Published in final edited form as:

Dent Clin North Am. 2017 July ; 61(3): 589–606. doi:10.1016/j.cden.2017.02.005.

Pediatric dental-focused inter-professional interventions: Rethinking early childhood oral health management

Burton L. Edelstein, DDS, MPH

Professor of Dental Medicine and Health Policy & Management at the Columbia University Medical Center, Senior Fellow in Public Policy, Children's Dental Health Project (Washington DC), 622 West 168th Street, PH17-306, Box 20, New York, NY 10032

Synopsis

Evidence of effectiveness for prevention of early childhood caries (ECC) suggests that parent engagement needs to occur perinatally and that unconventional providers—helping professionals like social workers and dietitians and lay health workers like community health workers—are most effective. This finding, coupled with the emergence of population-based accountable care, value-based purchasing with global payments, understanding of common risk factors for multiple conditions, and social determinants of health behaviors, calls for a rethinking of early childhood oral health care. A population-based model that incorporates unconventional providers is suggested together with research needed to achieve caries reductions in at-risk families.

Keywords

Early childhood caries; Common risk factors; Social determinants of health; Social workers; Health educators; Dietitians/nutritionists; Community Health Workers; Population health; Accountable care/patient centered medical homes

The early childhood caries problem

The problem addressed by this contribution is that too many young children suffer from early childhood caries (“ECC”) that could have been prevented, suppressed, or arrested through adoption of sustained daily salutary behaviors. Too little is known, however, about how to consistently secure those behaviors over time, particularly in high-risk families. This problem is compounded by dentistry's conventional reparative treatment for ECC which is costly, inefficient, inequitable, and too often fails—a situation that is increasingly untenable in an era of value-based purchasing.

Corresponding Author: Burton L. Edelstein DDS, MPH, Professor of Dental Medicine and Health Policy & Management at the Columbia University Medical Center, Senior Fellow in Public Policy, Children's Dental Health Project (Washington DC), ble22@columbia.edu, 622 West 168th Street, PH17-306, Box 20, New York, NY 10032.

Disclosure statement: I disclose that the early childhood caries research I direct is currently sponsored by the federal Center for Medicare and Medicaid Innovation (C1CMS331347) and report no financial conflicts of interest.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ECC remains highly prevalent and consequential, disproportionately impacting low-income children.¹ Analyses of the 2011-2012 National Survey of Children's Health² reveal that 10% of poor parents and 7% of working-poor parents report that their young child is not in excellent or very good oral health compared to only 4% of middle income and 2% of high income parents. Similarly poor and working poor parents report higher levels of dental or oral problems in the past year than do middle and high income parents (16%, 13%, 10%, 6% respectively). Yet data from Medicaid shows that even among poor children, most require little dental care while a small minority (~5%) account for a high proportion of dental care spending (~30%).³

Like other chronic diseases, caries determinants relate substantially to socially-grounded health behaviors rather than clinical factors.⁴ Key ECC behavioral determinants are highly cariogenic diets and harmful feeding practices coupled with insufficient exposures to fluorides. Among relevant social determinants that explain ECC's prevalence in poor and low-income families are:

- poverty itself;
- food, income, and housing insecurity;
- low levels of educational attainment and illiteracy;
- lack of social cohesion and discrimination;
- unavailability of healthful foods; and
- unfavorable built environments marked by poor quality housing, crime and violence, and toxic exposures.⁵

Healthy People 2020 provides an explanation of how social and environmental risks impact health:

“Health starts in our homes, schools, workplaces, neighborhoods, and communities. We know that taking care of ourselves ... influence[s] our health. Our health is also determined in part by access to social and economic opportunities; the resources and supports available in our homes, neighborhoods, and communities; the quality of our schooling; the safety of our workplaces; the cleanliness of our water, food, and air; and the nature of our social interactions and relationships. The conditions in which we live explain in part why some Americans are healthier than others and why Americans more generally are not as healthy as they could be.”

Applying this understanding to oral health, Sheiham and Watt recognize that poor diet and hygiene contribute to multiple illnesses and call for an “approach [that] addresses risk factors common to many chronic conditions within the context of the wider socio-environmental milieu,” adding that “adopting a collaborative approach is more rational than one that is disease specific.”⁶ Appreciation of social determinants has also led to calls to ‘go upstream’⁷ when addressing preventable chronic diseases by targeting health behaviors that result in health inequalities.⁴ The recognition that social, environmental, behavioral, and epigenetic health determinants are more influential in determining health status than is healthcare *per se*⁸⁹ raises fundamental questions about the limits and limitations of

healthcare and its relationship with educational and support services. In analyzing cross-national differences in health outcomes, Bradley and Taylor note in their 2013 book, “The American Health Care Paradox: Why Spending More is Getting Us Less,” that other developed countries with better health outcomes not only spend less on health services than does the US but also spend more on social services that address housing, employment, disability, education, and food security as health determinants.¹⁰

Nonetheless, there is an important role for clinical care and the absence of accessible quality dental care contributes to oral health disparities. Unfortunately, despite remarkable improvements in dental care for poor and low-income children,¹¹ the subpopulations of children at greatest risk for ECC because of non-clinical determinants are also at greatest risk for lack of dental care that is sufficient to meet their needs.¹²

Given the potent forces of social determinants and the ineffectiveness of conventional preventive and therapeutic ECC management (evidence reviewed below), the question at hand is whether conventional dental teams, even in collaboration with conventional medical teams, are best situated to reduce ECC prevalence or whether new inter-professional teams that engage helping professionals and lay health workers may be more effective when assisting at-risk families in the contexts of their lives, homes, and communities.

Evidentiary review of conventional family-level ECC behavioral interventions

There is little evidence to support conventional educational interventions intended to effectuate sustained daily oral health behavior change.⁶¹³¹⁴¹⁵ In their call to integrate oral health with general health promotion, Sheiham and Watt conclude that conventional oral health education is neither effective nor efficient.⁶ In a landmark 1996 systematic review and meta-analysis of dental educational interventions, Kay and Locker found that these interventions have “a small positive, but temporary effect on plaque accumulation...; no discernible effect on caries increment, and a consistent positive effect on knowledge levels.” A 2013 review largely agreed with these findings while noting that successful oral health education programs are those that are “labor intensive, involve significant others and have received funding and additional support.”¹⁴ Focusing specifically on the effectiveness of oral health education in children, Habbu and Krishnappa also find that clinical improvements are “shortlived” and that knowledge improvements do not lead to proportionate behavioral improvements.¹⁵ A US Preventive Services Task Force (USPSTF) systematic review on prevention of caries in children younger than age five found insufficient evidence that screening and counseling by primary care pediatric medical providers reduces ECC experience.¹⁶ A 2013 update to the USPSTF report similarly found a lack of evidence that physician engagement reduces ECC.¹⁷

Albino and Tiwari's 2016 review of behavioral research found that motivational interviewing (MI) “represents the most effective [family-level] behavioral strategy to date in terms of caries prevention, as well as changing oral health behaviors.”¹⁸ Yet only one of five supporting studies involved conventional healthcare providers--physicians, nurses, and administrators in community health centers who were trained by an “experienced

nutritionist”¹⁹--and none involved dentists or dental hygienists. Rather they involved “masters level therapists;”²⁰ peer counselors described as “community health representatives” and “local women;”²¹ clerical and medical staff at antenatal visits who distributed written materials (reinforced by subsequent mailings);²² and “dental health educators.”²³ Also of note, all studies that reported caries reductions engaged pregnant women¹⁹²¹²² or women who had recently given birth²¹²³ rather than parents of dentate children.

Taken together, these findings suggest that conventional healthcare providers are neither effective nor well positioned in a child's life course to provide effective family-level early childhood caries prevention counseling.

Evidentiary review of conventional ECC dental treatments

To explore the effectiveness of ECC interventions in young dentate children, the evidence of effectiveness is considered for both medical and surgical approaches.

Medical

Topical chemotherapeutics are available for caries prevention (e.g. fluoride varnish, chlorhexidine, xylitol, and providone iodine) and arrest (silver nitrate, silver diamine fluoride).²⁴ Preventive agents can be delivered by medical and dental personnel while arresting agents can be provided by dentists. The USPSTF confirms moderate evidence of effectiveness (“B” level) for fluoride varnish application by medical personnel at the age of tooth eruption. Application of effective agents is also cost-effective relative to repair as they prevent caries progression in high risk children at low cost.²⁵²⁶ With further study through randomized controlled trials now underway,²⁷²⁸ evidence of effectiveness for arresting agents is likely to catch up with pediatric dental educators' enthusiasm for them.²⁹

Surgical or reparative/restorative treatments

In sharp distinction to chemotherapeutic approaches, reparative treatments are neither inherently effective nor cost-effective at preventing caries progression. Of necessity, reparative interventions are often provided with the young child under protective stabilization, sedation, or general anesthesia, each of which has recognized benefits and risks³⁰ and added costs. Dental repair, in the absence of intensive, effective, and sustained behavioral risk reduction interventions, are short-lived as dental restorations, with the exception of glass ionomer fillings, are not therapeutic and restorations frequently fail. Among children treated for ECC under general anesthesia, the literature reports caries recurrence rates of 22%-79%³¹³²³³³⁴³⁵³⁶³⁷³⁸ at 6 to 36 months post-treatment. Youngest children, whose primary dentition is incomplete at the time of repair are reportedly more likely to demonstrate subsequent caries progression.³⁸ Restoration failure compounds the problem of caries progression as Amin *et al* report that one-third of restored teeth (32.9%) required further treatment over a three-year follow up and a significant portion of children, nearly one-in-ten (8%), require a second dental rehabilitation under general anesthesia.³⁹ Evidence is largely lacking on which restorative materials are more successful but amalgam restorations and stainless steel crowns are more often retained.⁴⁰⁴¹ When assessed for value,

measured as health outcomes per unit cost, these interventions are notably high cost and disappointing in their impact on caries progression.

Yet extensive repair of primary teeth at a young age is the current standard of care for children with significant ECC. It is supported by professional association policies, current insurance coverage, fee-for-service payment mechanisms, accreditation training requirements in pediatric dentistry, and tradition. It succeeds in eliminating pain and infection, preventing space loss, and improving masticatory function. However, given an understanding of the social and environmental determinants of salutary health behaviors, it is not surprising that caries progression continues even after substantial dental repair.

Cost-effectiveness of early childhood dental care will likely become of ever-greater concern to public and private payers as they seek alternatives that support the “Triple Aim” of US healthcare: better health outcomes at lower cost with improved patient experience.⁴² While a thorough review of the cost-effectiveness of current ECC prevention and repair is beyond the scope of this contribution, it is notable that the value propositions for the age-one dental visit and for dental rehabilitation is questionable because analyses suffer from probable selection bias in both Medicaid⁴³ and privately insured⁴⁴ populations and available studies engage high-cost dental professional personnel rather than low-cost non-conventional health workers.⁴⁵ System dynamics modeling of ECC prevention and management²⁵²⁶ finds that all tested interventions reduce caries occurrence and progression but only those that do not involve a health professional are cost savings. Overall, “interventions targeting the highest-risk children provide the greatest return on investment and combined interventions that target ECC at several stages of its natural history have the greatest potential for cavity reduction.”²⁵ In reviewing the limited evidence of effectiveness and cost-effectiveness for early professional dental visits, Lee *et al* conclude that the rationale for early intervention is strong and that “If appropriate measures are applied sufficiently early, it may be possible to raise a cavity-free child.”⁴⁶ The question at hand is which health workers are best able to provide caries guidance early enough in a child's life and at a low cost while ensuring a long-term positive outcome.

Evidentiary consideration of non-conventional health workers

The above-referenced review by Albino and Tiwari of family-level ECC management revealed that all successful programs engaged non-dental personnel. Rather, successful programs featured either helping professionals who have engaged in advanced socio-medical training grounded in health behavioral and communications theory and practice or peer counselors who are so alike those they counsel that they have an intuitive understanding of targeted-families' lives. Both are better prepared than dental professionals to address ECC's psycho-social, behavioral, environmental, and cultural determinants. They typically work away from dental facilities in homes and community sites and focus on social and educational predicates of health behaviors as well as those behaviors themselves.

Dental personnel may also serve effectively as helping professionals in ECC counseling⁴⁷⁴⁸ but would require sufficient compensation to routinely implement disease management protocols in practice⁴⁹ to offset income lost from reductions in dental repair. The high cost

of dental professionals and their sophisticated clinical expertise, however, suggest that engaging them in family-level counseling is inherently inefficient while limiting their availability to function at the top of their scope of practice. Improving healthcare efficiency and effectiveness requires that delegable care be assigned to the least costly competent provider⁵⁰ despite the challenges inherent in expanding scopes of practice.⁵¹

Non-conventional health workers have already been integrated into physical healthcare to assist patients and their families in disease management and case management. Common to all are their focus on patient- and family-level engagements, frequent interactions in clinical and non-clinical settings, interest in and ability to directly address social and environmental determinants of health, and capacity to relate to socially disadvantaged families.

Medical Social Workers (MSWs)

MSWs, longstanding in hospitals with an historical emphasis on case management and discharge planning, are trained to assess social and environmental support needs as patients and their families manage their own health risks and protective factors. MSWs screen and evaluate families' psychosocial and environmental competencies, facilitate understanding of diseases and their management, educate families about the roles of health professionals, facilitate decision making and communication, provide coordinating and navigation services, and arrange for supportive resources.⁵² Social Work's "multi-system model of case management" also addresses the complexities of adherence to recommended behaviors.⁵³ As such, social workers are ideally prepared to facilitate families of children with ECC or at risk for ECC to adopt and implement tailored strategies that include goal setting, action planning, and self-management. MSWs have been engaged in dental care, for example addressing psychosocial barriers to care in Columbia University's student clinics; retaining patients in care at the State University of New York at Buffalo student clinics;⁵⁴ and assisting parents whose young children are at risk for early childhood caries at the University of Washington Center for Pediatric Dentistry.⁵⁵

Certified diabetes educators (CDE)

Strong parallels between diabetes and caries control include the need for daily diet management and the analogous management of therapeutics: insulin for diabetes and fluorides for caries. CDEs are credentialed diabetes counselors who work in concert with physicians "to promote self-management to achieve individualized behavioral and treatment goals that optimize health outcomes."⁵⁶ These counselors, who may be medical professionals, psychologists, pharmacists, occupational therapists, optometrists, podiatrists, dieticians, or social workers,⁵⁷ "support informed decision-making, self-care behaviors, problem-solving, and active collaboration with the health care team to improve clinical outcomes, health status, and quality of life"⁵⁸—exactly the components of ECC management needed to prevent, suppress, or arrest its expression. An evaluation by Moran *et al* concludes that engagement of CDEs "improves clinical outcomes and is cost effective" and that "diabetes education and support are integral components of diabetes management."⁵⁹ More generally, quality improvement trials based on precepts of chronic disease management have similarly demonstrated effectiveness of such counselors for pediatric diabetes as well as for pediatric asthma.⁶⁰ Although CDEs do not typically engage

in oral health promotion,⁶¹ their potential roles, responsibilities, training requirements, and deployment in oral health settings have been explored by the American Association of Diabetes Educators.⁶² A dentist who elected to train as a CDE advocates for other dentists to pursue this training and more actively engage in clinical management of patients with diabetes.⁶³

Certified Health Education Specialists (CHES)

Like CDEs, CHESs may come from a variety of health-related disciplines but may also be graduates of bachelor's or higher level education programs in health, community health, public health, and school health. CHESs must demonstrate competency on examination in seven defined areas: assessing needs; planning, implementing, evaluating, and administering programs; acting as a resource person; and communicating and advocating.⁶⁴ Their work is not disease specific but does address common risk factors for poor health, including poor oral health. No reference to CHESs involvement in oral health promotion has yet been identified.

Registered Dietitian Nutritionists (RDNs)

Educated at the bachelors or higher level, RDNs complete an accredited curriculum, a supervised internship, and a certifying examination in preparation for individualized diet counseling specific to health conditions and risks, termed medical nutrition therapy (MNT). Because ECC has a predominant feeding and diet component, RDNs may be particularly well positioned to assist families in adopting appropriate healthful practices. RDNs assess health histories, eating habits and patterns, and diet content before assisting clients in setting goals and carrying out action plans to reach those individualized goals.⁶⁵ The dietetic profession is moving from a “standard educational and informative approach” to “an individualized therapeutic approach” involving “behavioral and lifestyle therapies” that seek to change patients' eating patterns in the context of “cultural needs and desires to achieve sustainable results.”⁶⁶ Randomized controlled trials and clinical reports validate the effectiveness of RDNs in diabetes management⁶⁷ and sustained weight loss and lipid level improvements.⁶⁸ The professional association of RDNs, the Academy of Nutrition and Dietetics, strongly supports integration of oral health with nutrition services, education, and research noting a “synergistic multidirectional association between diet, nutrition, and oral health.”⁶⁹ No studies describing the integration of RDNs in dental care were identified.

Community Health Workers (CHWs)

Known by a variety of names including *promotores*, health navigators, and community health representatives, CHWs are peer counselors who “can improve health access, improve health outcomes, and reduce health care costs for targeted subpopulations.”⁷⁰ Unlike health professionals and healing professionals who are credentialed and/or licensed, CHWs typically are not and they do not provide clinical services. A 2014 Medicaid regulatory change established a state option under which federally-approved state Medicaid plans can allow licensed healthcare providers (e.g. dentists) to delegate preventive services (e.g. caries counseling and prevention facilitation) to these non-licensed health workers. Under this delegation authority, the CHWs are paid directly by Medicaid.⁷¹ A diabetes prevention program offered by the YMCA that has been recognized by the federal Centers for Disease

Control and Prevention for its effectiveness and Centers for Medicare and Medicaid Services for its cost-effectiveness engages lay health workers who are called “lifestyle coaches.”⁷² A dental-specific variant of the CHW is the Community Dental Health Coordinator (CDHCs) advanced by the American Dental Association.⁷³ Like CHWs, CDHCs engage, educate, and assist at-risk families. They differ, however, in that they are additionally trained to provide a limited set of clinical procedures (e.g. coronal polishing and placement of sealants).⁷⁴ An early childhood caries intervention with an immigrant Vietnamese population reported that “One-to-one counseling with regular follow-up provided by a lay person of similar background and culture to the participants is an effective way to facilitate adoption of healthy behaviors and to improve oral health of children.”⁷⁵ Further engagement of CHWs in oral health management has been advocated by the American Academy of Pediatric Dentistry (AAPD) to “enhance provider-patient communication; preventive care; adherence to treatment, follow-up, and referral; disease self-management; and navigation of the healthcare system.” AAPD's policy brief additionally suggests that CHWs can “build individual and community capacity by increasing health knowledge and self-sufficiency through a range of activities such as outreach, community education, informal counseling, social support, and advocacy among communities such as Hispanic/Latino communities.”⁷⁶

Professionals Certified in Public Health (CPH)

Unique to CPHs is their focus on improving health of populations rather than individuals by conducting population-level needs assessments and planning, implementing, and evaluating preventive interventions and services that impact groups of people. While certification is not required of public health professionals, this voluntary credential, validated by examination and continuing education, indicates that “public health professionals have mastered the foundational knowledge and skills relevant to contemporary public health.”⁷⁷ From a public health perspective, “Strategies to prevent and control ECC should address the dental disease process, promote systems of care that support children during their early developmental years and develop public health practices for prevention.”⁷⁸ Common public health approaches important to childhood caries include public education campaigns, population triage efforts to identify highest-risk individuals, community water fluoridation, instituting fluoride varnish programs, and educating health center staff on ECC risks and management.

Further evidence of effectiveness by helping professionals and lay health workers is reported for the federal Home Visiting Program that “gives pregnant women and families, particularly those considered at-risk, necessary resources and skills to raise children who are physically, socially, and emotionally healthy and ready to learn.”⁷⁹ This national program reaches over 140,000 families of young children whose parents are overwhelmingly poor (77%) with modest education (31% have less than high school education) and are compromised by age (22% are teen parents), prior experience of abuse (15%), and drug use (12%). Such high-risk families share social determinants with early childhood caries risk. Of the nineteen unique programs that have been federally approved to participate in home visiting, “most models had favorable impacts on primary measures of child development and school readiness and positive parenting practices” and 10 of 12 that measured child health improvements demonstrated success.⁸⁰ Among the 48 states for which data are available, 10 incorporate

dental referral into their home visiting program, 16 provide some level of direct dental service or conduct relevant research, and 22 do not incorporate oral health.⁸¹

How this evidence can be used to deliver better care to young children and their families

Taken together, the evidence regarding early childhood caries prevention suggests that the most effective and efficient approaches involve:

- targeting the highest risk families--those who today receive the least early preventive care;
- starting early, during the perinatal period and well before the first tooth or first birthday;
- involving helping professionals and lay health workers whose training, commitments, and expertise complement that of dental professionals;
- addressing oral health knowledge and enhancing parental capabilities so that families can become active agents for children's overall and oral health;
- tailoring advice and support to the idiosyncratic social, environmental, and cultural conditions in which families live;
- assisting families in accomplishing risk reduction through goal setting, action planning, facilitation, and follow through;
- ensuring the availability of quality dental care for the provision of services that only professional dental personnel can deliver;
- allocating financial and delivery resources proportional to need rather than accepting the current environment in which families self-select for oral health services; and
- integrating oral health promotion within programs that address overall health.

These principles suggest a new inter-professional population-based model that features four cumulative tiers. Each subsequent tier addresses a more narrowly defined group at higher risk for ECC.

Tier 1 – Full population intervention by public health personnel

The inter-professional model begins by identifying a discrete population of pregnant women and infants. The population may be defined by shared health insurance coverage (e.g. those insured by a public or private insurance plan), administration (e.g. those enrolled in a managed care plan), service location (e.g. those served by a community health center or medical or dental service organization), geography (e.g. those in a defined community), program (e.g. those enrolled in an Early Head Start Center), healthcare provider (e.g. those under the care of defined obstetricians and pediatricians) or other attribute or combination of attributes that establishes clear inclusion criteria. The entire defined population is served by public health professionals who engage community resources in needs assessment and

triage; public education to raise awareness about ECC, its etiologic pathways, risks, and protective factors; and appropriate availability and use of fluorides including community water fluoridation. Public health personnel additionally work with a range of social services to incorporate ECC prevention within community programs and with Medicaid and CHIP policymakers to maximize options and opportunities for payment (including, by example, paying community health workers under federal delegation authority).

Tier 2 – At-risk subgroup health promotion & disease prevention interventions by helping professionals and lay health workers

The subpopulation of families with elevated risk need to be targeted with more intensive health promotion and disease prevention efforts. Segmentation can be accomplished using sociodemographic data supplemented with survey or screening findings; by having providers, programs, or insurers identify at-risk families; or by having families self-identify. For example, higher-risk families may be identified as those enrolled in the federal Early Intervention Program, those with a history of intergenerational caries experience or an older child who already experienced ECC, or pregnant women identified by obstetricians, WIC programs, or Early Head Start. Once identified, helping professionals and/or lay health workers determine, implement, and evaluate strategies to intensify ECC messaging to this population. As with the CPHs in Tier 1, these champions can liaison with a range of social service programs that target families with shared common health determinants to promote inclusion of pediatric oral health.

Tier 3 – Acute risk group disease management intervention with helping professionals and lay health workers

A subset of the Tier 2 population will be those young children at the greatest risk for ECC—those who, if left alone would be most likely to present with acute symptoms and extensive dental destruction by age 3 years. To meaningfully reduce risk, these families need intensive, personalized, sustained assistance by helping professionals and/or peer counselors who provide individualized education, assistance in goal setting and action planning, and facilitation to accomplish defined goals.

Tier 4 – Clinical dental intervention

Some families will not respond sufficiently to the proactive interventions detailed in Tiers 1-3 and will require dental treatment. In Tier 4, these children are provided care by appropriately trained dentists who deliver both chemotherapeutic and reparative dental services.

The inter-professional population-based oral health approach requires coordination and management across the four Tiers. This can be provided by dentists who assume leadership responsibility to develop, implement, and evaluate a system of care designed to meet the needs of all children in the catchment population while integrating with other health promotion programs. Alternatively, coordination and management services may be provided by health systems, particularly emerging accountable care organizations and patient centered medical homes, or by managed care companies responsible for the group.⁸² Financing such a system requires a profound shift from fee-for-service that incentivizes high volume care to

global payment that incentivizes value-based care predicated on objective oral health process or outcome measures. Yet unexplored are methodologies to reward oral health outcomes in early childhood oral healthcare. At the child level, outcomes may be assessed clinically or by parent-reports of their children's oral health status, dental problem, or unmet need for dental care. At the family level, outcomes may be assessed by parent-reports of their oral health knowledge and behaviors. At the systems level, outcomes may be assessed by rates of emergency room use for dental complaints and operating room use for dental repair.

The proposed four-Tier inter-professional population-based model reflects and honors recommended action steps made in 1999 by the Association of Maternal and Child Health Programs⁸³ and in 2000 by the US Surgeon General's Workshop on Children and Oral Health.⁸⁴ (FIGURE 1) The eight recommendations are:

1. "Start early and involve all:" This reflects evidence that "early," in the context of ECC prevention, means well before the first tooth or first birthday and even before a child is born. Involving all suggests that everyone who can provide authoritative information to families should be engaged to do so within an integrated system of care.
2. "Assure competencies:" This requires that providers of oral health information are competent to do so within the contexts of common risk factors and social determinants of health as well as caries knowledge.
3. "Be accountable:" This begs for a care system that measures performance for the entire defined population and allocates resources particularly to those at highest risk.
4. "Take public action:" This addresses Tier 1 in which the entire population is addressed to raise awareness and benefit from population-level interventions.
5. "Maximize the utility of science:" This calls for retaining fidelity to caries science, behavioral science, communications science, and social science knowledge that is foundational to effective interventions at all Tier levels.
6. "Fix public programs:" This suggests that public health and public finance conventions be reconsidered in a movement toward value-based care and incentives inherent to global payments.
7. "Grow an adequate workforce:" Today this means a workforce that is competent to serve at each Tier – from public health personnel addressing an entire population to the clinical dentist serving the unique dental treatment needs of an individual child.
8. "Empower families and enhance their capabilities:" This acknowledges that ECC risks abide in families and that only successful family engagement can effectively reduce risky behaviors.

An example of a pediatric oral health intervention that reflects many of these principals is the MySmileBuddy (MSB) delivery model that was developed by an interdisciplinary team (pediatric medicine and dentistry, health education, nutrition, social work, informatics, and

policy) with support from the National Institutes of Health⁸⁵ and fielded in an effectiveness trial with support from the federal Center for Medicare and Medicaid Innovation.⁸⁶ MSB aims to prevent or arrest early childhood caries progression in young at-risk children by pairing their families with technology-assisted community health workers (CHWs) who conduct home visits to educate parents about ECC's determinants and consequences; assess caries risk; assist parents in establishing family-defined goals and action steps to reduce caries risk and activity; and facilitate accomplishment of those salutary action steps. MSB meets the “start early and involve all” principle by reaching out to families of at-risk children under six years of age, developing longstanding family interaction with the CHWs, and linking parents with a range of community housing, food, social, and education services. It “assures competencies” by empowering families with knowledge, tools (oral hygiene supplies and dietary counseling), and assistance in reaching their self-defined disease management goals. It maximizes the utility of both behavioral and caries science by incorporating key elements of motivational interviewing and behavioral modification along with dietary counseling and regular toothbrushing with fluoridated toothpastes. As a Medicaid innovation demonstration, MSB seeks to “fix public programs” by demonstrating that non-surgical caries management in young children is less costly, more effective in obtaining and maintaining oral health, and provides a better patient and family experience than surgical repair of ECC. This intervention contributes to “growing an adequate workforce” by adding CHWs to the dental team and engaging them in sustained promotion of quotidian oral health behaviors. It “empowers families and enhances their capabilities” by ensuring that they accept control for their children's oral health and act accordingly with as much assistance from the CHW as is appropriate to a given family. Clinical outcomes associated with MSB are pending.

It is problematic that an inter-professional population-based approach such as MSB is at variance with some current professional policies intended to reduce ECC occurrence and progression. The currently recommended universal preventive dental visit by age one⁸⁷⁸⁸⁹ in a dental home with a dentist⁹⁰ appears from the evidence presented to occur too late to be effective and to be delivered by personnel who are less effective and more costly than non-conventional providers. Logistic constraints on the professionally-endorsed early dental home visit⁹¹ additionally tend to favor utilization by low-risk families who are already attuned to oral health while crowding out or limiting access for families who would benefit most. The proposed model addresses the problem of dealing with parents who are regarded as “not engaged” in their children's oral health⁹² as helping professionals and community health workers are better able to engage parents who may be otherwise overwhelmed by their life circumstances. The proposed model additionally aligns with value-based purchasing changes currently underway in US healthcare.

Future possibilities and research directions to improve young children's oral health

Research is needed to enhance capacity to implement the proposed model by better detailing methods to triage and segment a population by ECC risk; assessing oral health status and

care outcomes; providing tiered interventions that are effective and cost-effective; and engaging unconventional health workers in oral health.

Additional experimentation is required to test various insurance designs and payment incentives that can support the tiered inter-professional population-based model, particularly within Medicaid. Future direction can be gained from studying current and past Medicaid policies including (1) consumer incentives for healthy behaviors⁹³ and (2) financing approaches that promote disease management and case management, e.g. Primary Care Case Management, the Medicaid Health Home Initiative, State Plan Amendments for Prevention, and Targeted Case Management.

Ongoing unconventional approaches that can inform the inter-professional population-based model include the Iowa I-Smile Program that ensures a dental home for all Medicaid beneficiary children that does not require a dentist, the Oregon Coordinated Care Organizations that utilize global payments for oral health services, and the California Medicaid Dental Transformation Initiative that is promoting ECC disease management approaches. The federal Center for Medicare and Medicaid Innovation (CMMI) and the National Institute for Dental and Craniofacial Research (NIDCR) also promote unconventional interventions that support a population-based approach. For example, NIDCR underwrote the development of a health information technology called MySmileBuddy^{94,95} that CMMI-sponsored community health workers use in home visits to effectuate sustained behavioral change in families whose children already have ECC.⁹⁶

Information relevant to financing of the proposed model will be increasingly forthcoming from experience of nascent accountable care organizations and patient centered medical homes that are funded by global payments and/or incentivized for positive health outcomes (and financially sanctioned for poor outcomes). Similarly, the increasing occurrence of integrated dental coverage within medical plans, as evidenced in California's and Connecticut's health exchanges, will provide useful experience in promoting financing that cuts across health disciplines.

Overall, application of inter-professional population-based perspectives to the ECC problem holds potential to target children at greatest risk, address their oral health within a larger context of overall health, provide meaningful support for parents who need assistance in providing healthful conditions for their children, improve family experience with oral health care, and save money. Wrenching as such a novel approach may be to the status quo, it is an evidence-based alternative that synthesizes public health and clinical care for the benefit of all children.

References

1. [Accessed September 23, 2016] Healthy People 2020 OH-1.1: Children with dental caries in their primary teeth (percent, 3-5 years). Disparities details by income for 2011-12. Available at <https://www.healthypeople.gov/2020/data/disparities/detail/Chart/4992/6.1/2012>
2. Shariff JA, Edelstein BL. Medicaid meets its equal access requirements for dental care, but oral health disparities remain. *Health Affairs*. 2016; 35:2259–67. [PubMed: 27920314]

3. Reforming States Group. Pediatric Dental Care in CHIP and Medicaid: Paying for What Kids Need, Getting Value for State Payments. Milbank Memorial Fund; New York, NY: 1999. Available at <http://www.milbank.org/uploads/documents/990716mrpd.html> [Accessed September 23, 2016]
4. Watt RG. From victim blaming to upstream action: tackling the social determinants of oral health inequalities. *Community Dent Oral Epidemiol.* 2007; 35:1–11. [PubMed: 17244132]
5. Healthy People 2020 Topics and Objectives. [Accessed September 2, 2016] Social Determinants of Health. Available at <https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-of-health>
6. Sheiham A, Watt RG. The common risk factor approach: a rational basis for promoting oral health. *Community Dent Oral Epidemiol.* 2000; 28(6):399–406. [PubMed: 11106011]
7. Robert Wood Johnson Foundation. [Accessed September 11, 2016] BUILD: Going upstream to improve community health. 2014. Available at http://www.rwjf.org/en/culture-of-health/2014/11/build_going_upstream.html
8. Centers for Disease Control and Prevention. [Accessed September 5, 2016] NCHHSTP Social Determinants of Health. Available at <http://www.cdc.gov/nchhstp/socialdeterminants/faq.html>
9. Health Policy Brief. Health Affairs; 2014. The relative contribution of multiple determinants to health outcomes. Researchers continue to study the many interconnected factors that affect people's health. Available at http://healthaffairs.org/healthpolicybriefs/brief_pdfs/healthpolicybrief_123.pdf [Accessed September 6, 2016]
10. Bradley, EH., Taylor, LA. The American Health Care Paradox: Why Spending More is Getting Us Less. Public Affairs, Perseus Books Group; 2013.
11. Nasseh, K., Vujcic, M. American Dental Association Health Policy Institute; 2016. Dental Care Utilization Rate Continues to Increase among Children, Holds Steady among Working-Age Adults and the Elderly. Available at http://www.ada.org/~media/ADA/Science%20and%20Research/HPI/Files/HPIBrief_1015_1.pdf?la=en [Accessed September 30, 2016]
12. Edelstein BL, Shariff J. Medicaid meets its equal access requirement for dental care but oral health disparities remain. *Health Affairs.* 2016 in revision review September 27, 2016.
13. Kay EJ, Locker D. Is dental health education effective? A systematic review of current evidence. *Community Dent Oral Epidemiol.* 1996; 24:241–235.
14. Nakre PD, Harikiran AG. Effectiveness of oral health education programs: a systematic review. *J Int Soc Preve Community Dent.* 2013; 3(2):103–115.
15. Habbu SG, Krishnappa P. Effectiveness of oral health education in children – a systematic review of current evidence (2005–2011). *Int Dent J.* 2015; 65:57–64. [PubMed: 25345565]
16. US Preventive Services Task Force. [Accessed September 24, 2016] Final recommendation statement: dental caries in children from birth through age 5 years: Screening. Available at <https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/dental-caries-in-children-from-birth-through-age-5-years-screening>
17. Chou R, Cantor A, Zakher B, Mitchell JP, Pappas M. Preventing dental caries in children <5 years: systematic review updating USPSTF recommendation. *Pediatrics.* 2013; 132(2):332–50. [PubMed: 23858419]
18. Albino J, Tiwari T. Preventing childhood caries: a review of recent behavioral research. *J Dent Res.* 2016; 95(1):35–42. [PubMed: 26438210]
19. Chaffee BW, Feldens CA, Vitolo MR. Cluster-randomized trial of infant nutrition training for caries prevention. *J Dent Res.* 2013; 92(7):S29–S36.
20. Ismail AI, Ondersma S, Jelede W, Jenefer M, Little RJ, Lepkowski JM. Evaluation of a brief tailored motivational intervention to prevent early childhood caries. *Community Dent Oral Epidemiol.* 2011; 39(5):433–448.
21. Harrison RL, Veronneau J, Leroux B. Effectiveness of maternal counseling in reducing caries in Cree children. *J Dent Res.* 2012; 91(11):1032–1037. [PubMed: 22983408]
22. Plutzer K, Spencer AJ, Keirse JM. Reassessment at 6–7 years of age of a randomized controlled trial initiated before birth to prevent early childhood caries. *Community Dent oral Epidemiol.* 2012; 40(2):116–124.

23. Wagner Y, Greiner S, Heinrich-Weltzien R. Evaluation of an oral health promotion program at the time of birth on dental caries in 5-year-old children in Vorarlberg, Austria. *Community Dent Oral Epidemiol.* 2014; 42(2):160–169. [PubMed: 24033742]
24. Milgrom P, Chi DL. Prevention-centered caries management strategies during critical periods in early childhood. *J Calif Dent Assoc.* 2011; 39(10):735–41. [PubMed: 22132585]
25. Hirsch GB, Frosh M, Anselmo T, Edelstein BL. A Simulation Model for Designing Effective Interventions in Early Childhood Caries. *Preventing Chronic Disease.* 2012; Mar9:E66. Epub 2012 Mar 1. doi: 10.5888/pcd9.110219
26. Edelstein BL, Hirsch G, Frosh M, Kumar J. Reducing early childhood caries in a Medicaid population: a systems model analysis. *J Am Dent Assoc.* 2015; 146:224–32. DOI: 10.1016/j.adaj.2014.12.024 [PubMed: 25819653]
27. Chu CH, Gao SS, Li SK, Wong MC, Lo EC. The effectiveness of the biannual application of silver nitrate solution followed by sodium fluoride varnish in arresting early childhood caries in preschool children: study protocol for a randomised controlled trial. *Trials.* 2015 Sep 25;16:426.doi: 10.1186/s13063-015-0960-2 [PubMed: 26407698]
28. Mattos-Silveira J, Floriano I, Fereira FR, Vigano ME, et al. New proposal of silver diamine fluoride use in arresting approximal caries: study protocol for a randomized controlled trial. *Trials.* 2014 Nov 19;15:448.doi: 10.1186/1745-6215-15-448 [PubMed: 25409545]
29. Nelson T, Scott JM, Crystal YO, Berg JH, Milgrom P. Silver diamine Fluoride in pediatric dentistry training programs: survey of graduate program directors. *Pediatr Dent.* 2016; 38(3):212–7. [PubMed: 27306245]
30. AAPD Guideline on Behavior Guidance for the Pediatric Dental Patient. *Pediatr Dent.* 2015-2016; 37(6):180–193.
31. Jamieson WJ, Vargas K. Recall rates and caries experience of patients undergoing general anesthesia for dental treatment. *Pediatr Dent.* 2007; 29(3):253–7. [PubMed: 17688025]
32. Amin MS, Bedard D, Gamble J. Early childhood caries: recurrence after comprehensive dental treatment under general anaesthesia. *Eur Arch Paediatr Dent.* 2010 Dec; 11(6):269–73. [PubMed: 21108916]
33. Foster T, Perinpanayagam H, Pfaffenbach A, Certo M. Recurrence of early childhood caries after comprehensive treatment with general anesthesia and follow-up. *J Dent Child (Chic).* 2006; 73:25–30. [PubMed: 16734310]
34. Drummond BK, Davidson LE, Williams SM, Moffat SM, Ayers KM. Outcomes two, three and four years after comprehensive care under general anesthesia. *NZ Dent J.* 2004; 100:32–7.
35. Graves CE, Berkowitz RJ, Proskin HM, Chase I, Weinstein P, Billings R. Clinical outcomes for early childhood caries: influence of aggressive dental surgery. *J Dent Child (Chic).* 2004 May-Aug;71(2):114–7. [PubMed: 15587091]
36. Eidelman E, Faibis S, Peretz B. A comparison of restorations for children with early childhood caries treated under general anesthesia or conscious sedation. *Pediatr Dent.* 2000 Jan-Feb;22(1):33–7. [PubMed: 10730284]
37. Almeida AG, Roseman MM, Sheff M, Huntington N, Hughes CV. Future caries susceptibility in children with early childhood caries following treatment under general anesthesia. *Pediatr Dent.* 2000; 22:302–6. [PubMed: 10969437]
38. Amin M, Nouri R, ElSalhy M, Shah P, Azarpazhooh A. Caries recurrence after treatment under general anaesthesia for early childhood caries: a retrospective cohort study. *Eur Arch Paediatr Dent.* 2015; 16(4):325–31. DOI: 10.1007/s40368-014-0166-4 [PubMed: 25619862]
39. Amin M, Nouri MR, Hulland S, ElSalhy M, Azarpazhooh A. Success rate of treatments provided for early childhood caries under general anesthesia: a retrospective cohort study. *Pediatric Dent.* 2016; 38(4):317–324.
40. Yengopal V, Harneker SY, Patel N, Siegfried N. Dental fillings for the treatment of caries in the primary dentition. *Chochrane Database Syst Rev.* 2009; 15(2) CD004483. doi: 10.1002/14651858.CD004483.pub2
41. Duangthip D, Jiang M, Chu CH, Lo EC. Restorative approaches to treat dentin caries in preschool children: a systematic review. *Eur J Paediatr Dent.* 2016; 17(2):113–21. [PubMed: 27377109]

42. Institute for Healthcare Improvement. [Accessed September 16, 2016] The IHI Triple Aim. Available at <http://www.ihl.org/engage/initiatives/tripleaim/pages/default.aspx>
43. Savage MF, Lee JY, Kotch JB, Vann WF. Early preventive dental visits: effects on subsequent utilization and costs. *Pediatr*. 2004; 114:e418–423.
44. Kolstad C, Zavras A, Yoon RK. Cost-benefit analysis of the age one dental visit for the privately insured. *Pediatr Dent*. 2015; 37(4):376–80. [PubMed: 26314607]
45. Nowak AJ, Casamassimo P, Scott J, Moulton R. Do early dental visits reduce treatment and treatment costs for children? *Pediatr Dent*. 2014; 36:489–93. [PubMed: 25514078]
46. Lee JY, Bouwens TJ, Savage MF, Vann WF. Examining the cost-effectiveness of early dental visits. *Pediatr Dent*. 2006; 28:102–105. [PubMed: 16708783]
47. Ng MW, Torresyap G, White A, Melvin P, Graham D, Kane D, Scoville R, Ohiomoba H. Disease management of early childhood caries: results of a pilot quality improvement project. *J Health Care Poor Underserved*. 2012; 23(2Suppl):193–209.
48. DentaQuest Institute. [Accessed September 25, 2016] Early Childhood Caries (ECC) Collaborative. Available at <https://www.dentaquestinstitute.org/learn/quality-improvement-initiatives/early-childhood-caries-ecc-collaborative>
49. Ng MW, Ramos-Gomez F, Lieberman M, Lee JY, Scoville R, Hannon C, Maramaidi P. Disease management of early childhood caries: ECC Collaborative Project. *Int J Dent*. 2014; 2014:327801.doi: 10.1155/2014/327801
50. Kocher R, Sahni NR. Rethinking health care labor. *N Engl J Med*. 2011; 365:1370–1372. [PubMed: 21995383]
51. LeBuhn, R., Swankin, DA. Citizen Advocacy Center; 2010. Reforming scopes of practice: a white paper. Available at <https://www.ncsbn.org/ReformingScopesofPractice-WhitePaper.pdf> [Accessed September 25, 2016]
52. National Association of Social Workers Center for Workforce Studies and Social Work Practice. [Accessed September 25, 2016] Social Workers in Hospitals and Medical Centers: Occupational Profile. Undated. Available at <http://workforce.socialworkers.org/studies/profiles/Hospitals.pdf>
53. Vourlekis B, Ell K. Best practice case management for improved medical adherence. *Social Work in Health Care*. 2007; 44(3):161–177. [PubMed: 17548273]
54. Zittel-POalamara K, Fabiano JA, Davis EL, Waldrop DP, Wysocki JA, Goldberg LJ. Improving patient retention and access to oral health care: the CARES Program. *J Dent Educ*. 2005; 69:912–18. [PubMed: 16081574]
55. University of Washington Pediatric Dental Alumni News. [Accessed 12-7-16] Team Social Work. 2010. Available at <http://thecenterforpediatricdentistry.com/intranet/pednews2010-1.pdf>
56. National Certification Board for Diabetes Educators. [Accessed September 25, 2016] What is a CDE?. Available at http://www.ncbde.org/certification_info/what-is-a-cde/
57. National Certification Board for Diabetes Educators. [Accessed September 25, 2016] Discipline requirements. Available at http://www.ncbde.org/certification_info/discipline-requirement/
58. National Certification Board for Diabetes Educators. [Accessed September 25, 2016] Definition of diabetes self-management education – 2016. Available at http://www.ncbde.org/certification_info/eligibility-requirements/
59. Moran K, Burson R, Critchett J, Olla P. Exploring the cost and clinical outcomes of integrating the registered nurse-certified diabetes educator into the patient-centered medical home. *Diabetes Educ*. 2011; 37(6):780–793. [PubMed: 22075501]
60. Edelstein BL, Ng MW. Chronic disease management strategies for early childhood caries: support from the medical and dental literature. *Pediatr Dent*. 2015; 37(3):281–287. [PubMed: 26063557]
61. Yuen HK, Onicescu G, Hill EG, Jenkins C. A survey of oral health education provided by Certified Diabetes Educators. *Diabetes Res Clin Pract*. 2010 Apr; 88(1):48–55. DOI: 10.1016/j.diabetes.2009.12.015 [PubMed: 20079551]
62. American Association of Diabetes Educators. [Accessed 12-7-16] AADE Thought Leader Summit: Diabetes and Oral Health. Undated. Available at <https://www.diabeteseducator.org/docs/default-source/default-document-library/aade-diabetes-oral-health-white-paper.pdf?sfvrsn=0>
63. Manchir, M. Dentist highlights dentistry's key role in identifying diabetes. *American Dental Association News*; Aug 20. 2015 Available at <http://www.ada.org/en/publications/ada-news/2015->

[archive/august/dentist-highlights-importance-of-dental-role-in-identifying-diabetes](#) [Accessed 12-7-16]

64. [Accessed September 25, 2016] National Commission for Health Education Credentialing, Inc. Available at www.nchec.org
65. Academy of Nutrition and Dietetics. [Accessed September 26, 2016] What an RDN can do for you. Available at <http://www.eatright.org/resource/food/resources/learn-more-about-rdns/what-an-rdn-can-do-for-you>
66. Endevelt R, Gesser-Edelsburg. A qualitative study of adherence to nutritional treatment: perspectives of patients and dietiticians. *Patient Prefer Adherence*. 2014; 8:147–154. [PubMed: 24523580]
67. Pastors JC, Warshaw H, Daly A, Franz M, Kulkarni K. The evidence for the effectiveness of medical nutrition therapy in diabetes management. *Diabetes care*. 2002; 25(3):608–613. [PubMed: 11874956]
68. Welty, Fk, Nasca, MM., Lew, NS., Gregoire, S., Ruan, Y. Effect of onsite dietitian counseling on weight loss and lipid levels in an outpatient physician office. *Am J Cardiol*. 2007; 100:73–75. [PubMed: 17599444]
69. Academy of Nutrition and Dietetics. [Accessed 12-7-16] Oral health and nutrition. 2014. Available at <http://www.eatrightpro.org/~media/eatrightpro%20files/practice/position%20and%20practice%20papers/practice%20papers/practice-paper-oral-health-and-nutrition.ashx>
70. Bovbjerg, RR., Eyster, L., Ormond, BA., Anderson, T., Richardson, E. The Urban Institute; 2013. The evolution, expansion, and effectiveness of community health workers. Available at <http://www.urban.org/sites/default/files/alfresco/publication-pdfs/413072-The-Evolution-Expansion-and-Effectiveness-of-Community-Health-Workers.PDF> [Accessed September 28, 2016]
71. Update on Preventive Services Initiatives. [Accessed September 28, 2016] CMCS Informational Bulletin. Nov 27. 13 Available at: <https://www.medicaid.gov/Federal-Policy-Guidance/Downloads/CIB-11-27-2013-Prevention.pdf>
72. Centers for Medicare and Medicaid Services. [Accessed September 28, 2016] Certification of Medicare diabetes prevention program. Mar 14. 2016 Available at <https://www.cms.gov/Research-Statistics-Data-and-Systems/Research/ActuarialStudies/Downloads/Diabetes-Prevention-Certification-2016-03-14.pdf>
73. American Dental Association. [Accessed September 28, 2016] Action for Dental Health: About Community Dental Health Coordinators. Available at <http://www.ada.org/en/public-programs/action-for-dental-health/community-dental-health-coordinators>
74. American Dental Association. [Accessed September 29, 2016] Action for Dental Health: CDHC Education and Training. Available at <http://www.ada.org/en/public-programs/action-for-dental-health/community-dental-health-coordinators/cdhc-education-and-training>
75. Harrison R, Wong T. An oral health promotion program for an urban minority population of preschool children. *Community Dent Oral Epidemiol*. 2003; 31:392–9. [PubMed: 14667011]
76. Silverman, J., Douglass, J., Graham, L. [Accessed 12-7-16] The Use of Case Management to Improve Dental Health in High Risk Populations American Academy of Pediatric Dentistry Oral Health Research and Policy Center. Undated. Available at http://www.aapd.org/assets/1/7/Case_Management.pdf
77. National Board of Public Health Examiners. [Accessed September 28, 2016] Certified in Public Health: About NBPHE. Available at <https://www.nbphe.org/aboutNBPHE.cfm>
78. Association of State and Territorial Dental Directors. [Accessed September 25, 2016] Early childhood caries policy statement. adopted June 26, 2012. Available at <http://www.astdd.org/docs/early-childhood-carries-policy-statement-june-26-2012.pdf>
79. Health Resources and Services Administration, Maternal and Child Health. [Accessed September 25, 2016] Home Visiting. Available at <http://mchb.hrsa.gov/maternal-child-health-initiatives/home-visiting>
80. Avellar, S., Paulsell, D., Sama-Miller, E., Del Grosso, P., Akers, L., Kleinman, R. Home Visiting Evidence of Effectiveness Review: Executive Summary. Office of Planning, Research and Evaluation, Administration for Children and Families, U.S. Department of Health and Human Services; Washington, DC: 2016.

81. Unpublished survey research on Home Visiting Programs conducted by Sobia Raffiudin at Columbia University during 2016. Available from Ms. Raffiudin at sr2782@cumc.columbia.edu.
82. Edelstein, BL., Rubin, MS., Douglass, J. Connecticut Health Foundation; 2015. Improving children's oral health by crossing the medical-dental divide. Available at <https://www.cthealth.org/wp-content/uploads/2015/02/Crossing-the-Medical-Dental-Divide-Final.pdf> [Accessed September 30, 2016]
83. Association of Maternal and Child Health Programs. [Accessed September 29, 2016] Putting teeth in children's oral health policy and programs: the state of children's oral health and the role of State Title V Programs. 1999. Available at <http://mchoralhealth.org/PDFs/22360.PDF>
84. Edelstein BL. Forward to the Background papers from the US Surgeon General's Workshop on Children and Oral Health. *Amb Pediatr*. 2002; 2(2 Supplement)
85. Chinn CH, Levine J, Matos S, Findley S, Edelstein BL. An interprofessional collaborative approach in the development of a caries risk assessment mobile tablet application: My Smile Buddy. *J Health Care Poor Underserved*. 2013; 24:1010–20. [PubMed: 23974376]
86. The Trustees of Columbia University in the City of New York. [Accessed January 19, 2017] MySmileBuddy: Demonstrating the value of technology-assisted non-surgical care management in young children. Available at <https://innovation.cms.gov/initiatives/Health-Care-Innovation-Awards-Round-Two/New-York.html>
87. AAPD. Guideline on Infant Oral Health Care. *Pediatr Dent*. 2015-2016; 37(6):146–150. adopted 1986, revised 2014.
88. AAPD. Guideline on the periodicity of examination, preventive dental services, anticipatory guidance/counseling, and oral treatment for infants, children and adolescents. *Pediatr Dent*. 2015-2016; 37(6):123–130.
89. AAPD. Policy on the Dental Home. *Pediatr Dent*. 2015-2016; 37(6):24–25. adopted 2001, revised 2015.
90. AAPD. Policy on workforce issues and the delivery of oral health care services in a dental home. *Pediatr Dent*. 2015-2016; 37(6):26–31. adopted 2011, revised 2014.
91. Edelstein, BL. US Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau; Rockville, MD: 2008. Environmental Factors in Implementing the Dental Home for All Young Children. Available at <http://www.usnoha.org/sites/default/files/reports/1.%20Implementing%20the%20Dental%20Home.pdf> [Accessed September 30, 2016]
92. AAPD. Guideline on caries-risk assessment and management for infants and management for infants, children, and adolescents. *Pediatr Dent*. 2015-2016; 37(6):132–139.
93. Medicaid and CHIP Payment and Access Commission. [Accessed September 30, 2016] Use of healthy behavior incentives in Medicaid. Available at <https://www.macpac.gov/wp-content/uploads/2016/08/The-Use-of-Healthy-Behavior-Incentives-in-Medicaid.pdf>
94. Levine J, Wolf RL, Chinn C, Edelstein BL. MySmileBuddy: an iPad-based interactive program to assess dietary risk for early childhood caries. *J Acad Nutr Diet*. 2012; 112(10):1539–1542. [PubMed: 23017564]
95. Custodio-Lumsen CL, Wolf RL, Contento IR, Basch CE, Zybert PA, Koch PA, Edelstein BL. Validation of an early childhood caries risk assessment tool in a low-income Hispanic population. *J Public Health Dent*. 2016; 76(2):136–142. [PubMed: 26440728]
96. Center for Medicare and Medicaid Innovation. Health Care Innovation Awards Round Two: New York. [Accessed September 30, 2016] The Trustees of Columbia University in the City of New York: "MySmileBuddy:" demonstrating the value of technology-assisted non-surgical caries management in young children. Available at <https://innovation.cms.gov/initiatives/Health-Care-Innovation-Awards-Round-Two/New-York.html>

Key points

1. Early childhood caries shares social, environmental, and behavioral determinants with other chronic diseases and conditions that are termed “common risk factors.”
2. Evidence of effective ECC prevention suggests that prenatal and immediately post-natal interventions work best.
3. Unconventional providers like helping professionals (e.g. social workers, health educators, dietitian/nutritionists) and lay health workers (e.g. community health workers) are more effective at ECC preventive health behavioral counseling than dental and medical professionals.
4. Children at greatest risk of ECC are disproportionately children of social disadvantage whose families are best served by unconventional providers.
5. Pressures on U.S. healthcare systems to deliver best outcomes at lowest costs suggest the need for a more efficient and cost-effective approach to early childhood oral health supervision.
6. Population-based early childhood health systems hold great potential to allocate resources by risk, improve healthcare efficiency and cost-effectiveness, and reduce the burden of ECC.
7. A tiered delivery system that engages non-traditional providers and serves all young children in a defined population is presented along with suggestions for research needed for implementation.

Figure 1.

Action steps to improve young children's oral health.

From Columbia Center for New Media Teaching and Learning. Opening the Mouth, Continuing MCH Education in Oral Health: Action steps. Available at <http://ccnmtl.columbia.edu/projects/otm/action.html#one>. Accessed Sept 29 2016; with permission.