



# Determinants of Health in Children and the Problem of Early Childhood Caries

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Amid I. Ismail, BDS, MPH, DrPH

*Dr. Ismail is professor and director, Detroit Center for Research on Oral Health Disparities, School of Dentistry, and is professor, Department of Epidemiology, School of Public Health, University of Michigan, Ann Arbor, Mich. Correspond with Dr. Ismail at ismailai@umich.edu*

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## Abstract

Early childhood caries (ECC) is a significant dental problem for many low-income and minority children in the United States.<sup>1</sup> The diagnosis, prevention, and management of ECC have been based upon both experiential knowledge and scientific evidence. In the prevention and management of ECC, the focus has been on modifying the dental, infectious, and behavioral determinants of the disease.<sup>2</sup> The purpose of this concept paper is to expand the paradigm used to understand the etiology of ECC and design programs to prevent and manage this condition. (*Pediatr Dent.* 2003;25:328-333)

**KEYWORDS:** EARLY CHILDHOOD CARIES, NURSING CARIES, DENTAL CARIES, TOOTH DECAY

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## Defining ECC

The dental profession has changed the definition of early childhood caries (ECC) several times during the last 50 years.<sup>3</sup> The condition has been labeled as baby bottle tooth decay, nursing caries lesions, nursing bottle syndrome, maxillary anterior caries lesions, rampant caries lesions, labial caries lesions, maxillary anterior caries lesions, and most recently, ECC lesions. Some of these labels are based on findings from case studies and uncontrolled cross-sectional studies that some feeding practices early in life increase the risk of developing ECC.

The recent policy statement from the American Academy of Pediatric Dentistry (AAPD) recognized that poor feeding practices alone will not cause caries lesions, hence “baby bottle tooth decay,” “bottle mouth,” and “nursing decay” are misleading terms.<sup>4</sup> ECC is a term that better reflects the multifactorial etiologic process.<sup>4</sup> The AAPD defines ECC as “the presence of 1 or more decayed (noncavitated or cavitated lesions), missing (due to caries lesions), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger.”<sup>4</sup>

This definition was developed by a workshop organized in 1999 by the National Institute for Dental and Craniofacial Research (NIDCR)<sup>5</sup> following the conference on ECC that was held in 1997.<sup>1</sup> The NIDCR workshop additionally defined ECC as a condition referred to as severe

ECC (S-ECC). The rationale for this decision is as follows: the participants of the workshop concluded that it is important as a public health policy to promote the goal that no child less than 6 years of age should develop dental carious lesions. Hence, the “zero tolerance” concept was adopted as a public health goal (though not widely promoted so far). However, defining the presence of any caries lesion in children less than 6 years old as evidence of S-ECC may group older children with occlusal caries lesions on their primary molars with those suffering from rampant caries involving smooth tooth surfaces. Hence, it was decided to develop age-specific ECC and S-ECC definitions. All children below the age of 3 years with any noncavitated or cavitated caries lesion are classified as S-ECC children.

Starting from the age of 3 years, the definition of S-ECC was developed to identify about 50% of the children with the highest level of dental caries lesions for each year of life between the ages of 3 and 5. All children who do not meet the definition of S-ECC are classified as children with ECC.<sup>5</sup>

The field of research of ECC has been hampered by several methodological and logistical problems. The NIDCR workshop attempted to resolve the issue of developing case definitions and criteria for the detection and classification of ECC. While the AAPD has adopted the definition, the challenge has been to convince the research and practicing communities to use the same language and promote the concepts upon which the definition was developed.

## Children and their universe

Deciding on what causes ECC requires data from large, prospective, well-designed population studies. Unfortunately such information is not yet available. Cross-sectional, case control, and case studies, and some prospective studies identified the following determinants of ECC:

1. oral hygiene status;
2. night-feeding with a sweetened beverage;
3. bacterial infection;
4. enamel defects.<sup>6,7</sup>

These factors should be considered within the context of the “universe of childhood” defined as all the determinants of health and development of children from the point of conception until adulthood.

Young children live in complex social environments. Figure 1 depicts 12 universes or influences that can impact children’s development and health. These 12 universes are divided into:

1. prenatal care;
2. people with whom children depend upon and interact with such as caregivers, other adults, and peer groups;
3. local structural universes such as housing, neighborhoods, transportation, schools, access to health care, and commercial influences;
4. the national policy environment that includes policies on health and social programs and laws that protect the environment where children live.

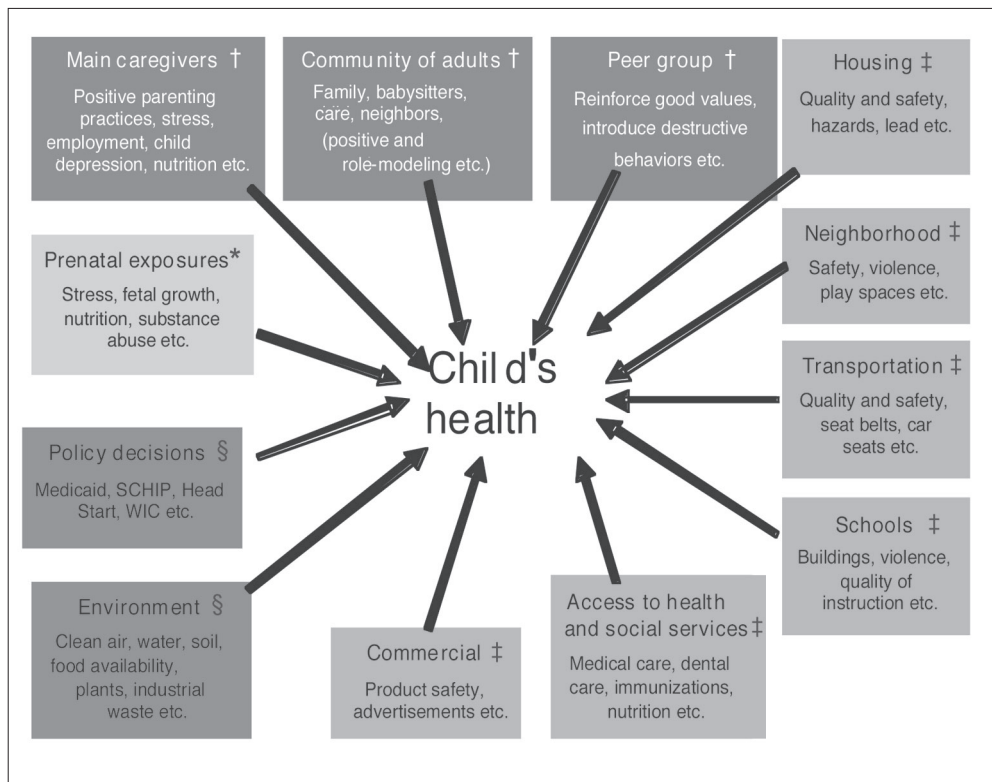


Figure 1. Determinants of health and development of children.

\*Prenatal.

†People.

‡Local structure.

§National structure.

From the point of conception until delivery, environmental factors impact the health of the developing fetus. For example, stress, malnutrition, substance abuse, and exposure to environmental toxins influence fetal growth and development.<sup>8-13</sup>

A recent Swedish study that followed the causes of death until the end of 1995 of a cohort of 14,611 babies born between 1915 and 1929<sup>15</sup> found that birth weight is inversely associated with ischemic heart disease. This association was only significant in men. The study also found that a 1,000-gram (2.68 lb) increase in birth weight is associated with a 23% decrease in the mortality rate from future heart diseases.<sup>14</sup>

At the point of delivery, all healthy children are born free and equal. Afterwards, factors beyond their control influence their growth and development. Parents and caregivers play significant roles in influencing the destiny of children. Parental depression and stress, family support, family conflict, and marital conflicts have an impact on a child’s physical and mental development.<sup>15-18</sup> Children from families in which there is greater organization and consistency in the home use fewer aggressive coping strategies in response to everyday stress.<sup>19</sup>

A prospective study in Scotland involving 5,645 men aged 33 to 64 years who were followed for 21 years found that early- and later-life socioeconomic conditions affect a variety of health outcomes in adulthood, including self-rated health status, coronary heart disease, stroke, stomach cancer, and mortality.<sup>20</sup>

Aversive parental experiences and disregard for primary dentition are serious obstacles to preventing ECC.<sup>21</sup> Health literacy may be a significant factor which influences the adopting of healthy behaviors such as breast-feeding.<sup>22</sup>

Socioeconomic status during early childhood can have significant impact on the type of housing, sufficiency of foods, access to health care services, and future education of children. Sustained economic hardship during childhood can lead to poorer physical, psychological, and cognitive functioning.<sup>23</sup> Additionally, the economic health of a family affects whether children have nurturing care during the early years of life. Such

care should ideally be provided by parent(s) or caregiver(s); however, given the economic needs of most low-income families, it is not uncommon nowadays to have a parent going back to work shortly after the birth of a child.

The quality of child care, such as day care and in-home child care, can impact the social and mental development of a child. As children grow, the availability and quality of social interactions with other children and adults can significantly influence their development.<sup>24-27</sup> The imprinting of societal values starts early in life through the daily interactions with parent(s) or caregiver(s).

Children's health, including oral health, can be influenced by the availability of safe and healthy housing. In addition to the potential hazards of living in buildings with no running water or buildings infested with rodents (a situation not uncommon in some poor neighborhoods in the United States), environmental toxins such as lead in old houses, narcotics, and the wide availability of handguns and other weapons impose direct threats to the physical and mental health of children. Boarded-up housing was found to be a predictor of gonorrhea rates and premature mortality due to malignant neoplasms, diabetes, homicide, and suicide even after accounting for sociodemographic factors.<sup>28</sup>

In many low-income neighborhoods in the United States, there are no safe and easily accessible play areas for children. Furthermore, if a child is in need of any health care, public transportation may not be available to take him or her to a medical or dental clinic. Private transportation, when available, is not immune from hazards. Unsafe conditions of nonmaintained automobiles in low-income neighborhoods and lack of or refusal to use seat belts are potential health risks for children and their caregivers.

When children reach an age to start school, the environment may present additional challenges. Aside from the lack of well-trained teachers, low-income children may study in schools that are in disrepair and taught by teachers who are less qualified and less paid than their counterparts in middle- or high-income areas.

When in need of dental care, children at risk of developing ECC face many dilemmas. Medicaid (and its dental program) is:

1. not well funded in most states;
2. bureaucratically challenging to deal with for health practitioners;
3. highly disliked by dental providers.

A child eligible for Medicaid is severely limited by the choice of dentists that his or her parents can access. The dental profession and child advocates have not been successful in significantly improving the dental coverage of Medicaid. Given the potential impending changes because of the growing deficits in most states' budgets, many additional children, if not all in some states, may end up with no coverage for any dental care.

Race should not be forgotten as a determinant of health. Though the phenomenon of differential decision-making based upon race of a patient has not yet been well studied in dentistry, there is good evidence that such a problem

exists in the health care system in the United States.<sup>29</sup> Mistrust in the health care system and discrimination have an impact on health care seeking behaviors and health outcomes.<sup>30</sup>

The universe of a child, both before and after birth, influences the path that he or she may follow toward adolescence and adulthood. Unfortunately, for many low-income children, there are many impediments to developing healthy behaviors and achieving health. In its report on early childhood titled "From Neurons to Neighborhoods," the Institute of Medicine concluded:<sup>31</sup>

1. All children are born wired for feelings and ready to learn.
2. Early environments matter, and nurturing relationships are essential.
3. Society is changing, and the needs of young children are not being addressed.
4. Interactions among early childhood science, policy, and practice are problematic and demand dramatic rethinking.

As oral health professionals, we need to take the lead to assist children to develop physically, mentally, and emotionally. Most chronic diseases have their origins in childhood.<sup>32-33</sup> Oral health cannot be achieved without achieving full social health. The lives of some children in the United States must improve.

## Management of ECC

Our management of early childhood caries has been focused on the dental manifestations of ECC. The approach that is generally used consists of:

1. regular check-ups with the semiannual application of fluorides (such as fluoride varnishes);
2. removal of plaque at home and in dental offices;
3. dental restorative care either with or without sedation.<sup>34</sup>

There is some evidence that this current management strategy does not work for many children with ECC. For example, Almeida et al<sup>35</sup> reported that about 79% of ECC children, compared with 29% of non-ECC children, developed new caries lesions at subsequent recall visits. ECC children also had 4 times higher mean number of new caries lesions than non-ECC children. Most dramatically, one fifth of ECC children treated under general anesthesia required retreatment within 2 years. Similar observations were made by Berkowitz.<sup>36</sup>

Moreover, the quality of scientific evidence supporting the current interventions is at least mediocre. This does not mean that the current interventions do not work, but rather we have not invested in clinical research to scientifically document what works and does not work in managing ECC. The quest for scientific research in dentistry over the last 50 years has been skewed towards laboratory-based research. There are positive signs that a shift is occurring among funding agencies, and there is a higher demand from policy makers for outcomes.

One area that is receiving more attention is the field of patient and community health education. The dental and

pediatric professions have promoted educational messages that are based on logic, which is often wrong, rather than science. For example, recently the American Academy of Pediatrics recommended that anticipatory guidance should include, among other interventions, the promotion of oral hygiene, and “the parent should be instructed to brush a child’s teeth thoroughly twice daily. . .and to floss the teeth at least once every day.”<sup>2</sup>

Weaning of children by the first birthday has been widely promoted; yet such advice may “fly in the face of...cultural norms and/or may prove to be very difficult for the single caretaker/parent.”<sup>37</sup> The dental profession has also promoted messages assuming that all recipients are in the same stage of change and without factoring in the stage of cognition and other life events that may impact the adoption of the promoted message.

Hence, it is not surprising when subjects in research projects “exhibit excellent adherence while in the study but, at follow-up, reported behavior that differed little from baseline.”<sup>38</sup> There currently are exciting developments in the field of health education and behavioral change, and there is now recognition that different models of behavioral change should be selected for different messages, population groups, and social environments.

On the subject of evidence and interventions, the author would like to point out a finding from the province of Nova Scotia in Canada, which has a universal dental care program for all children (the upper age limit has changed over the last 25 years from 16 to 9). A province-wide survey of first-grade children who lived all their lives in that province and most likely had received regular dental care (95% of the children visited a dentist within a 2-year window) found that parents’ education levels remained a determinant of the mean dmfs scores. Children of parents with university education had less than half the average number of mean dmfs scores of children whose parents had elementary school education.<sup>39</sup> Hence, access to dental care, while it should remain the goal of the dental profession, is not the only solution to the disparities in oral health status.

While the current strategy of managing ECC is undoubtedly the best the profession currently has, practitioners should do better. Children need to be considered within the context of their caregivers or parents, families, neighborhoods, environment, society, and policies. All the determinants of childhood health that have been mentioned in this paper influence both the success of ECC management and whether a child develops and redevelops ECC.

Programs need to be developed and funding sought to promote oral health among families enrolled in Head Start, Healthy Start, and Women, Infant, and Children (WIC) programs. Some recent findings on outcomes of the WIC programs are very encouraging. Pediatric dentists should work closely with WIC, Healthy Start, and Head Start and advocate increased funding for these programs. WIC families were found to have significantly higher prenatal

screening rates than non-WIC families. They also had a significantly higher rate of well-child visits.<sup>40</sup>

In 1997, the author proposed a model that includes 3 intervention targets: (1) community; (2) professional; and (3) home care.<sup>41</sup> The model is based on extrapolations of evidence and has not yet been tested in randomized controlled trials. The author has learned since that the model oversimplifies the complex interplay of the determinants of oral health. A revised model should focus on the “health” of children at all ages.

Hence, it is crucial to take the lead in promoting:

1. prudent, financially sound, and outcome-based programs to provide prenatal and postnatal care;
2. maternal and paternal leaves to take care of children for at least the first 6 months of life;
3. economic development plans to create real jobs with health benefits;
4. educational systems that produce a literate and educated work force;
5. health care system that promotes prevention and self-care and provides adequate, well-managed, and evidence-based primary, secondary, and tertiary health care for children and their caregivers.

It stands to reason that if the United States can remove brutal dictators and terrorist governments in a couple of weeks, the intellect, technology, and leadership in this country can change the plight of some young children as well in a couple of years.

It is important to note that the United States is a diverse country with a mix of racial and ethnic groups, religions, languages, and origins. Economically, the United States has a wide spectrum of population groups—from the super rich to the super poor. There is a small but sizable segment of the United States population that lives under conditions similar to those that exist in developing countries. To develop this segment of the population, a new vision is needed. Social and health welfare programs have produced a society that is dependent on handouts—a society of welfare entitlements rather than a society of earned privileges. Health care should be a right for all Americans. There is a need for different plans that aim to develop a society with a sustainable economic health. To achieve this goal, we need to invest in the development of current and future cohorts of children. The model described in this paper presents 12 areas of influence on children’s health and development. As oral health professionals, we need to be active in developing policies in all these areas. Oral health is dependent on economic health and on community development.

### **Policy for management of the problem of ECC**

The profession has focused extensively on managing ECC as a dental problem, and most of the solutions prescribe what can be done in dental or medical offices.<sup>2</sup> Such an approach does not consider the determinants of health and development of children. Hence, the author advocates the



following expansion of the policy suggestions made by Burton Edelstein<sup>41</sup> to promote the oral health of children and to eliminate the burden of ECC:

1. The AAPD should cast ECC as a societal rather than a dental or pediatric problem.
2. ECC is determined by an interplay of social, mental, racial, familial, community, government, and work policies. We need to work to promote changes at all of these levels.
3. Programs must address the need for extensive dental care for children with ECC and the needs of their families. The separation between the oral health care of children and their parents should end. We need to cover the cost of health care for all low-income and vulnerable families. Such a program should be the responsibility of federal, state, and local governments as well as the business community.
4. We need to develop educational programs that are community based and community tailored, and performance must be measured at the community level.
5. We need to promote policies and programs to provide accessible prenatal and postnatal screening, risk assessment, and prevention for all childhood diseases.
6. We need trained oral health professionals (dentists, hygienists and community-based dental educators) with skills in developing community-based programs, advocacy and expertise in the analysis of the social and cultural beliefs and practices, and in developing and implementing behavioral change programs.

The prevalence of ECC among all American children, regardless of their race, income, and where they live, should be nonexistent. This is the only ethical and public health policy for the dental profession. We need a “shock-and-awe” policy to reduce the burden and even eliminate many diseases in children. Can the dental profession rise to the challenge? The author believes it can and should. An economic policy is a public health policy,<sup>42</sup> and a community development policy is a public health policy. We need to be concerned with, and focused on, all aspects of childhood to promote oral health.

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