Dental Caries in Children

Evidenced-Based Recommendations in Clinical and Public Health Practices

Jaana Gold, DDS, MPH, PhD, CPH
Professor
AT Still University
University of Florida College of Dentistry
Gainesville FL
Learning Objectives

• Describe the epidemiology and etiology of dental caries in children
• Discuss the role of sugar-containing beverages (SSBs) and nutritional counseling in caries prevention
• Discuss the evidence-based recommendations for caries prevention and management
Obesity

- Diabetes
- Heart disease
- Stroke
- Depression
- Cancer
- COVID19
- Higher mortality
Dental Caries

- Dental caries is the most prevalent chronic infectious disease and unmet health need, especially among low-income children.
- Untreated caries can cause pain and infections.
- Oral diseases can affect systemic health.
- Obesity and dental caries are multifactorial diseases in children and share common nutritional risk factors.
- Disparities exist in oral health and access to care.
- Dental caries and obesity are preventable or at least controllable.
Dental Caries

- Biofilm bacteria (S. mutans etc) metabolize sugars from carbohydrates into acid.
- Over time this acid demineralizes the tooth.
- CAVITY = decay
How Does Infection Occur?

• Cariogenic bacteria - *S. mutans* colonizes in the oral cavity around the time of tooth eruption

• Most likely infants become infected from their mothers, caregivers, siblings or other individuals in close contact

• Infants whose mothers harbor high levels of *S. mutans* become colonized more readily than infants of mothers with low levels
Dental Caries Epidemiology

- 5 X more common than asthma
- 46% of children had treated or untreated dental caries (NHANES)
- 13% of children had untreated dental caries (NHANES)
- Florida (2018):
  - 25% of 3rd graders had untreated dental caries
    - 35% of Black
    - 23% White
    - 21% Hispanic
  - 34% of Head Start children had dental caries and 24% had untreated dental caries (FLDOH)
Early Childhood Caries (ECC)

• “Nursing caries" or "baby bottle tooth decay”
• A severe, rapidly progressing form of tooth decay in children < 6 years of age
• Prevalence: 5% of all US children; 30-50% of low-income children
• Florida: 6% of Early Head Start children and 18% of Head Start children had ECC

Gold & Tomar 2018
FLORIDA ISSUES

- Large Medicaid, low-income, immigrant and rural populations
- 25% of 3rd graders with untreated dental caries
  - Low Medicaid utilization in 2018 (ACHA, 2019)
    - US: 50%
    - Florida: 41%
    - Marion County: 32% for children; 5% for adults
  - Dentist population ratio (ACHA, 2019)
    - US: 61 dentists per 100,000.
    - Florida: 56 dentists per 100,000
    - Marion County: 37 dentists per 100,000.

https://ahca.myflorida.com/medicaid/Finance/data_analytics/index.shtml
Hospital Emergency Department (ED) visits for preventable dental reasons in 2018

- Florida: 117,247 ED visits with total hospital charges of $323,434,519.
- Marion County: 3,727 ED visits with total hospital charges of $7,250,454.
- In 2017, Marion County had 1,311 hospital ED visits/100,000 residents for preventable dental conditions, compared to only 819/100,000 residents statewide in Florida (ACHA, 2019).
Social Determinants of Health

COMMON RISK FACTORS AND THEIR IMPORTANCE FOR ORAL HEALTH

Modiﬁed from Sheiham & Watt, 2000

- Tooth decay
- Periodontal disease
- Oral trauma
  - Diabetes
  - Obesity
  - Cancers
  - Cardiovascular disease
  - Respiratory disease
- Stress
- Unhealthy diet
- Tobacco use
- Alcohol
- Lack of exercise
- Poor hygiene
- Injuries
- Lack of control
Sugar-Sweetened Beverages (SSBs)

Drinks to which any forms of sugar are added.

- soft drinks (soda or pop), fruit drinks, sports and energy drinks, sweetened tea and coffee, sweetened milk or milk alternatives, and any other beverages to which sugar (high-fructose corn syrup or sucrose) has been added

Added sugars do not include fructose and lactose when present naturally in fruits, vegetables, and unsweetened milk.

SSBs are the single largest category of caloric intake in children ages 2-18

On average, kids are drinking more than 30 gallons of sugary drinks per year.

CDC, AAP
stateofchildhoodobesity.org/sugary-drinks-harm-kids-health/
Sugary Drink Consumption in Children

What types of drinks do children consume on any given day?

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Water</th>
<th>Sugar-Sweetened Beverages</th>
<th>Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-5 years old</td>
<td>83</td>
<td>44</td>
<td>65</td>
</tr>
<tr>
<td>6-11 years old</td>
<td>84</td>
<td>59</td>
<td>53</td>
</tr>
<tr>
<td>12-19 years old</td>
<td>81</td>
<td>57</td>
<td>34</td>
</tr>
</tbody>
</table>

Source: NHANES, Beverage Choices Among US Children, 2015-16

What types of drinks do children consume on any given day (by race and ethnicity)?

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Sweetened beverages</th>
<th>Soft drinks</th>
<th>Fruit drinks</th>
<th>Sports/energy drinks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Hispanic white</td>
<td>51</td>
<td>41</td>
<td>59</td>
<td>7</td>
</tr>
<tr>
<td>Non-Hispanic black</td>
<td>32</td>
<td>27</td>
<td>37</td>
<td>8</td>
</tr>
<tr>
<td>Hispanic</td>
<td>22</td>
<td>20</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>Asian</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

Source: NHANES, What We Eat in America, 2015-16
Sugary Drink Consumption in Children

Sugary drinks are the leading source of added sugars in children’s diets across all age groups.

- **2-5 years old**: 21.3%
- **6-11 years old**: 28.7%
- **12-19 years old**: 36.5%

**Percent of added sugar in children’s diets that comes from sugary drinks**

Nearly one in five U.S. high school students drinks a soda or pop at least once a day.

**I drank a soda or pop at least once per day**
- Total: 20%
- White: 22%
- Black: 20%
- Hispanic: 24%

**I drank a sports drink at least once per day**
- Total: 15%
- White: 13%
- Black: 18%
- Hispanic: 20%

Sources: NHANES, Added Sugars in American's Children's Diets, 2015-16. Note: The other sources of added sugar in children's diets that were studied include sweet bakery products (e.g., cakes, cookies, pies), candy, other desserts, ready-to-eat cereals, and flavored milk.

Sources: CDC Study, Reduction in Sugary Drink Consumption Among High School Youths; YRBS results.
Food Sources of Added Sugars

Food Category Sources of Added Sugars in the U.S. Population Ages 2 Years and Older

- Data Source: What We Eat in America (WWEIA) Food Category analyses for the 2015 Dietary Guidelines Advisory Committee. Estimates based on day 1 dietary recalls from WWEIA, NHANES 2009-2010.
Added Sugars: Intakes and Limit

Average Intakes as a Percent of Calories per Day by Age-Sex Group, in Comparison to the Dietary Guidelines Maximum Limit of Less than 10 Percent of Calories

*Consume <10% of calories per day from added sugars*

- CDC.gov/nutrition
- What We Eat in America, NHANES 2007-2010 for average intakes by age-sex group.
Limit your sugar intake

• WHO: Reduce the intake of sugar to <10 % of total energy intake, with increased benefits of reducing intake to <5% of calories

• AAPD: Reduce children’s risk of weight gain and dental caries, limiting the intake of sugar to <5% of total energy intake per day (less than 16 grams of sugar for children aged 4–8)

• AAP: No juice before 1 year of age

So, what do experts recommend about sugar-sweetened beverages?

0-6 MONTHS: Not recommended
6-12 MONTHS: Not recommended
1-3 YEARS: Not recommended
4-5 YEARS: Not recommended
Healthy Kids are Sweet Enough

Kids age 2-18 should have **LESS THAN 25 GRAMS or SIX TEASPOONS of ADDED SUGARS DAILY** for a healthy heart.

**Source:** American Heart Association statement Added Sugars and Cardiovascular Disease Risk in Children.
HEALTHY KIDS ARE SWEET ENOUGH

Heart Healthy Tip: **NO MORE THAN 1** Sugary Drink a Week

How many teaspoons of sugar in just one **SMALL 8 OUNCE** serving?

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>WATER</td>
<td>SPORTS DRINK</td>
<td>SWEET TEA</td>
<td>SODA</td>
<td>LEMONADE</td>
</tr>
<tr>
<td>0 TSPS</td>
<td>4 TSPS</td>
<td>6 TSPS</td>
<td>6 TSPS</td>
<td>7 TSPS</td>
</tr>
</tbody>
</table>

Learn more at [heart.org/sugar](http://heart.org/sugar)

Source: USDA National Nutrient Database for Standard Reference Release 28
So, how much water is good for kids?

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Water Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 MONTHS</td>
<td>No supplemental drinking water needed</td>
</tr>
<tr>
<td>6-12 MONTHS</td>
<td>0.5-1 cup/day (offer in a cup at meal times once solid food is introduced)</td>
</tr>
<tr>
<td>1-3 YEARS</td>
<td>1-4 cups/day</td>
</tr>
<tr>
<td>4-5 YEARS</td>
<td>1-5 cups/day</td>
</tr>
</tbody>
</table>
AAPD Recommendations

• Education regarding daily sugar-consumption, as well as the sugar content of foods, beverages and oral liquid medications.

• Dental professionals need to identify children who consume frequent or large quantities of sugar-containing foods and beverages, and who are at risk for dental caries and obesity.

• Dental professionals’ engagement in nutrition education and provision, when necessary, of appropriate referral for dietary counseling from pediatrician or nutritional specialist.
Caries Disease

• Etiologically complex multifactorial disease process
• Dynamic disease process that involves the shift of the balance between protective factors (remineralization) and pathological factors (demineralization) to favor demineralization of the tooth structure over time

Biological Risk Factors
- Fermentable carbohydrates
- Acid-producing bacteria
- Hyposalivation

Protective Factors
- Saliva, calcium, phosphate
- Remineralization — fluoride
- Antibacterial therapy

Caries

No Caries
Modern Caries Management

Detection
Diagnosis
Risk Assessment

Preventive + non-surgical + MI treatment (Medical Model)

Restorative (Surgical) tx + MI

Optimal Oral Health

ASSESSMENT
Caries Prevention and Management

- **Behavioral Modification: Oral Hygiene and Diet**
  - 2 x/day toothbrushing 1,100 ppm fluoride toothpaste

- **Topical Fluoride Application for Caries Prevention or Arrest**
  - Professional 5% NaF Varnish (22,600ppm)
  - Home use of 0.5% fluoride (5,000 ppm) (>6 yrs of age)
  - 0.09% fluoride mouthrinse (>6 yrs of age)
  - 38% SDF (anti-microbial and remineralization)

- **Pit-and-Fissure Sealants**

- **Antimicrobial tx**
  - 38% SDF, CHX, xylitol
Fluoride Varnishes

- 22,600 ppm fluoride
- Remineralization of early lesions
- Prolonged source of F - Provides F as CaF$_2$
- 2-4x/year, 3x in a week/year based on the risk level and activity
- Applications by individual needs, surfaces
Biannual SDF treatments to reduce pain and infections
- Decreases dentin hypersensitivity
- Arrests and prevents dental caries

✓ 38% SDF contains ~44,800 ppm F (5%) and ~253,870 ppm Ag (25%)

✓ Both fluoride and silver ions contribute to mechanism of action
  ✓ Silver acts as an anti-microbial agent killing bacteria and preventing the formation of new biofilm
  ✓ Fluoride prevents demineralization, promotes remineralization

Yamaga et al. 1972
38% Silver Diamine Fluoride (SDF)

- In 2014, FDA cleared SDF in US for the treatment of dentinal hypersensitivity
- Off-label use for caries treatment
- In 2015, 1 product available in US market: Advantage Arrest, by Elevate Oral Care
  www.elevateoralcare.com
Silver Diamine Fluoride

- Advanced cases or cases involving very young children
- Extreme caries risk (xerostomia, ECC)
- Pts with behavioral or medical management challenges
- Patients without access to dental care
- Community-based, outreach programs
38% SDF Application

- Consent
- Protect the counters and patient (covers, eyewear etc)
- 1 drop of SDF into a dish (treats ~1-5 teeth)
- Remove excess saliva
- Isolate with cotton rolls
- Apply petroleum jelly to gingiva near affected areas
- (Air dry)
- Apply with microbrush to the lesion
- Allow to absorb for 1 min (protect w FV)
- No rinsing
- 1-2 x/year (most studies)
- 3 x in 2 wks
Considerations for SDF Use

- No excavation, decay removal or anesthesia needed
- Do not use on exposed pulp
- Does not stain sound tooth tissue
- Darkening of the lesions occur over 24 hrs and days (do not light-cure)
- SDF can stain the skin which will clear in 2-3 weeks without treatment
- SDF can permanently stain surfaces, clothes

![Images of teeth at different times](Time 0, 1 day, 1 week)
• Meta-analysis of the 5 studies using 38% SDF to arrest caries on primary teeth
• The overall caries-arresting rate after 38% SDF treatment was 81%
• ADA Clinical Guidelines: 38% silver diamine fluoride solution applied biannually [is] effective for arresting advanced cavitated carious lesions on any coronal surface (low certainty in permanent teeth to moderate in primary)
A clinical study in Oregon showed 100% arrest after 3 months

100% acceptance by parents
### Expert Panel Recommendation

<table>
<thead>
<tr>
<th>SDF (silver diamine fluoride)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To arrest advanced cavitated carious lesions on any coronal surface of primary teeth,</strong> the expert panel recommends clinicians prioritize the use of 38% silver diamine fluoride (SDF) solution (barnyard application) over 5% sodium fluoride varnish (application once per week for 3 weeks).†</td>
</tr>
<tr>
<td>Low to Very Low</td>
</tr>
<tr>
<td><strong>To arrest or reverse noncavitated carious lesions on occlusal surfaces of primary teeth,</strong> the expert panel recommends clinicians prioritize the use of sealants + 5% sodium fluoride varnish (application every 3-6 months) or sealants alone over 5% sodium fluoride varnish alone (application every 3-6 months), 1.23% acidulated phosphate fluoride gel (application every 3-6 months), resin infiltration + 5% sodium fluoride varnish (application every 3-6 months), or 0.2% sodium fluoride mouthrinse (once per week).‡</td>
</tr>
<tr>
<td>Low to Very Low</td>
</tr>
<tr>
<td><strong>To arrest or reverse noncavitated carious lesions on facial or lingual surfaces of primary teeth,</strong> the expert panel suggests clinicians use 1.23% acidulated phosphate fluoride gel (application every 3-6 months) or 5% sodium fluoride varnish (application every 3-6 months).‡</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td><strong>To arrest or reverse noncavitated carious lesions on approximal surfaces of primary teeth,</strong> the expert panel suggests clinicians use 5% sodium fluoride varnish (application every 3-6 months), resin infiltration alone, resin infiltration + 5% sodium fluoride varnish (application every 3-6 months), or sealants alone.‡</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td><strong>To arrest or reverse noncavitated carious lesions on coronal surfaces of primary teeth,</strong> the expert panel suggests clinicians do not use 10% casein phosphopeptide-amorphous calcium phosphate paste if other fluoride interventions, sealants, or resin infiltration is accessible.</td>
</tr>
<tr>
<td>Low</td>
</tr>
</tbody>
</table>

---

* "Clinicians" refers to the target audience for this guideline, but only those authorized/trained to perform the specified interventions should do so.

† In keeping with the concept of informed consent, all nonrestorative and restorative treatment options and their potential side effects (such as blackened tooth surfaces treated with silver diamine fluoride) should be offered and explained to all patients.

‡ The order of treatments included in this recommendation represents a ranking of priority defined by the panel when accounting for treatment effectiveness, feasibility, patients’ values and preferences, and resource utilization. Considerations such as a particular patient’s values and preferences, special needs, or insurance status should inform clinical decision making.
### Summary of clinical recommendations for the nonrestorative treatment of caries on permanent teeth

**GRADE Certainty in the Evidence**

- **High**: We are very confident that the true effect is close to that of the estimate of the effect.
- **Moderate**: We are moderately confident in the effect estimate. The true effect is likely to be close to the estimate of the effect.
- **Low**: Our confidence in the effect estimate is limited.
- **Very Low**: We have very little confidence in the effect estimate.

**GRADE Interpretation of Strength of Recommendations**

<table>
<thead>
<tr>
<th>Implications</th>
<th>Strong Recommendations</th>
<th>Conditional Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Patients</td>
<td>Most individuals in this situation would want the recommended course of action and only a small proportion would not.</td>
<td></td>
</tr>
<tr>
<td>For Clinicians</td>
<td>Most individuals should receive the intervention.</td>
<td></td>
</tr>
<tr>
<td>For Policy Makers</td>
<td>The recommendation can be adapted as policy in most situations.</td>
<td></td>
</tr>
</tbody>
</table>

### Expert Panel Recommendation

**To arrest advanced cavitated carious lesions on any coronal surface of permanent teeth**, the expert panel suggests

- Clinicians prioritize the use of 38% silver diamine fluoride (SDF) solution (barnual application) over 5% sodium fluoride varnish (application once per week for 3 weeks).<sup>*</sup>

**To arrest or reverse noncavitated carious lesions on occlusal surfaces of permanent teeth**, the expert panel recommends

- Clinicians prioritize the use of sealants + 5% sodium fluoride varnish (application every 3-6 months) or sealants alone over 5% sodium fluoride varnish alone (application every 3-6 months), 1.23% acidiPhate fluoride gel (application every 3-6 months), or 0.2% sodium fluoride mouthrinse (once per week).<sup>†</sup>

**To arrest or reverse noncavitated carious lesions on facial or lingual surfaces of permanent teeth**, the expert panel suggests

- Clinicians use 1.23% acidulated phosphate fluoride gel (application every 3-6 months) or 5% sodium fluoride varnish (application every 3-6 months).<sup>†</sup>

**To arrest or reverse noncavitated carious lesions on approximal surfaces of permanent teeth**, the expert panel suggests

- Clinicians use 5% sodium fluoride varnish (application every 3-6 months), resin infiltration alone, resin infiltration + 5% sodium fluoride varnish (application every 3-6 months), or sealants alone.<sup>‡</sup>

**To arrest or reverse noncavitated and cavitated carious lesions on root surfaces of permanent teeth**, the expert panel suggests

- Clinicians prioritize the use of 5,000 ppm fluoride (1.1% sodium fluoride) toothpaste or gel (at least once per day) over 5% sodium fluoride varnish (application every 3-6 months), 38% SDF + potassium iodide solution (annual application), 38% SDF solution (annual application), or 1% chlorhexidine + 1% thymol varnish (application every 3-6 months).<sup>‡, †</sup>

**To arrest or reverse noncavitated carious lesions on coronal surfaces of permanent teeth**, the expert panel suggests

- Clinicians do not use 10% casein phosphopeptide-amorphous calcium phosphate paste if other fluoride interventions, sealants, or resin infiltration is accessible.<sup>‡</sup>
Early Prevention

• Prevent frequent consumption of liquids containing sugar
• For infants, avoid bottles containing formula, juice or other sweetened drinks
• Brush 2x daily using a soft toothbrush and a small amount (rice-sized) of fluoridated toothpaste for children under 3.
• For children 3–6 years, use a pea-sized amount of fluoridated toothpaste
Summary

• Oral health is essential to overall health for children and their families

• Sugary drinks harm our health and contribute to serious diseases, like obesity and diabetes, that disproportionately affect Black and Latin communities.

• We need to improve oral health of children and their families (e.g., racial/ethnic minorities, those with lower education, or with lower income)

• Dental caries is preventable

• We need to improve access to preventive and comprehensive oral care, particularly among the most vulnerable groups

• Integrate oral health care into overall health care
Major Messages

• Concerted efforts among all segments of society are needed to support healthy lifestyle choices.

• Professionals have an important role in leading disease-prevention efforts.

• Collaborative efforts can have a meaningful impact on the health of current and future generations.
Resources

• Healthy Eating Research, a national program of the Robert Wood Johnson Foundation [https://healthydrinkshealthykids.org/professionals/](https://healthydrinkshealthykids.org/professionals/)


• ChooseMyPlate.gov

• ADA EBD [https://ebd.ada.org/en](https://ebd.ada.org/en)

• AHA [https://www.heart.org/en](https://www.heart.org/en)
Next …

• Obesity Webinar Dec 10\textsuperscript{th} 2020
• Motivational Interviewing webinar 2021
• Recordings
• Project Website
• Tools, handouts, materials, flyers
• social media messages
Questions?

Jaana Gold, DDS, MPH, PhD, CPH
Email: jgold@dental.ufl.edu