

# Caries-risk Assessment and Management for Infants, Children, and Adolescents

## Latest Revision

2019

### Purpose

The American Academy of Pediatric Dentistry recognizes that caries-risk assessment and management protocols, also called care pathways, can assist clinicians with decisions regarding treatment based upon child's age, caries risk, and patient compliance and are essential elements of contemporary clinical care for infants, children, and adolescents. These recommendations are intended to educate healthcare providers and other interested parties on the assessment of caries risk in contemporary pediatric dentistry and aid in clinical decision-making regarding evidence- and risk-based diagnostic, fluoride, dietary, and restorative protocols.

### Methods

This document was developed by the Council on Clinical Affairs and adopted in 2002<sup>1</sup> and last revised in 2014<sup>2</sup>. To update this best practices document, an electronic search of systematic reviews/meta-analyses or expert panels was conducted from 2012 to 2018 using the terms: caries risk assessment, diet, sealants, fluoride, radiology, non-restorative treatment, active surveillance, caries prevention. There were four systematic reviews that informed this update on caries risk assessment.<sup>3-6</sup> There were 10 systematic reviews and clinical practice guidelines that inform this update on care pathways for caries.<sup>7-16</sup> When data did not appear sufficient or were inconclusive, recommendations were based upon expert and/or consensus opinion by experienced researchers and clinicians.

### Background

#### Caries-risk assessment

Risk assessment procedures used in medical practice generally have sufficient data to accurately quantitate a person's disease susceptibility and allow for preventive measures. However, in dentistry there still is a lack of sufficiently validated multivariate screening tools to determine which children are at a higher risk for dental caries.<sup>5,6</sup> Nevertheless, caries-risk assessment:

1. fosters the treatment of the disease process instead of treating the outcome of the disease.
2. allows an understanding of the disease factors for a specific patient and aids in individualizing preventive discussions.
3. individualizes, selects, and determines frequency of preventive and restorative treatment for a patient.
4. anticipates caries progression or stabilization.

Caries-risk assessment models currently involve a combination of factors including diet, fluoride exposure, a susceptible host, and microflora that interplay with a variety of social, cultural, and behavioral factors. Caries-risk assessment is the determination of the likelihood of the increased incidence of caries (i.e., the number of new cavitated or incipient lesions) during a certain time period<sup>9</sup> or the likelihood that there will be a change in the size or activity of lesions already present. With the ability to detect caries in its earliest stages (i.e., non-cavitated or white spot lesions), health care providers can help prevent cavitation.<sup>3</sup>

Caries risk indicators are variables that are thought to cause the disease directly (e.g., microflora) or have been shown useful in predicting it (e.g., life-time poverty, low health literacy) and include those variables that may be considered protective factors. The most commonly used caries risk indicators include presence of caries lesions, low salivary flow, visible plaque on teeth, high frequency sugar consumption, presence of appliance in the mouth, health challenges, socio-demographic factors, access to care, and cariogenic microflora.<sup>3</sup> Protective factors in caries risk include a child's receiving optimally-fluoridated water, having teeth brushed daily with fluoridated toothpaste, receiving topical fluoride from a health professional, and having regular dental care.<sup>3</sup>

Some issues with the current risk indicators include past caries experience is not particularly useful in young children and activity of lesions may be more important than number of lesions. Low salivary flow is difficult to measure and may not be relevant in young children.<sup>17</sup> Frequent sugar consumption is hard to quantitate. Socio-demographic factors are just a proxy for various exposures/behaviors which may affect caries risk. Predictive ability of various risk factors across the life span and how risk changes with age have not been determined.<sup>3</sup> Furthermore, genome-level risk factors may account for substantial variations in caries risk.<sup>3</sup>

Risk assessment tools can aid in the identification of reliable predictors and allow dental practitioners, physicians, and other non-dental health care providers to become more actively involved in identifying and referring high-risk children. Tables 1 and 2 incorporate available evidence into practical tools to assist dental practitioners, physicians, and other non-dental health care providers in assessing levels of risk for caries development in infants, children, and adolescents. As new evidence emerges, these tools can be refined to provide greater

predictably of caries in children prior to disease initiation. Furthermore, the evolution of caries-risk assessment tools and care pathways can assist in providing evidence for and justifying periodicity of services, modification of third-party involvement in the delivery of dental services, and quality of care with outcomes assessment to address limited resources and work-force issues.

### Care pathways for caries management

Care pathways are documents designed to assist in clinical decision-making; they provide criteria regarding diagnosis and treatment and lead to recommended courses of action.<sup>8</sup> The pathways are based on evidence from current peer-reviewed literature and the considered judgment of expert panels, as well as clinical experience of practitioners. Care pathways for caries management in children aged 0-2 and 3-5 years old were first introduced in 2011.<sup>18</sup> Care pathways are updated frequently as new technologies and evidence develop.

Historically, the management of dental caries was based on the notion that it was a progressive disease that eventually destroyed the tooth unless there was surgical/restorative intervention. Decisions for intervention often were learned from

unstandardized dental school instruction and then refined by clinicians over years of practice.

It is now known that surgical intervention of dental caries alone does not stop the disease process. Additionally, many lesions do not progress, and tooth restorations have a finite longevity. Therefore, modern management of dental caries should be more conservative and includes early detection of non-cavitated lesions, identification of an individual's risk for caries progression, understanding of the disease process for that individual, and active surveillance to apply preventive measures and monitor carefully for signs of arrest or progression.

Care pathways for children further refine the decisions concerning individualized treatment and treatment thresholds based on a specific patient's risk levels, age, and compliance with preventive strategies (Tables 3 and 4). Such clinical pathways yield greater probability of success, fewer complications, and more efficient use of resources than less standardized treatment.<sup>8</sup>

Content of the present caries management protocol is based on results of systematic reviews and expert panel recommendations that provide better understanding of and

**Table 1. Caries-risk Assessment Form for 0-5 Years Old**

| Factors  | High risk | Moderate risk | Low risk |
|--|-----------|---------------|----------|
| <i>Risk factors, social/biological</i>   |           |               |          |
| Mother/primary caregiver has active dental caries  | Yes       |               |          |
| Parent/caregiver has life-time of poverty, low health literacy   | Yes       |               |          |
| Child has frequent exposure (>3 times/day) between-meal sugar-containing snacks or beverages per day             | Yes       |               |          |
| Child uses bottle or non-spill cup containing natural or added sugar frequently, between meals and/or at bedtime | Yes       |               |          |
| Child is a recent immigrant  |           | Yes           |          |
| Child has special health care needs  |           | Yes           |          |
| <i>Protective factors</i>  |           |               |          |
| Child receives optimally-fluoridated drinking water or fluoride supplements                                      |           |               | Yes      |
| Child has teeth brushed daily with fluoridated toothpaste  |           |               | Yes      |
| Child receives topical fluoride from health professional   |           |               | Yes      |
| Child has dental home/regular dental care  |           |               | Yes      |
| <i>Clinical findings</i>   |           |               |          |
| Child has non-cavitated (incipient/white spot) caries or enamel defects  | Yes       |               |          |
| Child has visible cavities or fillings or missing teeth due to caries  | Yes       |               |          |
| Child has visible plaque on teeth  | Yes       |               |          |

Circling those conditions that apply to a specific patient helps the practitioner and parent understand the factors that contribute to or protect from caries. Risk assessment categorization of low, moderate, or high is based on preponderance of factors for the individual. However, clinical judgment may justify the use of one factor (e.g., frequent exposure to sugar-containing snacks or beverages, more than one decayed missing filled surfaces [dmfs]) in determining overall risk.

Overall assessment of the child's dental caries risk: High  Moderate  Low

Adapted with permission from the California Dental Association, Copyright © October 2007.

**Table 2. Caries-risk Assessment Form for ≥6 Years Old**  
(For Dental Providers)

| Factors  | High risk | Moderate risk | Low risk |
|--|-----------|---------------|----------|
| <i>Risk factors, social/biological</i>   |           |               |          |
| Patient has life-time of poverty, low health literacy  | Yes       |               |          |
| Patient has frequent exposure (>3 times/day) between-meal sugar-containing snacks or beverages per day | Yes       |               |          |
| Child is a recent immigrant  |           | Yes           |          |
| Patient has special health care needs  |           | Yes           |          |
| <i>Protective factors</i>  |           |               |          |
| Patient receives optimally-fluoridated drinking water  |           |               | Yes      |
| Patient brushes teeth daily with fluoridated toothpaste  |           |               | Yes      |
| Patient receives topical fluoride from health professional   |           |               | Yes      |
| Patient has dental home/regular dental care  |           |               | Yes      |
| <i>Clinical findings</i>   |           |               |          |
| Patient has ≥1 interproximal caries lesions  | Yes       |               |          |
| Patient has active non-cavitated (white spot) caries lesions or enamel defects                         | Yes       |               |          |
| Patient has low salivary flow  | Yes       |               |          |
| Patient has defective restorations   |           | Yes           |          |
| Patient wears an intraoral appliance   |           | Yes           |          |

Circling those conditions that apply to a specific patient helps the practitioner and patient/parent understand the factors that contribute to or protect from caries. Risk assessment categorization of low, moderate, or high is based on preponderance of factors for the individual. However, clinical judgment may justify the use of one factor (e.g., interproximal lesions, low salivary flow) in determining overall risk.

Overall assessment of the dental caries risk: High  Moderate  Low

Adapted with permission from the California Dental Association, Copyright © October 2007.

**Table 3. Example of a Caries Management Pathways for 0-5 Years Old**

| Risk Category | Diagnostics  | Interventions  |                    |          | Restorative  |
|---------------|--|--|--------------------|----------|--|
|               |  | Fluoride   | Dietary Counseling | Sealants |  |
| Low risk      | <ul style="list-style-type: none"> <li>– Recall every six to 12 months</li> <li>– Radiographs every 12 to 24 months</li> </ul> | <ul style="list-style-type: none"> <li>– Drink optimally fluoridated water</li> <li>– Twice daily brushing with fluoridated toothpaste</li> </ul>  | Yes                | Yes      | – Surveillance   |
| Moderate risk | <ul style="list-style-type: none"> <li>– Recall every six months</li> <li>– Radiographs every six to 12 months</li> </ul>      | <ul style="list-style-type: none"> <li>– Drink optimally fluoridated water</li> <li>– Twice daily brushing with fluoridated toothpaste</li> <li>– Fluoride supplements</li> <li>– Professional topical treatment every six months</li> </ul>                           | Yes                | Yes      | <ul style="list-style-type: none"> <li>– Active surveillance of non-cavitated (white spot) caries lesions</li> <li>– Restore of cavitated or enlarging caries lesions</li> </ul> |
| High risk     | <ul style="list-style-type: none"> <li>– Recall every three months</li> <li>– Radiographs every six months</li> </ul>          | <ul style="list-style-type: none"> <li>– Drink optimally fluoridated water</li> <li>– Twice daily brushing with fluoridated toothpaste</li> <li>– Professional topical treatment every three months</li> <li>– Silver diamine fluoride on cavitated lesions</li> </ul> | Yes                | Yes      | <ul style="list-style-type: none"> <li>– Active surveillance of non-cavitated (white spot) caries lesions</li> <li>– Restore of cavitated or enlarging caries lesions</li> </ul> |

Refer to notes below Table 4.

recommendations for diagnostic, preventive, and restorative treatments. Recommendations for the use of fluoridated toothpaste are based on the three systematic reviews,<sup>9,11,12</sup> and dietary fluoride supplements are based on the Centers for Disease Control and Prevention's fluoride guidelines;<sup>19</sup> professionally-applied and prescription strength home-use topical fluoride are based on two systematic reviews;<sup>10,12</sup> the use of silver diamine fluoride to arrest caries lesions also is based on two systematic reviews.<sup>13,14</sup> Radiographic diagnostic recommendations are based on the uniform guidelines from the three national organizations.<sup>7</sup> Recommendations for pit and fissure sealants, especially regarding primary teeth, are based on the American Dental Association Council on Scientific Affairs' systematic review of the use of pit-and-fissure sealants.<sup>15</sup> Dietary interventions are based on a systematic review of strategies to reduce sugar-sweetened beverages.<sup>16</sup> Caries risk is assessed at both the individual level and tooth level. Treatment of caries with interim therapeutic restorations is based on the American Academy of Pediatric Dentistry policy and recommended best practices.<sup>20,21</sup> Active surveillance

(prevention therapies and close monitoring) of enamel lesions is based on the concept that treatment of disease may only be necessary if there is disease progression,<sup>22</sup> and that caries can arrest without treatment.<sup>23</sup>

Other approaches to the assessment and treatment of dental caries will emerge with time and, with evidence of effectiveness, may be included in future guidelines on caries-risk assessment and care pathways.

## Recommendations

1. Dental caries-risk assessment, based on a child's age, social/biological factors, protective factors, and clinical findings, should be a routine component of new and periodic examinations by oral health and medical providers.
2. While there is not enough information at present to have quantitative caries-risk assessment analyses, estimating children at low, moderate, and high caries risk by a preponderance of risk and protective factors will enable a more evidence-based approach to medical provider referrals, as well as establish periodicity and intensity of diagnostic, preventive, and restorative services.

**Table 4. Example of a Caries Management Pathways for ≥6 Years Old**

| Risk Category | Diagnostics  | Interventions  |                    |          | Restorative  |
|---------------|--|--|--------------------|----------|--|
|               |  | Fluoride   | Dietary Counseling | Sealants |  |
| Low risk      | <ul style="list-style-type: none"> <li>– Recall every six to 12 months</li> <li>– Radiographs every 12 to 24 months</li> </ul> | <ul style="list-style-type: none"> <li>– Drink optimally fluoridated water</li> <li>– Twice daily brushing with fluoridated toothpaste</li> </ul>  | Yes                | Yes      | – Surveillance   |
| Moderate risk | <ul style="list-style-type: none"> <li>– Recall every six months</li> <li>– Radiographs every six to 12 months</li> </ul>      | <ul style="list-style-type: none"> <li>– Drink optimally fluoridated water</li> <li>– Twice daily brushing with fluoridated toothpaste</li> <li>– Fluoride supplements</li> <li>– Professional topical treatment every six months</li> </ul>                       | Yes                | Yes      | <ul style="list-style-type: none"> <li>– Active surveillance of non-cavitated (white spot) caries lesions</li> <li>– Restore of cavitated or enlarging caries lesions</li> </ul> |
| High risk     | <ul style="list-style-type: none"> <li>– Recall every three months</li> <li>– Radiographs every six months</li> </ul>          | <ul style="list-style-type: none"> <li>– Drink optimally fluoridated water</li> <li>– Brushing with 0.5 percent fluoride gel/paste</li> <li>– Professional topical treatment every three months</li> <li>– Silver diamine fluoride on cavitated lesions</li> </ul> | Yes                | Yes      | <ul style="list-style-type: none"> <li>– Active surveillance of non-cavitated (white spot) caries lesions</li> <li>– Restore of cavitated or enlarging caries lesions</li> </ul> |

### Notes for caries management pathways tables:

Twice daily brushing: Parental supervision of a “smear” amount of fluoridated toothpaste twice daily for children under age 3, “pea size” amount for children ages 3-6.

Optimize dietary fluoride levels: Ideally by consuming optimally-fluoridated water; alternatively by dietary fluoride supplements, in a non-fluoridated area, for children at high caries risk.

Surveillance and active surveillance: Periodic monitoring for signs of caries progression and active measures by parents and oral health professionals to reduce cariogenic environment and monitor possible caries progression.

Silver diamine fluoride: Use of 38 percent silver diamine fluoride to assist in arresting caries lesions. Informed consent, particularly highlighting expected staining of treated lesions.

Interim therapeutic restorations: also may be called protective restorations.<sup>20</sup>

Sealants: Although studies report unfavorable cost/benefit ratio for sealant placement in low caries risk children, expert opinion favors sealants in permanent teeth of low risk children based on possible changes in risk over time and differences in tooth anatomy. The decision to seal primary and permanent molars should account for both the individual level and tooth level risk.

- Care pathways, based on a child's age and caries risk, provide health providers with criteria and protocols for determining the types and frequency of diagnostic, preventive, and restorative care for patient specific management of dental caries.

## References

- American Academy of Pediatric Dentistry. The use of a caries-risk assessment tool (CAT) for infants, children, and adolescents. *Pediatr Dent* 2002;24(7):15-7.
- American Academy of Pediatric Dentistry. Caries-risk assessment and management for infants, children, and adolescents. *Pediatr Dent* 2014;36(special issue):127-34.
- American Dental Association. Guidance on caries risk assessment in children, June 2018. Available at: "[https://www.ada.org/-/media/ADA/DQA/CRA\\_Report.pdf?la=en](https://www.ada.org/-/media/ADA/DQA/CRA_Report.pdf?la=en)". Accessed February 12, 2019. (Archived by WebCite® at: "<http://www.webcitation.org/768BDwVDc>")
- Fontana M. The clinical, environmental, and behavioral factors that foster early childhood caries: Evidence for caries risk assessment. *Pediatr Dent* 2015;37(3):217-25.
- Cagetti MG, Bonta G, Cocco F, Lingstrom P, Strohmenger L, Campus G. Are standardized caries risk assessment models effective in assessing actual caries status and future caries increment? A systematic review. *BMC Oral Health* 2018;18(1):123.
- Moyer V. Prevention of dental caries in children from birth through age 5 years: U.S. Preventive Services Task Force recommendation statement. *Pediatrics* 2014;133(6):1102-10.
- Food and Drug Administration, American Dental Association, Department of Health and Human Services. Dental radiographic examinations for patient selection and limiting radiation exposure, 2012. Available at: "[https://www.ada.org/-/media/ADA/Member%20Center/Files/Dental\\_Radiographic\\_Examinations\\_2012.pdf](https://www.ada.org/-/media/ADA/Member%20Center/Files/Dental_Radiographic_Examinations_2012.pdf)". Accessed February 12, 2019. (Archived by WebCite® at: "<http://www.webcitation.org/768BXNww3>")
- Rotter T, Kinsman L, James E, et al. The effects of clinical pathways on professional practice, patient outcomes, length of stay, and hospital costs: Cochrane systematic review and meta-analysis. *Eval Health Prof* 2012;35(1):3-27.
- Santos APP, Nadanovsky P, Oliveira BH. A systematic review and meta-analysis of the effects of fluoride toothpaste on the prevention of dental caries in the primary dentition of preschool children. *Community Dent Oral Epidemiol* 2013;41(1):1-12.
- Weyant RJ, Tracy SL, Anselmo T, et al. Topical fluoride for caries prevention: Executive summary of the updated clinical recommendations and supporting systematic review. *J Am Dent Assoc* 2013;144(11):1279-91.
- Wright JT, Hanson N, Ristic H, et al. Fluoride toothpaste efficacy and safety in children younger than 6 years. *J Am Dent Assoc* 2014;145(2):182-9.
- Scottish Intercollegiate Guidelines Network: SIGN 138: Dental interventions to prevent caries in children, March 2014. Available at: "<https://www.sign.ac.uk/assets/sign138.pdf>". Accessed February 12, 2019. (Archived by WebCite® at: "<http://www.webcitation.org/768Bl4pgr>")
- Crystal YO, Marghalani AA, Ureles SD, et al. Use of silver diamine fluoride for dental caries management in children and adolescents, including those with special health care needs. *Pediatr Dent* 2017;39(5):135-45.
- Slayton R, Araujo M, Guzman-Armstrong S, et al. Evidence-based clinical practice guideline for non-restorative management of dental caries. *J Am Dent Assoc* 2018;149(10):837-49.
- Wright JT, Crall JJ, Fontana M, et al. Evidence-based clinical practice guideline for the use of pit-and-fissure sealants. American Academy of Pediatric Dentistry, American Dental Association. *Pediatr Dent* 2016;38(5):E120-E36.
- Vercammen KA, Frelief JM, Lawery CM, McGlone ME, Ebbeling CB, Bleich SN. A systematic review of strategies to reduce sugar-sweetened beverage consumption among 0-year to 5-year olds. *Obesity Review* 2018;19(11):1504-24.
- Alaluusua S, Malmivirta R. Early plaque accumulation: A sign for caries risk in young children. *Community Dent Oral Epidemiol* 1994;22(10):273-6.
- Ramos-Gomez F, Ng MW. Into the future: Keeping healthy teeth caries free. *Pediatric CAMBRA protocols. J Cal Dent Assoc* 2011;39(10):723-32.
- Centers for Disease Control and Prevention. Recommendations for using fluoride to prevent and control dental caries in the United States. *MMWR Recomm Rep* 2001;50(RR14):1-42.
- American Academy of Pediatric Dentistry. Policy on interim therapeutic restorations. *Pediatr Dent* 2018;40(special issue):58-9.
- American Academy of Pediatric Dentistry. Pediatric restorative dentistry. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2019:341-53.
- Parker C. Active surveillance: Toward a new paradigm in the management of early prostate cancer. *Lancet Oncol* 2004;5(2):101-6.
- Ekstrand KR, Bakhshandeh A, Martignon S. Treatment of proximal superficial caries lesions on primary molar teeth with resin infiltration and fluoride varnish versus fluoride varnish only: Efficacy after 1 year. *Caries Research* 2010;44(1):41-6.
- Ramos-Gomez FJ, Crall J, Gansky SA, Slayton RL, Featherstone JDB. Caries risk assessment appropriate for the age 1 visit (infants and toddlers). *J Calif Dent Assoc* 2007;35(10):687-702.
- Featherstone JBD, Domejean-Orliaguet S, Jenson L, et al. Caries risk assessment in practice for age 6 through adult. *J Calif Dent Assoc* 2007;35(10):703-13.