Eradicating tooth decay in Colorado’s children
A report to Delta Dental of Colorado Foundation
Acknowledgements

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Chapter 1: Etiology of Dental Caries

Dental caries is a transmissible and contagious bacterial infection caused primarily by two bacteria: *Streptococcus mutans* and *Lactobacillus*. Dental caries is preventable and reversible in its earliest stages and is characterized by the demineralization and remineralization of tooth structure. This ongoing and continual process may never manifest itself with the erosion of tooth structure. However, an imbalance between demineralization and remineralization results in a breakdown of the tooth structure, with an end result of **tooth decay (cavity)**; therefore, the terms “caries” and “cavity” are not totally interchangeable. A cavity is an “end result” of the disease caries. Unlike the common cold (the end result of a variety of viruses), a cavity is not self-resolving.

The most common way of describing this process has traditionally been at the “tooth” level:

![Diagram](Image Courtesy of Dinesh Dental Clinic)

Healthy tooth + refined sugars + plaque (bacteria filled) = cavities

Another popular model shows these factors as overlapping:

In this diagram, plaque is a result of highly fermentable sugars and carbohydrates in the diet, feeding on bacteria, which if left on a susceptible tooth surface, results in dental decay (the point where all three factors intersect), labeled as “caries.”

What this diagram does not show is that it is a balancing act between the factors, and it fails to showcase the dynamic, continual process that is the disease “caries.” A carious lesion may be “cavitated” (has broken through the enamel surface), “non-cavitated” (white spot lesion), “active” (progressing), or “in-active” (arrested). This makes preventive strategies and treatment decisions
extremely variable and subjective. But it is also a simple diagram to highlight how various preventive measures have been targeted over the decades to shift the balance between demineralization and remineralization:

- Brush and floss to remove plaque
- Reduce consumption of sugar and carbohydrates between meals, and possibly changing the type of sweetener to Xylitol
- Increase hardness and resistance of teeth through use of fluoride and sealants

However, it is now known that the process of tooth decay, particularly Early Childhood Caries (ECC), is not this simplistic. ECC is defined as “the presence of one or more decayed teeth, missing teeth (resulting from caries), or filled tooth surface in any primary tooth in a child 6 years old or younger” (AAPD 2010).

ECC used to be known by what was thought to cause it – Baby Bottle Tooth Decay (BBTD). Campaigns in the late ‘70’s and ‘80’s focused on not putting the baby to bed with a bottle filled with milk, formula, or any sweetened liquid to prevent the liquids from pooling around the teeth during the night. Efforts also promoted the switch from bottle to sippy cup by age 1.

Despite the success in educating non-dental providers (particularly Head Start and WIC staff - Women, Infant, Children health and supplemental food program) about the problem of baby bottles, there has been only minimal impact on the rate of severe decay among very young children. Children still developed the tooth decay, and even more confusing, some children who had a bottle in bed did not develop the severe decay. Another factor had to be identified.

A Different Paradigm

Dr. Lisa Chamberlain, associate professor in pediatrics at Stanford University School of Medicine, refers in her analysis of multiple failures in child health to the concept of thinking only “down-stream.” “Down-stream” includes familiar interventions at various points:

- Dentist: fixes the decay
- Parent: keeping baby happy (not crying), and thriving
- Public: personal responsibility for brushing and flossing children’s teeth, and diet
- Policy makers: more dentists to improve access to care

Yet the child still has tooth decay. Dr. Chamberlain highlights possible “up-stream” interventions at the start of the disease process and recognizing the multi-factorial nature of childhood diseases. Crucial to upstream thinking is taking into account the communities’ perception of the disease as well as how to prevent the disease (Chamberlain 2009).

Preventing ECC begins with looking at the “transmissible” nature of the bacteria responsible for tooth decay, which is currently the focus of a great deal of research. As with any infectious disease, there is a “host”, (in this case the child rather than simply a tooth); and a “vector”, (in this case the mother/primary care giver.) If the child is exposed to this bacteria during a crucial
time period, known as the “window of infectivity,” (when the bacteria infect the child) the chances for a lifetime of decayed teeth increase. This in part explains why some children who go to bed with a bottle do not develop tooth decay. If mothers do not have high counts of bacteria to transmit, the bacteria is not available for sweetened liquids in the child’s mouth to feed on, and tooth decay does not result.

This bacteria (*Streptococcus mutans*) requires teeth on which to adhere to begin the replication and potential demineralization processes. As the bacteria feeds on the sugar created by the carbohydrates, it becomes sticky and forms “plaque” on the teeth. Primary teeth begin to erupt between four and eight months, a time when bottle feeding is still in use and new, soft foods are being introduced, signaling the potential start of tooth decay.

Streptococcus mutans also requires fermentable carbohydrates to survive and multiply, so it is not only sugary foods, but also those carbohydrates (such as breads, crackers, pasta) that break down into simple sugars upon digestion that contribute. It is the frequency of carbohydrate consumption that is key, rather than the overall amount and type of food. This frequency is influential in the demineralization and remineralization process. When demineralization progresses beyond what the process of remineralization can repair, a cavitated lesion occurs.

In this scenario, the two primary points of interruption involve the mother and the child:

- Reducing the bacteria in the mother’s mouth by assuring dental visits before and during pregnancy to eliminate any untreated decay and gingivitis
- Preventing direct saliva contact with the child (not sharing utensils, not licking pacifiers, not tasting food prior to giving it to baby) through motivational interviewing and anticipatory guidance
- Increasing the resistance of the child’s teeth to the bacteria through fluoride varnish

Good oral hygiene for the infant also impacts the cycle. Wiping baby’s mouth with a soft cloth after feedings reduces the source of sugar for the bacteria. Brushing teeth when they first erupt with a small, soft toothbrush and a smear of fluoridated toothpaste reduces the bacterial counts and breaks up the adherence of the plaque on the teeth. Appropriate feeding practices (e.g. holding the baby with the bottle, sippy cups only at mealtimes) reduce the “frequency” aspect of the equation, allowing the remineralization process an opportunity to compensate for the demineralization process.

These are strategies that the oral health community has been aware of for quite some time, and while oral health has gained increased awareness through a variety of media and education of primary care providers, more needs to be done.

While seemingly complex, the Socio-Ecological model developed by Dahlberg & Krug illustrates the complex “interplay” of factors when addressing prevention strategies for those people at risk. Fisher-Owens has taken this model and adapted it to children’s oral health (below) to combine the dental disease process and illustrate the various components
of up-stream thinking. In the Fisher-Owens’ model, the oral cavity and what happens at the
tooth level, is influenced by the child, the family, and the community in which the child and
his/her family live, and all of these factors may change over time. In other words, the “social
determinants of health” applies to oral health as well.

The advantage to the Fisher-Owens model is that elements within each factor are identified. As
each element is addressed, explanations emerge as to why efforts to improve oral health over the
last several decades, aimed at a particular component in isolation of the various influences, have
not had as much success as anticipated (Fisher-Owens 2007). The etiology of dental caries, then, will
be described using this model throughout the rest of this chapter.

At the tooth level, the
familiar “tooth, diet, and
bacteria intersection” is at
the core of the model,
diagramed to highlight the
overlapping and
intersection of factors
leading to tooth decay.
The child’s genetics,
home environment, access
to dental care, and oral
hygiene influence this
core. The child’s
environment is certainly
not of his/her own
choosing, but rather,
determined by the family.
Factors such as culture,
oral and physical health
status of the parents, family size and composition, socioeconomic status all work in concert to
affect the child’s environment.

Family influences are also compounded by the community in which they live. Factors such as
the availability of health and oral health services, fluoridation of drinking water supplies, how
safe the community is, and the overall social capital of the community influences the family
environment. “Time” is a factor that influences all of these environments, individually and
together, as families and communities change, and children and their oral health change.

Any of these environments are subject to change over time, and looking at each environment
separately will help to highlight the dynamic nature of this model and of a child’s oral health.
Referring back to the Social Ecological Model, a fourth level of “society” could be added to the
Fisher-Owen model to include local, state, and national policies that impact a child’s oral health.
Perhaps the phrase “It takes a village to raise a child” is not that far-fetched.
Tooth Environment

In the simpler models presented earlier, the tooth that is subjected to continual acid attacks, as a result of bacteria feeding on sugar and carbohydrates, is most likely to experience a breakdown in the enamel structure resulting in tooth decay. Enamel, the hard cover surrounding the tooth structure visible in the mouth (as differentiated from the tooth structure imbedded in bone and surrounded by gum tissue), is a crystalline structure resembling bone.

While harder in most instances than any other human bone, because it is exposed to the environment of the oral cavity and to the outside world, enamel is much more susceptible to onslaught. Under a microscope, enamel reveals its porous nature, despite its hardness. It is this porous nature that allows bacteria to penetrate the surface, but also allows the uptake of fluoride and retention of pit and fissure sealants.

From an anatomical point of view, primary teeth (baby or deciduous teeth) may have very different anatomy from adult teeth, and for very practical reasons. Deciduous teeth are smaller in both size and number (20 deciduous teeth versus 32 permanent teeth) due to the size of the child’s jaw and their function. Deciduous teeth may have fewer deep grooves on the occlusal (biting) surfaces as the child is not eating the foods that require significant grinding and tearing expected of permanent teeth.

The diagram at right indicates the probable timetable for the eruption of the deciduous teeth. There is variation among children, but it is important to note that the deciduous teeth are fully mineralized upon eruption and the permanent teeth (waiting to erupt) are beginning their mineralization at birth.

The root structure below the gums is very broad to allow the developing permanent tooth to push the deciduous tooth out at the appropriate time. The roots of the deciduous tooth dissolve with the impending eruption of the permanent tooth, rendering the tooth very loose, so that all that remains to put under the pillow for the “tooth fairy” is the crown of the deciduous tooth. Severe
decay in deciduous teeth, that affects the blood and nerve supply of the tooth (pulp) and creating an abscess, can adversely affect the quality of the enamel structure of the permanent tooth directly underneath. Deciduous teeth DO matter. Deciduous teeth are important for chewing, speech development (try saying “tooth” without having the tongue touch the teeth), smiling, and maintaining space for the permanent teeth. It is vitally important to protect these deciduous teeth to preserve the space for the permanent teeth to erupt beginning about age 6.

**Child Level Influences**

A number of genetic disorders affect the deciduous and permanent teeth. Sjögren’s Syndrome, Ectodermal Dysplasia, and Down’s Syndrome are just a few of the conditions with dental malformations as a component. About 4% of children born in Colorado have major congenital abnormalities (CRCSN 2006). Not all of these abnormalities have physical dental sequelae, but many of these children struggle with oral hygiene habits and have difficulty accessing dental professionals with the training and compassion to deal with their special needs. Some of these children have delayed development, and others have physical and mental disabilities making oral hygiene and routine dental care challenging for them and for the dental providers. As a result, some are treated under general anesthesia in hospital settings. Children exposed to drugs, such as methamphetamine, and alcohol in utero (including Fetal Alcohol Syndrome-FAS), often have disrupted enamel development. Excessive exposure to lead in old paint on furniture, toys, and woodwork may also cause abnormalities of teeth in addition to cognitive damage.

Research is ongoing to investigate whether caries and periodontal disease have a genetic factor associated with them. To date, there is some evidence suggesting a hereditary component to aggressive periodontal disease, as well as a host of genetic “risk factors” for oral disease. It is too early to state there is a genetic component to caries, but this will be worth watching in the future.

**Family Level Influences**

A child born into a family without dental insurance is another adverse factor. The Surgeon General’s report, “Oral Health in America” related that dental disease is a disease of poverty. Children of low-income families have “twice as much dental decay as their more affluent peers and their disease is more likely to be untreated.” The report also notes that this disparity continues on into adolescence.

Low-income status is increasing in Colorado’s population. In 2010, the federal poverty level (100% FPL) is $22,050 for a family of four. In Colorado, over 87,000 more children lived in poverty in 2007 than did in 2000; approximately 84% of these additional children live in the six-county Metro Denver Area. In addition, the number of children in public schools eligible for free lunch programs increased 38%. (Colorado Children’s Campaign 2009)
The map at left, created from data obtained from Colorado Household Survey administered in 2008, illustrates the percentage of low-income population by region in Colorado. The San Luis and Arkansas Valleys have the highest percentage of low-income population in Colorado, and therefore a high percentage of children on publicly funded programs.

Medicaid and Child Health Plan Plus (Colorado’s health plan for children eligible for the federal State Children’s Health Insurance Program-SCHIP) dental utilization data is difficult to quantify due to the way the Department of Health Care Policy and Financing reports the data by member month rather than as unique individuals for reporting purposes. In data released, children of school age receive far more services than younger children or young adults. The graph below illustrates opportunities for focused efforts based on what is now known about caries transmission and progression, as some of the 18-20 year olds may be pregnant and not getting dental care, and neither are their children under age 2. There is no question that children in publicly funded programs do not have the same access to oral health services that their privately insured peers have.

For low-income children who are not eligible for Medicaid, the CHP+ program offers a limited, but comprehensive, oral health benefit. With the expansion of the number of children eligible (up to 250% of the federal poverty level), it is estimated that over 72,000 Colorado children will be enrolled in the program, a 30,000 increase in FY 04 enrollment levels. The annual report to the legislature indicates nearly 3,000 CHP+ children received dental services each month in fiscal year 2009 (July 2008-June 2009). (CHP+ 2009)

Health behaviors also pay a role, an area that blends both the child and family levels in the Fisher-Owen model. Children whose parents do not access preventive care on a routine basis themselves are more likely to be in fair or poor oral health. (CO Child Health Survey 2007). Research indicates a positive correlation, for example, between an African-American mother’s self-efficacy and brushing frequency in her preschool child. “Self-efficacy” is defined as a person’s belief about his or her ability/capacity to accomplish a task or to deal with the challenges of life. “If a mother brushed her own teeth a bedtime during the week, her 1-3-year old child’s brushing frequency was expected to increase by one-third, and among the 4-5 year olds, the child’s
frequency was expected to increase by one-quarter.” (Finlayson 2007) Self-efficacy variables included being under a lot of stress, feeling depressed, feeling like there’s not enough time, and being tired.

Other variables include knowledge about appropriate bottle use and knowledge about children’s oral hygiene. But among the Finlayson study population who scored well on the knowledge variables and moderately well on self-efficacy, the majority of mothers endorsed a “fatalistic” oral health belief: “most children eventually develop dental cavities.”

Knowledge is certainly related to literacy. Oral health literacy is defined as “the degree to which individuals have the capacity to obtain, process, and understand basic oral health information and services needed to make appropriate health decisions” (SG Report). Addressing oral health literacy is relatively new with limited studies in the literature. However, for the few that are published, low literacy levels are related to low levels of dental knowledge, less recent dental care visits, and worse perceived oral health status (M. Jones, 2007). Jones estimates that preventive dental services in population with low oral health knowledge may be less effective because the population is less compliant with recommendations, exacerbating the effects of poverty and other social factors.

Culture is another aspect to consider. For the purposes of this report, culture has been defined as “the totality of socially transmitted behavior patterns, arts, belief, institutions, and all other products of human work and thought” (answers.com). Culture can be one of poverty, race or ethnicity, religion, and a variety of other factors. Acculturation, the adoption of the behavior patterns of the surrounding culture, is often a factor in oral health status. Length of stay in the United States was positively associated with better oral health status as reflected by lower rates of decayed surfaces, possibly indicating that the longer immigrants were in this country, the better they were able to overcome barriers to access to the oral health care system. In the 1990’s, Colorado’s foreign-born population increased by 160%. (US Immigration Support)
Community Level Influences

However, language and immigration status at an individual level are not directly associated with decay incidence once here in the US, it is certainly associated with baseline prevalence and treatment needs (Maserejian 2008). The neighborhoods in which immigrants live are directly correlated to baseline caries rates, suggesting the strong effects of community networks in adopting the new culture.

Throughout the last century, multiple efforts have occurred to reform the health care system in the U.S. For the most part, the healthcare “system” can be described as a maze with multiple governmental agencies, providers, public and private insurers, employers and membership organizations for the healthcare user to negotiate. The dental care system is much the same, yet generally disconnected from general health care, rendering a second “system” for patients to comprehend.

Three out of four dentists in the U.S. are solo practitioners, compared to 32.5% of physicians, with 85% in general practice (BLS 2010-2011). Less than 5% of dentists are pediatric specialists. These percentages are nearly the same in Colorado. Of the 3,568 active licensed dentists, only 11.3% accept Medicaid patients (those prevalence of dental caries) (HCPF 2009).

This data is considerably different from self-reports by dental practices. Colorado Department of Health Care Policy and Financing (HCPF) bases it’s data on the claims submitted for payment. In the 2006 survey of Colorado dentists by the Colorado Health Institute (CHI), more than 23% of dentists stated they accepted Medicaid patients.

This data does not reflect those practices who accept “new” patients, so this may be a reflection of Medicaid and CHP+ patients currently in the dentist’s practice. Regardless of how the data is sliced, it still boils down to the majority of dentists in Colorado do not accept publicly-funded programs, leaving the vast majority of high-risk children without access to oral health care.
The Rural Dentist Survey conducted by CHI in 2008 also provided useful data about the dental workforce in rural areas of the state. While a slightly greater percentage of rural dentists reported accepting Medicaid and CHP+, the majority did not. In addition to citing poor reimbursement rates, rural dentists also highlighted missed appointments, poor oral hygiene practices, and payment hassles.

The following map highlights the dental workforce-to-population ratios by county, overlaid with the county population. Not surprising, the more populated a county is, the more oral health care providers. The circles also highlight the ratio of dentists to dental hygienists, which may suggest opportunities for improving preventive oral health in rural areas. This raises the age-old question about whether Colorado has enough dentists to serve the population. Looking strictly from the perspective of dentist-to-population standpoint, it would appear that we do. Compared to all the U.S. states, Colorado ranks toward the top with 0.8 dentists per 1,000 population. However, this does not mean that everyone in the population has access to a dentist (State Health Facts 2008).

It is recognized that a more accurate picture is the Dental Health Professional Shortage Area (DHPSA) designation. Nearly every county in Colorado is, or can be, designated either as a geographic HPSA (in which the dentist-to-population ratio is greater than 1:5,000) or a low-
income HPSA designation in which there is not enough dentists to serve the low-income population. Counties, regions, and census tracts with this designation have greater than 25% of their population at, or below, 200% of the federal poverty level. Twenty-three counties have total or partial geographic designation and 20 counties have total or partial low-income designations.

For the counties currently without a designation, work is ongoing at the state’s Primary Care Office to submit the required data to the Bureau of Health Professions (HRSA) to accurately reflect the oral health workforce situation in Colorado.

Colorado is fortunate to have a strong system of safety-net providers, including federally qualified health centers (FQHC) and community-funded safety-net clinics (CSNC). However, over half a million vulnerable Coloradans are estimated to still not have access to primary medical care services (CO Household Survey 2008-2009). Based on the Surgeon Generals’ report estimates, nearly three times more lack access to dental care. (Oral Health in America, SG Report 2000)

The majority of the dental patients seen by safety net clinics are children as they present with a source of payment: Medicaid and CHP+. But that leaves a large population of uninsured adults without a source of oral health care. Data from safety net organizations estimate 1.2 million Coloradans are “vulnerable” (those accessing safety net clinics plus those estimated to not having any access - ClinicNET 2010).

Another community influence is the proportion of residents on public water systems that have access to optimal levels of fluoride in the drinking water supply. The most recent data from the
Centers for Disease Control on the “My Water’s Fluoride” webpage indicates 73.6% of Coloradans have access to optimal levels (optimal range is between 0.9-1.1 parts per million in Colorado).

But in order to have access, one must drink the tap water. It is not known what percentage of the population relies exclusively on bottled water in fluoridated areas, but with the proliferation of bottled water in grocery and convenience stores, and vending machines, it is certainly not safe to assume that people living in fluoridated communities have optimal levels of fluoride in their diet for preventing tooth decay.

The etiology of dental caries is multi-faceted. A professor at the University of Colorado School of Dental Medicine reminds students that a “tooth does not walk into the clinic by itself.” In order to prevent, intervene, and treat the disease that is “dental caries”, a socio-ecological model must be employed so that the child, the family, and the community are all considered when designing programs and treatment plans to eradicate oral disease in children.
Chapter 2: Oral Health Status

The oral health status of children in Colorado may be described from a variety of state and national sources. Colorado does very well in quantifying the status due to the Oral Health Unit at the Colorado Department of Public Health and Environment’s participation in the National Oral Health Surveillance System (www.cdc.gov/NOHSS).

The oral health status may be looked at from some of the same aspects as the etiology of decay. At the “tooth” level, the National Health and Nutrition Examination Survey (NHANES) has described the average number of decayed, missing, and filled teeth (DMFT) and “surfaces” (DMFS) in U.S. children. These data are particularly useful in showing the efficacy of fluoridation and sealants over time. Analysis of NHANES data illustrates that nationally the percentage of untreated decay among deciduous teeth in children aged 2-11 years has remained essentially unchanged, while the percentage of untreated decay in permanent teeth of children has decreased (MMWR 2005).

In the 1999–2002 NHANES survey:

- 41% of children ages 2-11 had decay experience in their primary (deciduous) teeth
- Decay in children aged 2-5 yrs increased between the 1988–1994 and 1999–2002 surveys, which is of concern.
- 42% of children and adolescents (ages 6-19) had decay experience in their permanent teeth
- “The findings of this report indicate that the dental caries status of permanent teeth
has improved since the 1988–1994 survey. Despite the decrease in caries prevalence and severity in the permanent dentition and the increase in the proportion of children and adolescents who benefit from dental sealants, disparities remain” (MMWR 2005).

For program planning/evaluation and policy, data at the “child” level has become the standard. Colorado’s Oral Health Surveillance System (COHSS) has conducted three surveys of preschool, kindergarten, and third grade children in keeping with recommended protocols in the National Oral Health Surveillance System (NOHSS). As evidenced by multiple sources, dental decay is still a significant public health problem for Colorado’s children. Findings from the 2006-2007 screening of a statewide sample of kindergarten and third grade children (Basic Screening Survey - BSS) found:

- 45% of kindergarten and 57% of third grade children had decay experience (untreated decay plus fillings) (Healthy People Goal: 42%)

- 23% of kindergarten and 24.5% of third grade children had “untreated” decay (HP Goal: 21%)

- 37% of third graders have at least one sealant on a permanent first molar. (HP Goal: 50%)

These results are from an “in-mouth” visual survey utilizing a tongue blade and flashlight and most likely represents an “under estimation” of oral disease. However, it highlights how “chronic” a disease dental decay is, as these percentages have not changed significantly over the last three statewide surveys.

While this data gives an overall picture of oral health status, the story is in the oral health disparity data. In the graph at right, data reinforces that dental decay is a disease of poverty. Third-grade children of “Low SES” status have nearly twice the caries experience and untreated decay of their more affluent peers, and more than 3 times the amount of urgent need.

While they have significantly less sealants than the high SES group, it is interesting to note that the percentage of sealants in the lowest SES is slightly higher than the middle SES group. This can be attributed to the targeting of school-based sealant programs to low-income schools in the state supported by local foundations and federal grants.
The economic disparities are further illustrated by Medicaid eligible children who access dental care. While many eligible children do not access care, those that do present with more disease than their peers. The following chart indicates untreated decay among Medicaid eligible children receiving a dental visit in FY 09. By the time a Medicaid child reaches the age of 6, half of them are identified as having tooth decay (HCPF 2009).

Estimated Percentage of “Utilizer” Children and Adolescents with Known Caries Experience As Identified Through Paid Medicaid Claims 04/09

<table>
<thead>
<tr>
<th>FY 08-09 Percentage:</th>
<th>Estimated Percentage of CO Medicaid Clients with Caries Experience</th>
<th>HP 2010 Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Group</td>
<td>Number of Unique Clients Identified as Having Caries Experience</td>
<td>Number of Clients Receiving Dental Services</td>
</tr>
<tr>
<td>0 to 5</td>
<td>15,771</td>
<td>51,909</td>
</tr>
<tr>
<td>6 to 14</td>
<td>40,207</td>
<td>77,945</td>
</tr>
<tr>
<td>15 to 20</td>
<td>11,735</td>
<td>23,353</td>
</tr>
</tbody>
</table>

Disparities can also be geographic. The following map, developed by the state Maternal Child Health Program (MCH), illustrates the degree to which Colorado counties meet the Healthy People goal for the percent of children having untreated decay. These data are based on county “estimates” derived from the statewide BSS dataset and utilizing free and reduced lunch participation as a surrogate for socioeconomics.

**Untreated Decay**

**(Percent)**

**Healthy People 2010 Goal:** Reduce the proportion of children with untreated dental decay in primary and permanent teeth to 21.0 percent or less. The Colorado rate is 24.5 percent.
As the NOHSS-participating states conduct the surveys in different years, and not all states are currently participating, it is difficult to compare one state to another or Colorado to national data.

Other sources of data to compare Colorado to the U.S. include the National Survey of Children’s Health (NSCH). The NSCH provides state estimates based on national datasets, but Colorado also conducts the Colorado Child Health Survey to provide comparison data.

In the 2007 NSCH, two dental indicators were assessed: Percent of children with excellent or very good oral health, and percent of children with a preventive dental visit in the past year, both based on parental report to a random telephone survey.

Colorado data very nearly mimics the national estimates. In the Colorado administered Child Health Survey, additional questions also shed light on parent’s perception of their child’s oral health:

- Only 7.9% of children had a dental visit by age 1, but over 50% had a dental visit by age 3.

- 88.1% of children had a regular source of dental care (dental home).

- 17% of parents said that cavities was their child’s most significant oral health problem.  (Child Health Survey 2007)

These figures were cited in the Colorado Health Foundation’s “2009 Report Card”, released on February 11, 2010. Colorado’s 77% for “dental visit in the past year” ranks Colorado 38 out of 50 states and a contributor to the grade of “D+” in the healthy children category.

(Colorado Health Foundation 2009).
For specific data on young children, Head Start has federal reporting requirements regarding oral and physical health. “Head Start is a program that promotes school readiness by enhancing social and cognitive skills for children and their families through the provision of education, health, and social services.” (Office of Head Start 2009).

At program end in 2008, 82% of Colorado Head Start children had “access to a dental home” compared to 95% having access to a medical home. These data have remained constant over the last several years.

In 2004, Colorado’s Oral Health Unit conducted the Basic Screening Survey for as many Head Start schools in the state as possible. Nearly 3,000 children were screened for ECC in addition to other indicators. “All children had poor oral health regardless of race or ethnicity, with the level of dental disease more than three times higher than the Healthy People 2010 goal of 9 percent” (Impact of Oral Disease on the Health of Coloradans 2005).

Adolescent Oral Health

As the Basic Screening Survey is conducted primarily on elementary school children, getting a picture of adolescent oral health is more problematic. The Youth Risk Behavior Surveillance System (YRBSS) is administered through school districts every other year in Colorado. The purpose of the YRBSS is to “monitor priority health-risk behaviors and the prevalence of obesity and asthma among youth and young adults.” (CDC) These behaviors include injury and violence; alcohol, tobacco, and substance abuse; mental health issues; and dietary behaviors.

Of most interest to oral health is the use of tobacco. In the 2009 Colorado YRBSS:

- 8.8% of adolescents smoke a whole cigarette for the first time before age 13
- 17.7% smoke on one or more days of the 30 days prior to the survey
- 10.6% reported smoking daily
- 10.7% used chewing tobacco, snuff, or dip on one or more of the past 30 days

From the 2007 National Child Health Survey, the graph on the next page provides at least some Colorado-specific data for adolescents. Parents were asked how many oral problems their child had from these four: child had a toothache, child had decayed teeth/cavities, child had broken teeth, and child had bleeding gums. 76% of adolescents were reported as having no oral health problems; but adolescents with one or two or more oral health problems, which probably indicates some untreated decay, is still 24%, higher than the Healthy People target of 15%.
Some of these adolescents may be assumed to be pregnant teens, and with untreated decay, the passage of bacteria to their infants sets up the scenario for Early Childhood Caries, and the detrimental cycle is repeated.

**Pregnant Women**

Based on what is now known about the transmissible nature of bacteria from caregiver to child, it would be remiss not to mention the oral health status of pregnant women in Colorado. The Pregnancy Risk Assessment and Monitoring Survey (PRAMS) has been utilized in Colorado for over ten years, primarily to gather data to improve birth outcomes. The survey is completed by a random sample of new mothers in each calendar year selected from vital statistic records, and oral health questions have been added to the survey in Colorado since 2000 (note: recently passed health care reform legislation includes oral health questions in PRAMS for all 50 states).

While questions are asked about the last dental visit, of note is the question asking new mothers whether they recalled any health provider mentioning oral health to them while they were pregnant. The data indicates no significant change in the last nine years; much more needs to be done to have oral health one of the usual topics of conversation during prenatal care.

However, these data vary significantly when education, race, and income are taken into consideration. For mothers who are white, not eligible for Medicaid, and have some college or more education, the percentage receiving some discussion about oral health during pregnancy approaches fifty percent.
Chapter 3 – Best Practices

This chapter has essentially been written by the Association of State and Territorial Dental Directors (ASTDD) Best Practices Committee. ASTDD has developed a “Strategic Framework” for preventing and controlling tooth decay in early childhood. Based on the Fisher-Owen model for describing the etiology of dental caries, the framework has four primary focus areas for caries prevention and control:

- Prevention
- Disease Management
- Access to Dental Care Services
- Systems of Integration and Coordination

A brief description of each focus area and component is discussed here. The full report at [www.astdd.org/docs/BPAEarlyChildhood.pdf](http://www.astdd.org/docs/BPAEarlyChildhood.pdf) is essential reading to fully understand the interplay of all the factors and how as the etiology of the disease is multi-factorial, so must be a successful intervention.

Prevention and Disease Management

Certainly at the top of the list in any oral disease prevention “best practice” is fluoride. Efforts to promote and expand community fluoridation are an evidenced-based practice, recognized by the U.S. Preventive Health Services Task Force as being effective as well as cost-effective.
The Task Force publishes its results and recommendations on “The Community Guide” website. “Insufficient evidence” does not mean something is not recommended; just not enough research is available from which to make a determination.

<table>
<thead>
<tr>
<th>Community water fluoridation</th>
<th>Recommended</th>
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<tr>
<td>Statewide or community-wide sealant promotion</td>
<td>Insufficient Evidence</td>
</tr>
<tr>
<td>School-based or -linked sealant delivery programs</td>
<td>Recommended</td>
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</tbody>
</table>

The low-levels of fluoride in drinking water allow everyone, regardless of socioeconomic status, to frequently ingest the benefits. Approximately 73.6% of Colorado’s population on public water systems has access to optimal levels of fluoride in their drinking water. Optimal levels in Colorado are 0.9 parts per million – 1.1ppm (0.7ppm – 1.2ppm nationwide).

Fluoride varnish is increasingly more popular for individual fluoride treatments. It is effective for use with young children because of the pre-measured dose (which reduces/eliminates ingestion) and it is tolerated by children more readily. Fluoride varnish has 22,600 ppm and is applied with a small brush to teeth of at-risk children. While water fluoridation has the potential for remineralizing initial areas of tooth decay (white spot lesions), fluoride varnish is also effective for at-risk children.

Other fluoride modalities such as toothpastes, gels, mouthrinses, and supplements are also utilized. Due to potential ingestion, toothpaste with fluoride is not recommended for children under age 2, and then only a smear thereafter until they can spit out the toothpaste. Mouthrinses are not recommended for young children for the same reasons, and supplements are prescribed for those children 6 months – 16 years living in non-fluoridated communities.

There are several state and local projects that have been shown to be an emerging best practice in the area of fluorides:

Healthy Smiles Fluoride Varnish Program in North Dakota: similar in scope to the Colorado Cavity Free at Three initiative, the Healthy Smiles program trains LPNs, RNs, physicians, PA’s, dental hygienists and dental assistants in oral screenings and application of fluoride varnish.

Results: Since 2007, 14 local public health units are participating, providing fluoride varnish to 1,300 children annually. Nearly 50% of states have initiated a fluoride varnish program for high-risk children and the states highlighted in the map are those who have passed legislation to allow Medicaid reimbursement for caries risk assessment and fluoride varnish to non-dental providers (ASTDD 2010).
Into the Mouths of Babes (IMB) Program in North Carolina:  Perhaps the “pioneer” program in terms of training physicians and physician “extenders” with general orders to conduct caries risk assessment and apply fluoride varnish. This program is the collaborative effort of six partners: The NC Academy of Family Physicians, the NC Pediatric Society, the NC Division of Medical Assistance, the NC Oral Health Section, the UNC School of Dentistry, and the UNC School of Public Health.

Results: Funded by federal/state and foundation grants since 2000, the number of medical practices providing oral health services has steadily increased to 49 in 2010 (231 providers). Results indicate that over 70% of practices have instituted the oral evaluation and application of fluoride varnish on a routine basis. One of the more significant barriers to routine adoption was the difficulties in referrals to dentists for follow-up care (Close 2010).

BEST (Bringing Early Education, Screening and Treatment) Oral Health Program in Massachusetts: this oral health program “piggy backs” on early
childhood education programs. The early childhood education program serves as the “dental home,” and the education program staff is trained in oral health education and anticipatory guidance related to oral health. The local dental community provides preventive and treatment services utilizing portable equipment on site.

**Results:** As of July 2009, the BEST program has engaged 54 education centers and trained over 1,000 site staff, and provided prevention and treatment services to nearly 5,000 children. Pre-and Post-tests show increased oral health knowledge among education staff (ASTDD 2010).

**ABCD (Access to Baby and Child Dentistry) in Washington:** Focuses on preventive and restorative dental care for Medicaid-eligible children from birth to age six, with emphasis on enrollment by age one. It was begun in 1995 as a public-private partnership and is in 30 of Washington’s 39 counties. The program trains dental providers on pediatric techniques and works with Medicaid parents to understand the dental benefit and seek care appropriately.

**Results:** For children aged 2 years and under, utilization increased from 3% to 19%; for children under age 6, utilization increased from 21% to 38.7%. The number of dentists billing for Medicaid services has decreased since 2003, but the number billing for children under age 2 has increased (ABCD 2010).

Reduction of bacteria responsible for tooth decay is part of the “upstream” thinking and approach. Reducing the bacteria in the mouth of the mother or primary caregiver, through prescription mouthrinses, professional dental care, and daily oral hygiene practices, has shown to reduce the transmission of bacteria from mother to child. Also, reducing saliva-sharing activities, such as sharing of utensils, not licking a pacifier, and not sharing toothbrushes has also shown to prevent transmission.

**The Mother and Youth Access (MAYA) Project in California:** Primarily targeting migrant and Hispanic families, this randomized clinical trial out of the University of California San Francisco (PI: Francisco Ramos Gomez) aims to determine whether chlorhexidine rinses for reduction of bacterial counts and parental oral health counseling to promote behavioral change in a community health center setting will have significant ECC reductions in this vulnerable population.

**Results to date:** Results have been submitted for publication (Ramos-Gomez 03/2010).

Increasing public awareness, educating parents and caregivers on the importance of oral health is essential. So is the development of realistic prevention strategies. Helping parents and caregivers increase their knowledge on the causes of tooth decay, recognizing early signs of tooth decay, proper feeding practices, injury prevention, and the first dental visit should start in pregnancy and when the child’s first teeth erupt.
It is interesting to note that the Child Health Insurance Program Reauthorization (CHIPRA) 2009 contains a new requirement to provide new parent Early Childhood Caries education (National Oral Health Policy Center 2009).

Providing dental treatment, even preventive services, for pregnant women has been a contentious issue among the dental and primary care community for many years. Fear of harming the unborn child has been first and foremost in the minds of those providers delaying treatment until after the woman delivers. New guidelines are helping to change these perceptions:

- **Oral Health Care During Pregnancy and Early Childhood Practice Guidelines**
  Developed by the New York State Department of Health in 2006, the practice guidelines reaffirm the safety of providing routine dental care during pregnancy and outlining recommendations for oral health care providers and a separate set for prenatal providers. Linking the providers is a sample referral form to increase communication between providers and assuring a continuum of care for the pregnant mother.

- **Oral Health During Pregnancy and Early Childhood: Evidenced-based Guidelines for Health Professionals**
  Developed by the California Dental Association Foundation in 2009, the Guidelines “substantiates the relationship between health and oral health status, and promotes the importance and safety of dental care during pregnancy.” This publication builds on the New York guidelines and also includes guidelines for community-based programs to encourage oral health in their client education efforts.

Utilizing these guidelines, and developing programs to educate medical and dental students, health professionals, community health workers and health educators, and the public will aid in turning around the misconception that dental treatment is to be avoided when a woman is pregnant.

Adjuncts to specific dental treatment are also gaining traction. Xylitol, a natural sugar found in chewing gum, mints, and candy, has gained wide attention in recent years as a potentially effective daily oral hygiene procedure to prevent tooth decay.

**Results:** While no programs are exclusive to Xylitol, a meta-analysis of studies testing sorbitol and Xylitol chewing gums was published in 2008. Of the 231 articles reviewed, 19 were included. Results stated, “although research gaps exist, particularly on optimal dosing and relative….efficacy, there is consistent evidence to support the use of Xylitol and sorbitol- containing chewing gum as part of normal oral hygiene to prevent dental caries.” Results indicate a 10-59% caries reduction, with the highest reduction with Xylitol alone. The authors go on to mention that part of the efficacy could be the act of chewing gum, thereby increasing salivary flow, which is known to contribute to oral cleansing and additional release of fluoride (Deshpande 2008).

Chlorhexidine has also been of interest, particularly for use in pregnant women to reduce bacteria responsible for oral disease. In a few random controlled trials, pregnant women with periodontal disease were given chlorhexidine to reduce periodontal disease to prevent preterm low birth weight babies. The most recent research in the New England Journal of Medicine
(2006) suggests that there is not a “cause and effect” relationship between periodontal disease and preterm low birth weight. However, the use of chlorhexidine is safe to use during pregnancy and does reduce bacteria levels to prevent the transmission to infants (Michalowicz 2006).

**Disease Management**

When prevention does not stop the onset of tooth decay, the goal of caries management is to minimize the severity and consequences of dental decay. This highlights the need for caries risk assessment by all health care providers based on the Fisher-Owens model described in Chapter 1. A key component of management is the monitoring and surveillance of dental disease in children. Oral health programs in state health departments are responsible for “essential public health services” which includes monitoring and surveillance. Currently, the focus of the states’ Basic Screening Survey (BSS) is on children aged kindergarten through third grade. A module of the BSS for preschool children is now available and should be used by states to quantify the oral health status of their youngest residents.

From an economic standpoint this is critical. In 2009, nearly three thousand children were seen in the Denver Children’s Hospital’s operating room for extensive dental treatment under general anesthesia. At an average cost of $7,000/child, the resultant $21 Million for a preventable disease could have been utilized very differently (Savoie 2009). Unfortunately, nearly half of these children will be back with additional decay because the bacteria responsible for tooth decay have not been eradicated.

The spectrum of dental treatment modalities continues to develop. Treating tooth decay chemically, as with a chlorhexidine rinse for example, is a major shift in dental practice that has been accustomed to mechanical interventions. However, fluoride may also be considered a chemotherapeutic agent as it does have antimicrobial properties due to its low pH, so the idea of chemical intervention is not entirely new. But it is doubtful practitioners have thought in these terms before now.

**Access to Dental Care Services**

It may certainly be argued that the federally qualified health centers (FQHCs) and other safety net dental providers have had a large impact on improving access to oral health services for low-income children (NACHC 2010). Nationally, federally qualified health centers see nearly 60 million patients each year. Of those, only 15% were dental visits. Dental staff comprise roughly 36% of health center professional staff. In Colorado, 87% of FQHCs have a dental clinic associated with them, serving more than 76,000 patients in 2008. One-third of FQHC patients are Medicaid, less than 1% are CHP+, and nearly half are uninsured.
In addition to FQHCs, there are 22 non-federally funded safety net clinics, exclusively oral health related, or a primary care clinic with an oral health component. In Colorado, there are an additional 38 dentists and ten dental hygienists working in community-based oral health clinics. The following map highlights where all the safety net clinics with oral health components are located (CHI: SNIMS 2009).

Full implementation and adoption of a dental home concept for children will take significant improvements in public awareness and care coordination between medicine and dentistry (National Oral Health Policy Center), including the “meaningful use” of electronic health records (EHRs). Even in community health centers with medical and dental services co-located, EHRs are not working seamlessly in the integration of medical and dental records.

**I-Smile Dental Home Project – Iowa:** this project is in direct response to state legislation mandating that Medicaid-enrolled children age 12 and under have a dental home. Contracts with Title V agencies places twenty-four dental hygienists out in the field to provide screenings, education, preventive services, case management and referral for dental care.

**Results:** In the first year of the program (2007) the percentage of children ages 0-5 years receiving a dental service increased by 16%. The next year of the program realized another 9% increase. Overall, 57% of children received a valid screening certificate with 15% identified as needing follow-up care. Most of the screenings (94%) were completed by dentists and hygienists (ASTDD 2010).

The ADA, AAP (American Academy of Pediatrics), ASTDD, AAPHD (public health dentistry) and AAPD (pediatric dentistry) all have policy statements advocating for the first dental visit no later than age one and emphasize establishing a medical/dental home for children.
**Tooth Tutor Dental Access Program – Vermont:** this program links children ages K-6 and Head Start to dental homes. The “tooth tutor” is a dental hygienist assigned to a Head Start or elementary school. Over half of Vermont’s elementary schools are in the program, serving over 20,000 children. Children without a dental home are identified and the tooth tutor works with school nurses, classroom teachers, and the local dental community to solve.

**Results:** during 2008-2009, the percentage of Head Start children with a dental home increased from 65% to 94% (ASTDD 2010).

Dental workforce is an issue being discussed at all levels in the U.S. The recent Institute of Medicine’s workshop “The Oral Health Workforce in the Coming Decade” highlighted how oral health services are not accessible by some vulnerable populations, resulting in new models of care being proposed. Proposals include the concept of “mid-level” providers in dentistry, the expansion of dental hygiene and dental assistant roles, and community educators and case managers. The map on the previous page shows in green and pink those counties and census tracks in Colorado that are designated as dental health professional shortage areas (HPSA), a designation that is prepared by the state Primary Care Office and approved by the Bureau of Health Professions in the Department of Health and Human Services (DHHS) in Washington, D.C.

In the recently passed Patient Protection and Affordable Care (PPAC) Act, Section 5304 establishes a five-year, $4 million,15-site demonstration program beginning within two years to "train or employ" alternative dental health care providers (National Oral Health Policy Center at CDHP). It also designates the Institute of Medicine (IOM) to evaluate the demonstration program. The IOM has convened two groups now in anticipation of these oral health workforce issues: 1) Study on an Oral Health Initiative, which will give the IOM a jump start on the demonstration program evaluation; and 2) Study on Oral Health Access to Services, which will look at the U.S. Oral Health Care system and make recommendations for improvements to assure those most at risk for oral disease have access to the system. The Oral Health Initiative study is chaired by Dr. Richard Krugman, Dean for the University of Colorado School of Medicine (IOM 2010).

There are many other key provisions in the PPAC Act related to the oral health of children:

- Insurance plans offered through state exchanges must contain dental benefits for children
- Allows stand-alone dental plans in the exchanges
- Enhances funding for school-based health centers and lists oral health as a qualified service
- Five-year public education campaign focusing on ECC to be developed
- Establishes a grant program to demonstrate the effectiveness of caries disease management programs
- Enhances oral health surveillance activities
- Enhances state oral health program infrastructure
Chapter 4: Colorado’s Best Practices

Colorado has been in the forefront of innovation and “early adoption” in improving oral health of its residents for many years. Many of the best practices build on those practices of the past that were not sustained, but provided valuable lessons. The following table highlights those past practices, present efforts that respond to the best practices identified in Chapter 3, and emerging best practices that will require a watchful eye for successes.

<table>
<thead>
<tr>
<th>Colorado’s Best Practice</th>
<th>Brief Description</th>
<th>Colorado’s Results</th>
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<tbody>
<tr>
<td><strong>Past</strong></td>
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<tr>
<td>Colorado Commission On Children’s Oral Health</td>
<td>Nineteen-member commission appointed by the Governor and co-chaired by the executive directors of CDPHE and CDHCPF to devise policies that would improve the oral health of Colorado’s children</td>
<td>Nine recommendations were sent to the Governor and General Assembly, five of which resulted in successful legislation:  ◦ Dental Loan Repayment Program  ◦ Medicaid reimbursement for dental hygienists  ◦ CHP+ Dental Benefit  ◦ Dental infrastructure grants (3 yrs total)  ◦ Addition of dentists and dental hygienists to the State Health Professional Tax Credit Program (implemented for only one year due to state budget deficits)</td>
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<td>Colorado Oral Health Outcomes Project (COHOP)</td>
<td>The initial focus of this project, funded by the Colorado Health Foundation, was to increase medical-dental interaction to increase the number of children with an oral health visit by age 1 in FQHCs, consistent with the AAP and AAPD recommendations. This project was a pre-cursor to the Oral Health Collaborative (below) and to the ongoing Cavity Free at Three initiative. Medical and dental teams from FQHCs came to together for education on caries risk assessment, fluoride and referrals.</td>
<td>Over the three year period, over 170,000 children were seen. Dental referrals for children age 1 increased by 32% and for 2-yr olds 41% (referrals from medical to dental). The majority of medical providers were comfortable with assessing feeding habits and providing dietary counseling, but were less comfortable with tooth brushing instructions and assessing fluoride intake. Overall, very few referred children were seen by a dental provider due to missed appointments, ratio of medical to dental providers (capacity), and lack of support within each community health center.</td>
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<tr>
<td>Oral Health Collaborative</td>
<td>Federally funded initiative based on previously funded chronic disease collaborative with FQHCs to improve</td>
<td>Colorado was the pilot site for this collaborative, and although no other states have been funded, it still</td>
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oral health outcomes (ECC and Perinatal oral health) through clinic management changes. Launched in 2005, the collaborative brought in national experts on ECC (Dr. Ramos-Gomez) and Perinatal Oral Health (Dr. Irene Hilton) to assist clinics in medical-dental integration and improved patient outcomes. should be a best practice. Four community health centers brought medical and dental clinicians to the table to talk about patient care and flow between the two clinics to improve oral health outcomes. The result was a manual that all states could use, and the first steps toward a “health home” concept, incorporating oral health and primary care. The manual can be downloaded at: http://www.healthdisparities.net/hdc/hdcsearch/?IW_DATABASE=library &IW_FIELD_TEXT=5-31-2008.8762+IN+documentidtbl

Clinics are finding, however, difficulty in institutionalizing the integration, despite the knowledge of clinicians about the importance of oral health, due to the nature of their patient population and dental clinic capacity.

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<tr>
<th>State Oral Health Plan</th>
<th>Following the statewide Oral Health Summit in 2005, the Oral Health Awareness Colorado (OHAC!) coalition drafted the State Oral Health Plan. Utilizing web technology, multiple writers could work on the document simultaneously. The Plan outlines goals for Colorado around six topic areas: Health Promotion, Financing, Workforce, Policy and Advocacy, Systems of Care, and Promising Practices. <a href="http://www.beasmartmouth.com/plan.php">www.beasmartmouth.com/plan.php</a></th>
<th>Oral Health Awareness Colorado developed six workgroups (SPIT: State Plan Implementation Teams) around each of the focus areas. A “mid-course” review was conducted in 2008, which highlighted significant progress in some areas, with more to do in others. Another summit to update the state oral health plan is scheduled for June 3-4, 2010. Colorado’s state oral health plan is commensurate with other state plans.</th>
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<tr>
<td>Policy: Adult Medicaid and Sealants</td>
<td>Oral Health Awareness Colorado and the Oral Health Unit at CDPHE have proposed legislation to add an adult dental benefit to Medicaid (which would cover pregnant women) and assign general fund dollars to school-based sealant programs.</td>
<td>Both pieces of legislation were well received and had interprofessional testimony in support. The state’s economic situation kept both bills from progressing; however, there is enough support to reintroduce them should the opportunity arise.</td>
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<th>Present</th>
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<tr>
<td><strong>Colorado Oral Health Surveillance System (COHSS)</strong></td>
<td>Colorado’s Oral Health Surveillance System was fully launched in 2008. Colorado participates in the National Oral Health Surveillance System (NOHSS) housed on the CDC website,</td>
<td>This is a work in progress, but is accessible on the CDPHE website. The goal is move as much oral health data to the Colorado Health Information Dataset (CoHID) as</td>
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which contains 8 indicators. Colorado has added state-specific measures to track (PRAMS, Child Health Survey, Head Start data, etc.) to provide the public with needed data for grant writing and program development. Collection of many of the “primary” data elements require substantial funding (e.g. each BRFSS question beyond the module is about $2K/question) possible so that the public can query the dataset. However, oral health data is at the state level, rather than county, so this will take time. Colorado was one of the first states to participate in NOHSS and is among the first to develop a stand-alone state oral health surveillance system.

http://www.cdphe.state.co.us/pp/oral
health/COHSS.html

| Community Water Fluoridation Program | Colorado’s Community Water Fluoridation Program is multi-faceted: 1) education to communities on the safety and efficacy of fluoridation; 2) quality monitoring of participating systems; 3) training of water plant operators. Colorado’s Oral Health Unit relies on data from the Safe Drinking Water Information System (SDWIS) for population data and background fluoride levels. Colorado participates in the CDC’s Water Fluoridation Reporting System (WFRS), so that the public can research information about their drinking water on the “My Water’s Fluoride” site. Colorado is just shy of the HP 2010 goal of 75% (73.6%) due to several communities discontinuing fluoridation and population growth in non-fluoridated communities. Of the 61 water systems currently adjusting their level of fluoride to optimal levels, nearly 50% are consistently within 0.2 parts per million (ppm) on a daily basis. http://apps.nccd.cdc.gov/MWF/Index.asp |
| Be Smart and Seal Them (school-based sealant program) | Be Smart and Seal Them is the school-based sealant program administered by the Oral Health Unit at CDPHE. Utilizing CDC guidelines, the eligible elementary schools are those with greater than 50% participation in free and reduced school lunch programs. This population-based preventive measure has had a long history of controversy from the private dental community: should radiographs be taken first? Can you seal over incipient decay? What about follow-up and referral for restorative care? Both the ADA and CDC convened expert panels on this issue from 2004 – 2007, publishing their results in the Journal of the American Dental The Healthy People 2010 goal is for 50% of third graders to have at least one sealant on a permanent molar. In the state’s sealant plan, based on free and reduced school lunch participation, 398 schools (out of 1,024) would be eligible for the program, and if participating, Colorado would meet the HP 2010 goal of 50%. Currently, 93 schools are participating through contracts with 8 organizations and independent hygienists. Colorado’s methodology for selection of schools, sealant placement, and retention checks meet the protocol recommended by the expert panels. Over 2,540 2nd graders have received |
| **OHAC! State oral health coalition** | Following the CDC Framework for successful coalitions, Oral Health Awareness Colorado (OHAC!) was established to bring a focus to oral health policy issues in the state. The coalition has established a website [www.beasmartmouth.com](http://www.beasmartmouth.com) which highlights coalition efforts, showcases community partners and provides educational materials in English and Spanish. | OHAC! was established in 2003. The multitude of on-going partners and a contract managing director allows participants to raise awareness about the impact of oral disease on systemic health, oral health and health disparities, and the effects of lack of access to care on schools, employment, and quality of life. |
| **Cavity Free at Three** | Cavity Free at Three is an initiative of six Colorado Foundations to address the high rate of Early Childhood Caries in the state through interprofessional education and interventions. Following a model developed in California “First 5”, and replicating many of the successes realized by the North Carolina program “Into the Mouth of Babes”, primary care providers and dentists are taught caries risk assessment, fluoride varnish application, and motivational interviewing techniques. The program has moved to the Colorado Area Health Education Center (AHEC); an off-shoot is in the Healthy Smiles clinic at The Children’s Hospital. | Cavity Free at Three has trained more than 400 primary care and dental providers in the last 15 months. Over 4,000 children have received the intervention through the hands-on training. AHEC has instituted a train-the-trainer model to increase the number of trainers and respond to the numerous requests for training.  

In 2009, Medicaid began allowing physicians to bill for the caries risk assessment and fluoride varnish when done in conjunction with well-child visits. The outcome data is as yet not available as it is apparent that the majority of primary care providers are in community health centers and bill Medicaid differently than private providers. Most of the dental providers, however, are private practice dentists. As Medicaid retools this particular program to begin to aggregate the data, it is anticipated that Colorado will realize a greater number of Medicaid children accessing oral health services by age one.  

In terms of evaluation, Dr. Patty Braun (pediatrician with Denver Health), is conducting research on improvement in number of decayed primary teeth with the children at Denver Health with the CF3 model, which will also be valuable data to |
The Healthy Smiles Clinic at The Children’s Hospital is assuring that dental students learn the CF3 model and have the opportunity to practice the motivational interviewing component; in addition, they focus on creating a dental home by accepting the referrals from the community.

| Medical Home Initiative | The concept of Medical Home began with Children with Special Health Care Needs (CHSCHN) programs to help parents negotiate the complicated health care system and find continuity and coordination of care for their children. This concept has grown to include all children; the American Academy of Pediatric Dentists has also devised a model for the Dental Home. Colorado took the unique position of incorporating oral and behavioral health into their “vision” of medical home to encourage coordination and continuity of all health care services for all children. Legislation passed in 2007 has set the stage for guidelines, criteria, and demonstration projects. Oral Health experts participate in the Medical Home Advisory Committee and have provided presentations on the integration of the dental home with the medical home through CF3 and the Co-Location Project. The American Academy of Pediatric Dentists, in collaboration with Aid To Children and Families, has launched the Head Start Dental Home initiative across the United States. The goals are to develop a comprehensive system of care and increase capacity of providers by training pediatric and general dentist providers to work with Head Start and assist Head Start staff with assuring comprehensive oral health services. |
| Frontier Center | The Delta Dental Foundation Frontier Center supports interprofessional education at the Anschutz Medical Campus of the University of Colorado, with efforts originating in the School of Dental Medicine to improve Coloradan’s oral health through interprofessional training. (Refer to Foundation 2009-2010 annual report). The School of Medicine (SOM) provides instruction to dental students on hypertension, pregnancy, dermatology, medical interviewing, respiratory disease, obesity, anticoagulation/endocrinology, and community assessment. The School of Dental Medicine (SODM) provides instruction to medical and PA students on oral cancer exam/oral biopsy, caries risk assessment, oral anatomy, oral diagnosis, and oral-systemic connections (e.g. diabetes). These efforts are the SODM’s “face” to the campus-wide interprofessional education initiative (IPE). The SODM has been able to leverage additional funding to support rural clinical rotations with an
interprofessional component funded by Kaiser Permanente. In addition, the SODM launched rural and global health tracks for dental students, funded by the Colorado Health Foundation and which is totally interprofessional in nature.

| Early Childhood Framework | Colorado’s Lt. Governor has focused on early childhood in the areas of education, primary health, family and community support, and social and behavioral health. Utilizing a collaborative approach, a framework for Colorado’s initiative was developed (attachment A) that incorporated oral health throughout. | CDPHE’s Oral Health Unit has been instrumental in assuring oral health is incorporated into the framework through Maternal Child Health funding. Next steps include the development of a Systems Dynamic Model to identify leverage points for collaboration and improvement in children’s oral health through early childhood education and primary health care. There are 20 Early Childhood Councils representing 31 Colorado counties who have received 3-yr grants from The Colorado Trust to integrated physical, oral and mental health into their local systems. |

| Dental Loan Repayment Program | A legislative result of the Colorado Commission on Children’s Dental Health, the Dental Loan Repayment Program (DLRP) began in 2002. Funded by Master Tobacco Settlement monies, the program offers 3 participation levels for dentists and 2 for dental hygienists based on commitment to serve low-income populations (Medicaid, CHP+, low-income uninsured) for a two-year period. Rather than requiring practice in dental professional shortage areas, the program supports providers in any region of state if they serve underserved Coloradans. | A total of 79 dentists and hygienists have participated in the program since 2003. Providers have been in 9 counties designated as shortage areas and an additional 11 counties with high underserved populations. Over 220,000 children and low-income adults have received dental care from loan repayment participants. The success of Colorado’s program was highlighted in “Dental Fillings,” a report by the Council of State Governments in July 2008. |

| Dental Aid’s “Bright Smiles” Perinatal Program | Dental Aid, Inc. in Boulder County has made prenatal oral health a priority since 2002. Over 400 women are seen each year for preventive oral hygiene services and oral health education while they’re pregnant. | Throughout the course of the project, over 80% of participating women have followed through to treatment completion and the results are significant. The number of age one children with a dental visit has increased by 14%; the number of decayed, missing, and filled surfaces is half of those children whose mothers did not receive care; and the |
| **Total Oral Prevention Strategies (TOPS)** | TOPS is a nonprofit organization that provides comprehensive parent education and early childhood oral prevention services. Classes are offered in English and Spanish in one-on-one and group settings. Attendees receive a free dental screening and are referred to local providers willing to accept the referrals. Children aged 0-5 years receive screening, cleaning, and fluoride every 6 months at no charge. | TOPS received its 501(c)(3) status in October of 2007. To date, 950 children have received dental services with 250 parents (mostly women) involved in the presentations. Some of the mothers were in serious need of perio therapy which TOPS staff addressed. |
| **Community Partnership for Child Development (CPCD)** | CPCD is a 4-yr oral health initiative, funded by Head Start and Early Head Start, serving very young underserved children in El Paso County (Head Start, Early Head Start, and Preschool). Oral health staff provide screenings, fluoride varnish, and anticipatory guidance for children and their parents. In addition, parenting classes have incorporated oral health components. Community dentists are engaged to provide care at reduced fees. | Although the Head Start funding ended in April 2010, expansion grants from other local agencies and foundations will keep the program going. In 2009, 72 parent meetings were conducted with 445 parents attending. It is anticipated that 1,900 families will be served in 2010. Nearly 90% of children served follow-up with a dental exam with over 90% of those needing treatment completing treatment. |
| **Delta Dental of Colorado Foundation Oral Health Public Education Campaign** | The Delta Dental of Colorado Foundation worked with GBSM (media consulting firm) to develop a campaign to increase the knowledge of women of child bearing age in Metro Denver about the transmissibility of bacteria responsible for Early Childhood Caries. Media included print (magazines and brochures) and radio spots over the last three years. | Research and evaluation data indicate a 50% increase in awareness of the vertical transmission of oral disease; over 50% of mothers surveyed had changed their behavior to improve their child’s oral health. |

**Emerging**

| **CCHAP for Dental Providers** | Colorado Children’s Health Access Program (CCHAP) is a non-profit organization dedicated to assuring every Colorado child on Medicaid and CHP+ receives comprehensive primary care through a medical home; and that pregnant women on Medicaid and CHP+ receive comprehensive prenatal care. CCHAP works with practices and providers to reduce the barriers to serving Medicaid and CHP+ children. Discussions have begun with a select group of dental and public health policy | CCHAP currently supports 150 pediatric practices and over 400 individual primary care providers and it is estimated that 90,000 Medicaid and CHP+ have access to a medical home. 93% of all pediatric practices are affiliated with CCHAP. The success is attributed to several factors:  
- Increased Medicaid reimbursement rate through managed care structure  
- Linking providers with |
<table>
<thead>
<tr>
<th>makers to bring the model to dental practices.</th>
<th>community resources to assist with transportation, case management, care coordination, and other health services.</th>
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<tbody>
<tr>
<td><strong>Co-Location Project</strong></td>
<td>A pilot project of the Delta Dental of Colorado Foundation, independent practice dental hygienists are co-located in pediatric practices to integrate oral health services with primary care visits. The pilot has five sites (2 Metro Denver, Ft. Collins, Delta, and Montrose) which have been in place for a little over a year.</td>
</tr>
<tr>
<td><strong>Rural Track</strong></td>
<td>The University of Colorado School of Medicine has had a rural “track” for medical students to increase the number of primary care physicians practicing in rural areas for the past eight years. Through funding from The Colorado Trust, the School of Dental Medicine and School of Pharmacy have also launched rural tracks for their students.</td>
</tr>
<tr>
<td><strong>Systems Dynamic Modeling</strong></td>
<td>The Oral Health Unit at CDPHE, in collaboration with CDC and the Children’s Dental Health Project, is modeling the effectiveness of the inter-relationships between agencies and groups advocating for children’s health.</td>
</tr>
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</table>
Chapter 5: Recommendations

Colorado has long been in the forefront of efforts to improve the oral health of its residents, through successful infrastructure grants, multiple foundation support, and broad collaborations. Despite these efforts, however, there remain gaps in children’s oral health. As the nation moves into the next decade with new Healthy People objectives to be realized by 2020, Colorado has an opportunity to significantly improve children’s oral health through implementation of best practices and keeping abreast of new research and innovation. Targeted efforts will best utilize limited resources, and nearly all involve some aspect of improving oral health literacy among the public.

1. **Support community water fluoridation**: Educate the public on the safety and efficacy of this public health measure. Colorado is nearly at the Healthy People 2010 goal of 75%, but the need exists to assure 100% of residents on public drinking water systems have access to optimal levels of fluoride in the water. With the state and individual communities struggling with budget shortfalls, continuing a voluntary program is difficult to rationalize if the case for the public health benefit is not emphasized. One-time replacement and upgrading of fluoridation equipment would be beneficial, as well as a limited time (e.g. one year) purchase of fluoride chemical to assure communities maintain this preventive measure.

2. **Support and expand school-based sealant programs**: School-based sealant programs in Colorado are expanding through a variety of funding sources. Although the bill to have state general fund support did not pass on its initial try, it is important to continue funding and expanding the existing programs. School-based sealant programs likely will not be self-sustaining as the very low-income population targeted for the programs are often uninsured; and because the program is school-based, it is very difficult to obtain Medicaid and CHP+ information to be able to bill for services (although work is ongoing in this area).

3. **Support preventive activities such as Cavity Free at Three**: Assuring children receive an oral health screening/exam by age one, coupled with motivational interviewing and preventive measures is a recognized best practice and needs continual support. With the recent provision to allow primary care providers to bill for these procedures, it may take several years to evaluate the overall effectiveness of this aspect of the program. However, new providers will need training and others may need refresher courses. Support for on-going evaluation of the caries reduction outcomes will also be needed through enhanced oral disease surveillance (e.g. Head Start and preschool screenings).

4. **Support integration of “dental home” with “medical home” initiatives**: Colorado’s current vision of Medical Home includes oral and mental health, but operationalizing is more problematic. Colorado realizes the “home” is an approach, not a place, so the dental home may very well be a component of primary care, which the Cavity Free at Three initiative is addressing. This recommendation goes further to support integration of medical and dental electronic health records and dental should be considered in any Health Information Exchange and Technology discussions (HIE and HIT).

5. **Support interprofessional education efforts**: Oral health is a component of overall health and oral disease should be a concern for all health professionals due to the nature of
transmission of bacteria in children and its connection to chronic disease in adults. Supporting efforts to increase interprofessional education in all health professional schools is an emerging best practice and is necessary if we are to realize improved oral health outcomes.

6. **Support agencies and groups that advocate for children to include oral health:**
While it is important to bring other health professions on board, it is also imperative that advocates for children (including Early Childhood Education, child care centers, Colorado Children’s Campaign, WIC, etc) understand the importance of including oral health in discussions about health and school readiness. The work of the Early Childhood Colorado consortium and the upcoming systems dynamic modeling by the CDPHE Oral Health Unit will direct the most effective use of funding and effort. Policy to mandate oral health exams for school entry may have the effect of raising awareness of the importance of oral health, but potentially increase frustration regarding lack of resources for addressing the identified needs. Support of local oral health coalitions to devise local strategies may be helpful as well.

7. **Support case management services:** In the early 1990’s, the move was away from case management services to a strictly medical model for increasing access to care for all types of health services, including oral health. The pendulum has swung back to reconsidering case management as a means of improving targeted populations compliance with appointments, understanding of health issues, and compliance with preventive recommendations. Many dentists do not accept Medicaid and state they had no idea EPSDT case managers exist. On the other hand, EPSDT case managers state they cannot get a foot in the door in dental offices. A bridge needs to be forged to eliminate this barrier through efforts similar to the CCHAP project with physicians.

8. **Support efforts to reduce vertical transmission of oral bacteria:** While preventive dental visits are important during pregnancy and during child-bearing years, education about how to stop the transmission of Streptococcus mutans bacteria, similar to efforts to avoid H1N1 influenza, could be employed. Strategic placement of messaging (e.g. public baby changing tables, grocery bags, baby bottle inserts, post-delivery hospital discharge gifts, posters in check cashing facilities, churches), while difficult to evaluate in the short term, may have the desired impact in the long term.

9. **Support the provision of oral health services by a variety of health care providers:** Oral health is every health care provider’s concern and everyone is needed if Colorado is to make significant improvements in the oral health of its children. Primary care providers, alternative and midlevel oral health providers – all need to be recognized as qualified providers when addressing oral disease in children.

10. **Support oral health services/coverage for women of child bearing age to address the transmission of oral disease:** Any effort to reduce oral disease in children, improve oral health literacy, and change health behavior will need to address the oral health of the mother/primary care giver to have the desired impact.

Each of these strategies will align with the Patient Protection and Affordable Care Act and Healthy People 2020, and keep Colorado on the forefront of innovation in reducing dental caries in children and improving the oral health of all Coloradans.
Early Childhood Colorado Framework

A COLLECTIVE VISION ON BEHALF OF COLORADO’S YOUNG CHILDREN AND THEIR FAMILIES.

Appendix A

EARLY CHILDHOOD COLORADO PROVIDES A FRAMEWORK THAT:

- Recognizes the needs of the whole child and family.
- Communicates the vision for comprehensive early childhood work.
- Focuses on specific measurable outcomes.
- Guides, organizes, and focuses the actions and accountability of public and private stakeholders.

THIS WORK IS GUIDED BY THE FOLLOWING PRINCIPLES:

- Be child-focused and family-centered.
- Recognize and respond to variations in cultures, languages, and abilities.
- Use data to inform decisions.
- Build on strengths of communities and families.
- Focus on children from birth to age 8.
- Promote partnerships.
- Act at state, local, and statewide levels.
### Objectives Retained As Is From Healthy People 2010

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
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<tbody>
<tr>
<td>OH HP2020–1</td>
<td>Increase the proportion of oral and pharyngeal cancers detected at the earliest stage.</td>
</tr>
<tr>
<td>OH HP2020–2</td>
<td>Increase the proportion of the U.S. population served by community water systems with optimally fluoridated water.</td>
</tr>
<tr>
<td>OH HP2020–3</td>
<td>Increase the proportion of children and adults who use the oral health care system each year.</td>
</tr>
<tr>
<td>OH HP2020–4</td>
<td>Increase the proportion of low-income children and adolescents who received any preventive dental service during the past year.</td>
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<tr>
<td>OH HP2020–5</td>
<td>Increase the number of States and the District of Columbia that have an oral and craniofacial health surveillance system.</td>
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### Objectives Retained But Modified From Healthy People 2010

<table>
<thead>
<tr>
<th>Objective</th>
<th>Description</th>
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<tbody>
<tr>
<td>OH HP2020–6</td>
<td>Reduce the proportion of children and adolescents who have dental caries experience in their primary or permanent teeth.</td>
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<tr>
<td>OH HP2020–7</td>
<td>Reduce the proportion of children, adolescents, and adults with untreated dental decay.</td>
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<tr>
<td>OH HP2020–8</td>
<td>Increase the proportion of adults who have never had a permanent tooth extracted because of dental caries or periodontal disease.</td>
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<tr>
<td>OH HP2020–9</td>
<td>Reduce periodontitis (aged 45–74 years).</td>
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<tr>
<td>OH HP2020–10</td>
<td>Increase the proportion of children who have received dental sealants on their molar teeth.</td>
</tr>
<tr>
<td>OH HP2020–11</td>
<td>(Developmental) Increase the proportion of long-term care residents who use the oral health care system each year.</td>
</tr>
<tr>
<td>OH HP2020–12</td>
<td>Increase the proportion of school-based health centers with an oral health component.</td>
</tr>
<tr>
<td>OH HP2020–13</td>
<td>Increase the proportion of local health departments and Federally Qualified Health Centers (FQHCs) that have an oral health component.</td>
</tr>
<tr>
<td>OH HP2020–14</td>
<td>Increase the number of States, and the District of Columbia that have a system for recording and referring infants and children with cleft lips and cleft palates to craniofacial anomaly rehabilitative teams.</td>
</tr>
<tr>
<td>OH HP2020–15</td>
<td>Increase the number of health agencies that have a public dental health program directed by a dental professional with public health training.</td>
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### Objectives New to Healthy People 2020

<table>
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<th>Objective</th>
<th>Description</th>
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<tr>
<td>OH HP2020–16</td>
<td>(Developmental) Increase the proportion of adults who receive preventive screening and counseling from dental professionals.</td>
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</table>
OH HP2020–17: **Increase the proportion of patients that receive oral health services at Federally Qualified Health Centers each year.**

**Objectives Archived From Healthy People 2010**
Archived objectives are Healthy People 2010 objectives that are not included in the proposed set of Healthy People 2020 objectives for data, target or policy reasons.

**HP2010 21-5:** **Reduce periodontal disease: gingivitis.**
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HCPF – Colorado Department of Health Care Policy and Financing. Data obtained via email correspondence from Marcy Bonnett, RDH on several occasions 2009-2010.


Savoie, K. University of Colorado Area Health Education Center: Personal communication 01/14/10.


TOPS – Total Oral Prevention Strategies. [www.kidsoralprevention.org](http://www.kidsoralprevention.org)


“Colorado is recognized for its exemplary efforts on improving the oral health of children, but more can certainly be done in efforts to eradicate dental disease.”

— Diane Brunson, RDH, MPH