austrian investigators used a one-time MI intervention for changing mothers' dietary and oral hygiene behaviors immediately after the birth of a child. After 5 y, a case-cohort analysis demonstrated that children whose mothers had participated in the intervention had significantly lower caries experience than that of controls (Wagner et al. 2014).

An Australian study produced similar results. This MI intervention aimed to improve mothers' oral hygiene behavior on behalf of their children. Baseline data were collected when the children were 6 to 12 mo old, with examinations for dental caries at 6 to 7 y; study participants were compared with nonintervention children in the same school whose mothers had not participated in MI. Children in the intervention group had less caries and suffered less dental pain than that of the comparison group (Plutzer et al. 2012).

Only 1 recently reported MI study showed no reductions in caries increments, although it did result in improved caries prevention behaviors of mothers/primary caregivers of children ≤5 y (Ismail et al. 2011). This pragmatic randomized trial enrolled 1,021 low-income African American parent-child dyads, with the intervention group receiving MI and a special 15-min DVD on prevention of tooth decay. Six months and again 2 y later, parents in the intervention group reported better oral health behaviors, such as checking children for precavities and ensuring bedtime brushing and twice-daily brushing.

Although results of the research have not been fully consistent, these recent studies suggest that MI represents the most effective behavioral strategy to date in terms of caries prevention, as well as changing oral health behaviors. Several large-scale clinical trials are underway using MI as a behavior change intervention with a variety of populations, and their results should substantially advance our understanding of the efficacy and limitations of this approach (Merrick et al. 2012; Arrow et al. 2013; Broughton et al. 2013; Gao et al. 2013; Milgrom et al. 2013; Batliner et al. 2014).

Targeting dietary practices specifically, Chaffee et al. (2013) conducted a cluster-randomized trial in which dietary recommendations and strategies were incorporated into maternal consultations at health clinics. Intervention clinics were given posters to display and pamphlets to distribute to pregnant and lactating women. Group main effects for caries were not significant. However, in a subgroup analysis, a significant reduction in severe early childhood caries (ECC) was seen among children of mothers who remained exclusively at the same health center, using it as their source of feeding advice. Continuous access to dietary counseling may provide protection against ECC.

Community-based Interventions

Although oral health promotion alone has not usually produced behavior change sufficient to reduce caries, more robust

approaches that include both parent and child components, along with community-based support, have yielded stronger results (Satur et al. 2010). Strategies undertaken as community interventions have included the following: community-based participatory approaches to involve laypeople or community health workers in program implementation; utilizing >1 community venue for oral health promotion activities; using one-on-one and/or group intervention methods; and maintaining contact with participating families over a longer period (Blinkhorn et al. 2012; Merrick et al. 2012; Broughton et al. 2013; Hull et al. 2014; Quissell et al. 2014).

Recent studies demonstrated mixed results for such combination interventions. A clinical trial was conducted in a low-income Hispanic population using a *promotora* approach that relies on specially trained community health workers. A maternal postpartum chlorhexidine mouth rinse regimen was implemented, along with oral health counseling and fluoride varnish applications every 6 mo from ages 12 to 36 mo. The intervention did not significantly reduce caries in primary dentition (Ramos-Gomez et al. 2012), however, and the investigators speculated that multifaceted caries intervention programs may need to be combined with additional or longer-term therapies in high-risk populations.

By contrast, a community-based approach focused on Australian Aboriginal children aged 18 to 47 mo provided fluoride varnish applications and engaged parents and families during dental screenings and varnish applications at children's play groups, preschool and community councils, and other community events. This caries prevention program produced significantly lower dmfs increments in a 2-y period, when compared with a control community (Slade et al. 2011).

Several ongoing clinical trials are using a combination of interventions, such as anticipatory guidance for mothers, MI, and fluoride varnish applications for children, along with oral health promotion messages at the community level. The results of this work may substantially inform our current thinking about the value and efficacy of various prevention strategies (Blinkhorn et al. 2012; Broughton et al. 2013; Gao et al. 2013; Merrick et al. 2012; Batliner et al. 2014; Quissell et al. 2014).

Discussion

Caries prevention research of the last few years reflects a more refined understanding of risk factors associated with childhood caries, yet the disease remains extraordinarily resistant to prevention interventions. Among the 18 studies of behavioral strategies for preventing caries that we reviewed, 6 resulted in improved caries results when compared with controls; 8 investigations are not yet complete. Some of the studies reviewed also identified significant effects for oral health behaviors of either the parents/primary caregivers or their children. Among these, 1 study reported improvement in tooth brushing habits; 2 resulted in increased use of fluoridated toothpaste; 2 reported improvement in supervised tooth brushing; and 2 reported increased knowledge about oral health in parents.

Among the most successful interventions were those utilizing MI. In 3 studies that used MI interventions, carried out in Australia, Canada, and Austria, main effects for caries outcomes were observed. As a group, the MI studies are remarkable for results that are sustained over longer periods of time than usually are sustained with behavioral approaches.

Our understanding of the success of the MI approach is aided by the work of Markland et al. (2005). They described the mechanisms whereby MI achieves change in terms of assumptions of self-determination theory and emphasis on the human "innate tendency for personal growth toward psychological integration, and . . . the social-environmental facilitating factors . . . to promote this tendency." This description echoes the "global orientation for viewing life in coherent, manageable, and meaningful ways" that Antonovsky (1987) used in the original descriptions of sense of coherence. The importance of such personal perspectives was reflected in the work of Nammontri et al. (2013), who found that sense of coherence was related to oral health–related quality of life in children 10 to 12 y of age. Albino et al. (2014) studied a high caries population and concluded that patterns of oral health–specific beliefs and behaviors in the parents of caries-free children appeared to be supported by the positive psychological attitudes that were reflected by a strong sense of coherence. Along with the results of MI approaches, studies assessing sense of coherence suggest that an important key to generating and sustaining behaviors that are important for caries prevention is providing support that attends to the full life context and circumstances of the individuals involved. Understanding these and other underlying mechanisms of behavior change will be critical to the refinement of future prevention efforts.

The studies reviewed here also reveal advances in the precision and focus of newer efforts utilizing carefully designed behavioral strategies along with the use of other preventive interventions, such as fluoride varnish applications, pit and fissure sealants, and fluoridated toothpastes and chlorhexidine mouthwashes. In these investigations, the aim of behavioral interventions usually is to modify behavior to incorporate regular use of these preventive measures. However, 2 of the 3 studies using fluoride varnish in combined interventions had no effect on caries reduction (Slade et al. 2011; Ramos-Gomez et al. 2012; Agouropoulos et al. 2014). Numerous clinical trials have tested the efficacy of these products and their caries-preventing effects. Although fluoride varnish and sealants have demonstrated particularly strong efficacy for caries prevention (Ahovuo-Saloranta et al. 2013; Marinho et al. 2013), we may need better understanding of the relative value of fluoride products at various stages in the progression of disease. It is possible that when disease is already severe, the fluoride effect simply may not be strong enough to prevent further disease. When working with high-risk populations, we therefore need to be careful not to equate the failure of prevention efforts with resistance to those efforts.

These results also underscore the need to understand more about moderating and mediating influences. For example, low participation and retention rates, which may be attributable to upstream variables, may account for weaker effects in some populations (Petti 2010). The studies reported here suggest that 1) the level and type of change that are needed may be considerably more complex or difficult to achieve than what we have

assumed and 2) carefully controlled studies are needed to fully understand the roles and possible interactions of both biological and behavioral factors.

Attempts to look more closely at moderating and mediating factors in response to caries prevention efforts were seen in a few studies that did not meet the criterion of using caries outcomes. Worth noting are the work of Huebner and Milgrom (2015), who used a peer-to-peer education approach that succeeded in developing parents' self-efficacy and confidence for brushing their children's teeth twice a day. An evaluation of a web-based educational program for increasing oral health and caries transmission knowledge, attitudes, and planned behavior in young mothers suggested that web-based oral health education can be an effective and low-cost strategy for promoting maternal and infant oral health (Albert et al. 2014). These and other recent studies reflect the need for a variety of strategies that address the full spectrum of learning styles, life contexts, and psychosocial needs.

Cost-effectiveness of Behavioral Interventions for Caries Prevention

From a public health and policy maker perspective, it is essential to identify interventions that can reduce caries and reduce the cost burden of care. Yet, little work assessing economic factors has been reported.

Hirsch et al. (2012) used computer simulation techniques to develop a system dynamics model predicting costs of interventions for ECC. Using Colorado Child Health Survey data and Medicaid cost data, they found that fluoride varnish reduced decay of primary teeth by one-third, at a cost of $16 per child per application. Interventions aimed at reducing transmission of cariogenic oral bacteria to children by providing education and treatment to suppress mothers' oral bacteria reduced caries by an average of 73% and cost $100 for each mother. MI, with appropriate follow-up, was shown to reduce caries prevalence by 63% at an estimated per-child cost of $100. The investigators concluded that 1) interventions targeting children at younger ages take 2 to 4 y longer to affect the entire population of preschool-age children but lead to greater reductions in ECC, 2) interventions targeting the highest-risk children provide the highest return on investment, and 3) combined interventions that target ECC can have the most profound effects.

A recent cost-effectiveness study conducted in Queensland, Australia, found that a home-visit intervention for ECC provided significant cost savings to the public health care system and was more cost-effective than a telephone intervention delivery mode. Both were more cost-effective than no intervention at all. A Markov model was built to combine data on dental caries incidence, dental treatments, quality of life, and costs for a cohort of children from age 6 mo to 6 y. For every group of 100 children, the model predicted that the home-visit intervention would save $167,032 and telephone contacts, $144,709, when compared with no intervention (usual care) over 5.5 y. The home visits and telephone intervention would respectively prevent 113 and 100 carious teeth (per 100 children) relative to no intervention (Koh et al. 2015).

Although it was not the mission of this review, we believe that cost considerations must be addressed by future research, since the ultimate success of caries prevention strategies depends not only on their effectiveness in an absolute sense but also on the likelihood that they will be implemented.

Conclusion

In the absence of more universally effective and broadly accepted population-based and/or environmental approaches to caries prevention, we continue to be challenged to develop behavioral strategies that will ensure implementation and adherence to prevention recommendations. Unfortunately, the impact of our efforts has been limited by the fact that what works in 1 case or with 1 group does not always work in another. This observation is not surprising when we acknowledge the array of variables that contribute to the determination of oral health, but it does point to the need to fully understand the roles of those variables in different populations and contexts. Future research will require greater attention to upstream factors that can threaten the fidelity of implementation and influence receptivity to interventions. This means greater attention as well to variables that may moderate or mediate response to strategies for caries prevention. Studies using MI and those assessing sense of coherence attest to the strength of personalized approaches and the importance of understanding life context variables. Systematic assessment of the cost-effectiveness of prevention interventions is long overdue and will be essential to the adoption of effective approaches. Several large-scale ongoing trials—including those being carried out by National Institute of Dental and Craniofacial Research–funded Centers for Research to Reduce Oral Health Disparities—are examining a broad array of cultural and social, as well as biological, behavioral, and environmental, factors in the context of caries prevention programs. These efforts may shed light on whether and how behavioral interventions can more effectively forestall the "preventable" childhood disease that is dental caries.

Author Contributions

J. Albino, T. Tiwari, contributed to conception, design, data acquisition, analysis, and interpretation, drafted and critically revised the manuscript. Both authors gave final approval and agree to be accountable for all aspects of the work.

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