JOURNAL OF INTERNATIONAL CRISIS AND RISK COMMUNICATION RESEARCH
ISSN: 2576-0017
2024, VOL 7, NO S8

Updates in Diagnosis and Management of Dental Caries in Early Childhood

Suad Juwaybir AL Anazi[1], Nuwayyir Khulaif Alanazi[2], Maha Madallah Al-Anzi[3], Nouf Ahmed Alanezi[2], Wasayef Ayed Nahar Al-Anzi[4], Daleel Ayed Al-Otaibi[5], Zainab Ibrahim Salem Amaqa[6], Khaled Batin Al-Dhafiri[7], Ali Abdul Ghani Mahdi Al Jawad[8], Mohammed Sulaiman Alaenazi[9], Hamad Mohammed Gaydan Alshahrani[10]

1. Dental assistant, Al-Nazim Al-Shamali Medical Center, Riyadh, KSA
2. Dental assistant, Dental specialist center, Riyadh, KSA
3. Dental Assistant, Specialized Dental Center, Arar, KSA
4. Dental Assistant, Prince Abdullah bin Abdulaziz bin Musaed Specialized Dental Center, Northern Borders Arar, KSA
5. Dental Assistant, Second Cluster Al-Falah Health Center, Riyadh, KSA
6. Dental assistant, East Riyadh Dental Center, Riyadh, KSA
7. Dental Prosthodontics Technician, Hospital of specialized dentistry, Hafar Al-Batin region, KSA
8. Dental Technologist, Specialized Dental Center, Riyadh, KSA
9. Endodontist, Prince Abdullah bin Abdulaziz specialist center, Northern border region, KSA
10. Dental Assistant, Aseer Health Cluster - Wadi Bin Hashbal Sector, Aseer, KSA

ABSTRACT

Dental caries in early childhood is a significant global public health issue, affecting children's health, quality of life, and development. This study aims to examine the epidemiological factors contributing to the prevalence of dental caries, explore evidence-based preventive measures, review contemporary management options, and analyze the role of community programs and policies in addressing this challenge. The prevalence of early childhood caries (ECC) varies widely, influenced by socioeconomic status and access to dental care. Key risk factors include poor dietary habits, inadequate oral hygiene practices, and lack of caregiver knowledge. Recent advancements in diagnostic techniques, such as laser fluorescence and optical coherence tomography, enhance early detection of carious lesions, enabling timely intervention. The management of dental caries has shifted from traditional restorative approaches to preventive and minimally invasive strategies, emphasizing dietary education, fluoride treatments, and dental sealants. Innovative treatments like silver diamine fluoride and biomimetic materials further support caries management while preserving tooth structure. Community programs and policies play a crucial role in promoting dental health through initiatives that increase access to care, such as school-based dental programs and water fluoridation. These efforts are essential in reducing disparities and ensuring that all children receive the preventive care they need. This study underscores the importance of a multifaceted approach,

combining individual, clinical, and community efforts to effectively combat dental caries in early childhood and improve overall oral health outcomes.

KEYWORDS: Early childhood caries, etiology, feeding, fluorid.

1. Introduction

Dental caries, commonly referred to as tooth decay, remains one of the most prevalent chronic diseases affecting children worldwide. This issue transcends socioeconomic boundaries, impacting children's health, quality of life, and overall development. Particularly in early childhood, the onset of dental caries can have profound implications, not just for oral health but for general well-being. It is critical to understand that early intervention is essential to prevent the progression of dental caries and to maintain a healthy oral environment [1].

Recent years have seen significant advancements in both the diagnostic tools and management strategies for dental caries. Traditional methods of detection, such as visual examinations and radiographic assessments, are increasingly supplemented by innovative technologies, including digital imaging, laser fluorescence, and optical coherence tomography. These advances allow for the early identification of carious lesions, often even before they become clinically visible. Consequently, this helps in formulating timely treatment plans that can halt the disease process and facilitate remineralization [2].

Moreover, the approach to managing dental caries in young children has evolved substantially. The traditional focus on restorative treatments has shifted towards a more preventive and minimally invasive philosophy. Emphasis is now placed on dietary education, the promotion of oral hygiene habits, and the application of preventive agents like fluoride varnishes and sealants. These strategies not only work to prevent caries but also equip caregivers with the knowledge necessary to foster a culture of oral health in their children's lives. In addition to clinical advancements, the role of community and public health initiatives cannot be overlooked. Programs that promote regular dental check-ups and educate parents on the importance of early dental care are vital in reducing the incidence of dental caries. Furthermore, policy frameworks that support access to dental services for all children can significantly contribute to addressing this public health challenge [3].

Objectives:

The main objectives of this study are to:

1. Examine the key epidemiological factors contributing to the prevalence of dental caries in early childhood.

2. Explore evidence-based preventive measures, such as fluoride application, sealants, and nutrition education, to mitigate the risk of dental caries in young children.

3. Review contemporary management options for dental caries, focusing on minimally invasive techniques and the importance of early intervention to preserve tooth structure.

4. Analyze the role of community programs and policies that promote access to dental care and education, aiming to reduce the incidence of dental caries in early childhood across diverse populations.

Epidemiology and Risk Factors of Early Childhood Dental Caries:

Early childhood dental caries (ECC) is a significant public health concern that affects children globally. The World Health Organization estimates that dental caries is one of the most common chronic conditions in children, leading to substantial morbidity and healthcare costs. Understanding the epidemiology of ECC is crucial, as it provides insights into the prevalence, distribution, and determinants of this condition, allowing for targeted interventions [4].

Epidemiologically, ECC is characterized by its early onset, often appearing in children as young as two years old. Studies indicate that the prevalence of caries in young children ranges from 20% to over 80%, depending on geographic location, population demographics, and socioeconomic factors. Regions with limited access to dental care and lower socioeconomic status often report higher rates of dental caries. This disparity highlights the need for equitable access to oral health education and preventive services [5].

Several risk factors contribute to the development of early childhood caries. One of the primary factors is dietary habits, particularly high consumption of sugary foods and beverages. The frequent intake of these items creates an acidic environment in the mouth, promoting the decay process. Additionally, prolonged bottle feeding with sweetened liquids or letting infants fall asleep with a bottle can increase the risk of ECC, leading to a condition known as "baby bottle tooth decay." Oral hygiene practices are another critical factor in the development of caries [6]. Children who do not have regular brushing routines or who lack parental supervision during brushing are more susceptible to cavity formation. Moreover, caregivers' knowledge and attitudes toward oral health significantly impact children's oral hygiene. Education about the importance of maintaining good oral hygiene and the effects of diet can play a vital role in preventing ECC [7].

Socioeconomic status plays a pivotal role in the epidemiology of early childhood dental caries. Families with lower income levels may face barriers to accessing dental care, leading to untreated caries and further complications. This socioeconomic disparity emphasizes the need for community programs aimed at educating parents and providing accessible preventive dental services [8]. In addition to dietary and hygiene-related factors, biological factors, such as the presence of specific bacteria in the mouth, also contribute to the risk of developing dental caries. Streptococcus mutans, a bacterium associated with tooth decay, can be transmitted from caregivers to children, establishing a microbial environment conducive to caries development. Understanding this transmission can help healthcare providers educate parents about the importance of maintaining their oral health to protect their children [9].

Cultural beliefs and practices surrounding oral health can further complicate the landscape of ECC. In some communities, traditional remedies may be favored over professional dental care, leading to delayed treatment of dental issues. Public health

campaigns need to be culturally sensitive to encourage healthier practices within these communities [10].

Advancements in Diagnostic Techniques for Early Detection:

One of the most important advancements is the use of laser fluorescence. This technology utilizes a laser beam that illuminates the tooth surface, where healthy tooth structure reflects light differently compared to demineralized or carious areas. By applying this technique, clinicians can identify carious lesions that may not be visible to the naked eye. Laser fluorescence devices, such as DIAGNOdent, provide numerical readings that assist dentists in making informed decisions about the need for intervention [11].

Additionally, digital imaging has revolutionized radiographic assessments. Digital radiography offers clearer images with significantly reduced radiation exposure compared to traditional X-rays. The enhanced resolution and immediate image availability enable quicker diagnosis, making it especially beneficial in pediatric settings where child cooperation may be challenging. Techniques such as bitewing and periapical radiographs can help detect interproximal caries not visible during a standard oral examination [12]. Furthermore, optical coherence tomography (OCT) is an emerging non-invasive imaging technique that is revolutionary in caries detection. Similar to ultrasound used in medical imaging, OCT employs light to capture high-resolution, cross-sectional images of dental structures. This technique allows for visualization of early demineralization beneath the enamel surface, enabling clinicians to detect carious lesions before they progress. The non-invasive nature of OCT makes it particularly advantageous for use in young children, minimizing discomfort and anxiety during dental visits [13].

Transillumination has also gained traction as a diagnostic option. This technique involves shining light through the tooth to reveal decay in both anterior and posterior teeth. The light highlights differences in density and structure, facilitating the detection of hidden cavities. Digital transillumination tools enhance visualization and can provide a quantitative analysis of tooth structure. Moreover, advancements in salivary diagnostics are paving the way for a more holistic approach to dental health assessment. Analyzing saliva can provide valuable insights into an individual's risk for caries [14]. Researchers are exploring biomarkers and bacterial counts in saliva that could indicate susceptibility to dental decay. This information may allow for preventive strategies tailored to each child’s specific risk profile. Additionally, artificial intelligence (AI) and machine learning are becoming valuable allies in dental diagnostics. AI algorithms can analyze dental images, identifying patterns and anomalies to assist clinicians in diagnosing dental caries with greater accuracy. By streamlining the diagnostic process, AI has the potential to enhance precision in caries detection, particularly in complex cases or when human operators may overlook subtle signs of early decay [15].

Current Practices in Preventive Care and Oral Hygiene:

Preventive care and oral health are crucial for maintaining good oral hygiene, especially in children and adolescents. The increasing prevalence of dental caries and periodontal disease highlights an urgent need for effective preventive strategies.

Current practices focus on a comprehensive approach that includes education, regular dental visits, dietary changes, and the use of appropriate oral hygiene products. Patient education serves as the cornerstone of preventive care. Teaching children and their caregivers the significance of oral hygiene can greatly impact health outcomes. It is important to educate them on proper brushing and flossing techniques, the benefits of a balanced diet, and the risks associated with sugary foods and beverages. Utilizing interactive educational tools such as videos and games can enhance their understanding and motivation [16].

Regular dental visits play a significant role in preventive care. The American Academy of Pediatric Dentistry (AAPD) recommends that children have their first dental visit by their first birthday. These visits allow for professional cleanings, fluoride treatments, and monitoring the development of teeth. Dentists can provide personalized advice tailored to the specific needs of the child. Fluoride treatments are vital in caries prevention. Fluoride strengthens tooth enamel and makes it more resistant to acid attacks from bacteria [17]. Professional fluoride varnishes applied during dental visits can offer additional protection, particularly for high-risk children. Parents should also be encouraged to use fluoride toothpaste at home. Dental sealants represent another effective preventive measure. These thin protective coatings are applied to the chewing surfaces of back teeth, where cavities often occur. Sealants act as barriers that prevent food particles and bacteria from accumulating in the grooves of the teeth. Research indicates that sealants can reduce the risk of cavities by nearly 80%, making them a highly effective intervention. Dietary modifications are essential in preventing dental caries. Encouraging a diet rich in fruits, vegetables, whole grains, and dairy products while limiting sugary snacks and beverages can significantly mitigate the risk of tooth decay. Education for parents regarding healthy snacking and meal timing is crucial, as frequent snacking can increase the likelihood of cavities [18].

The use of appropriate oral hygiene products is also critical. Parents should choose soft-bristled toothbrushes that are suitable for their child's age. Electric toothbrushes may benefit some children, enhancing the effectiveness of brushing. Additionally, parents should supervise brushing until children are about 8 years old to ensure proper technique and appropriate amounts of toothpaste are used [19]. Flossing should not be overlooked. Teaching children to floss daily can help remove food particles and plaque from between teeth, areas that toothbrushes cannot reach. Floss picks or interdental brushes can make this task easier and more enjoyable for children. Mouthguards are recommended for children participating in sports to protect their teeth from injury. Custom-fitted mouthguards provide the best protection and should be worn during all contact sports. Educating parents about the importance of mouthguards can prevent dental trauma and preserve oral health. Cavity prevention programs in schools and community settings can enhance preventive care efforts. Programs providing fluoride treatments, sealant applications, and oral health education can reach children who may not have access to regular dental care. Collaborating with schools to promote oral health initiatives can create a supportive environment for children [20].

Innovative Treatment Modalities for Managing Dental Caries:

Dental caries remains a significant public health challenge globally, requiring innovative approaches for effective management. Traditional methods of caries treatment typically involve restorative procedures, but there has been a shift towards less invasive and more preventive strategies in recent years. One notable advancement is the use of silver diamine fluoride (SDF), a non-invasive agent that not only arrests existing carious lesions but also prevents further decay. SDF contains silver ions, which possess antibacterial properties, and fluoride, which aids in the re-mineralization of affected enamel. This treatment is particularly advantageous for young children and individuals who may not tolerate conventional restorative procedures due to anxiety or special needs [21].

Another promising avenue is the application of resin ionomer sealants. These materials act as protective barriers in the occlusal pits and fissures of teeth, reducing the risk of caries development. By releasing fluoride over time, resin ionomer sealants contribute to the ongoing remineralization of tooth structure, making them especially beneficial in pediatric dentistry. The concept of minimally invasive dentistry has gained traction, focusing on techniques that preserve healthy tooth structure while effectively managing decay. Procedures such as air abrasion and laser technology allow for precise removal of decayed tissue, minimizing trauma to surrounding enamel and promoting a quicker recovery for patients [22].

The development of biomimetic materials represents another innovative approach in caries management. These materials mimic the natural composition and structure of teeth, facilitating the remineralization of demineralized enamel and dentin. By promoting the regeneration of dental tissues, biomimetic materials enhance the tooth's resistance against future carious lesions, providing a more holistic solution to tooth decay. Additionally, the advent of smart dental restorations has introduced materials that actively respond to changes in the oral environment. These "smart" restorations can release therapeutic agents in response to acidity, thereby enhancing the longevity of the restoration while also fostering overall oral health [23].

Fluoride-releasing products, such as varnishes, gels, and pastes, are becoming common preventive strategies against caries. These products can be applied in dental offices or used at home, offering continuous protection for teeth and significantly reducing the risk of new carious lesions. Regular use of fluoride products complements other preventive measures and serves as an effective strategy in various populations, including high-risk individuals [24].

Emerging techniques like cryotherapy also hold potential in the realm of caries management. Cryotherapy uses extreme cold to freeze and halt the progression of carious lesions, making the decay-affected tissue more brittle and easier to address. Although still in experimental phases, this innovative method could provide a less invasive option compared to traditional treatments. Furthermore, research is ongoing into systemic and localized antimicrobial therapies [25]. Agents such as chlorhexidine and specific probiotic strains may help balance the oral microbiome, reducing the prevalence of caries-causing bacteria. This approach focuses on the underlying causes of caries development, offering a proactive method to manage and prevent dental decay [26].

Finally, the integration of these innovative modalities into clinical practice requires dental professionals to stay abreast of the latest research and techniques. Continuous education and training in new tools and methodologies are essential to ensure that practitioners can provide optimal care. As the field of dentistry evolves, embracing these advancements not only enhances treatment outcomes but also supports the broader goal of improving public oral health [27].

Impact of Community Programs on Childhood Dental Health:

The impact of policy and community programs on childhood dental health is profound and multifaceted, shaping the overall oral health landscape for young populations. Government policies and community initiatives play a critical role in addressing disparities in dental health access and outcomes, particularly for children from low-income families or underserved communities. One of the most significant ways that policies affect childhood dental health is through funding for preventive programs. Initiatives that provide access to dental care, such as water fluoridation, free or low-cost dental screenings, and treatment services in schools, contribute significantly to reducing the incidence of dental caries among children. Research has shown that communities with fluoridated water systems have lower rates of cavities, emphasizing the importance of such public health policies [28].

School-based dental programs are particularly effective in reaching children who may not have regular access to dental care. These programs often include preventive services such as fluoride varnish applications, sealant placements, and oral health education tailored specifically for young audiences. By integrating dental care into the school setting, these programs help eliminate barriers such as transportation difficulties and financial constraints, making it easier for children to receive essential dental services. Additionally, community programs that promote oral health education raise awareness about proper oral hygiene practices and nutrition. Engaging parents and caregivers in these educational initiatives is crucial, as informed households are more likely to prioritize and maintain their children's dental health [29].

Moreover, policies that promote the training and deployment of dental professionals in underserved areas significantly influence childhood dental health. By incentivizing dental practitioners to work in low-access regions through loan forgiveness programs or competitive salaries, policymakers can help increase the availability of care for children who might otherwise face barriers. Community health workers can also be instrumental in bridging the gap between families and dental services, helping navigate the healthcare system and ensuring that children receive timely preventive and restorative care [30].

The role of tax incentives and funding for community organizations that focus on oral health can further enhance childhood dental health outcomes. Grants for non-profit organizations that provide mobile dental clinics or outreach programs can extend the reach of dental care into communities where children face significant obstacles. Such initiatives not only offer direct services but also empower families with knowledge and resources regarding oral health, fostering a culture of prevention and care [31].

Evaluating the effectiveness of existing policies and programs through continuous research and data collection is vital for ensuring that they meet the needs of the communities they serve. Ongoing assessment helps identify successful interventions and areas needing improvement or additional resources. Community engagement, involving parents, teachers, and local leaders in the planning and implementation of these programs, is crucial for fostering trust and participation [32]. Ultimately, the impact of policy and community programs on childhood dental health is intertwined with broader societal factors, including socioeconomic status, education, and access to healthcare. A holistic approach that takes these elements into account will significantly enhance the efficacy of dental health initiatives. By prioritizing policies that promote preventive care, facilitate access to services, and provide education, communities can create a supportive environment that encourages healthy dental habits from an early age. The outcomes are clear: healthier children lead to healthier adults, ultimately benefiting society as a whole through reduced healthcare costs and improved quality of life [33].

2. Conclusions:

In conclusion, addressing early childhood dental caries requires a multifaceted approach that includes advancements in diagnostic techniques, innovative preventive and treatment strategies, and robust community programs. The epidemiological insights into the prevalence and risk factors of dental caries underscore the urgent need for early intervention and education. By leveraging modern technologies such as laser fluorescence and optical coherence tomography, clinicians can detect carious lesions earlier, allowing for timely and effective management. The shift towards minimally invasive treatments, including silver diamine fluoride and resin ionomer sealants, reflects a growing understanding of the importance of preserving tooth structure while preventing further decay. Furthermore, community initiatives and policies that promote access to dental care and education play a vital role in mitigating disparities and fostering a culture of oral health among families. Ultimately, a collaborative effort among healthcare providers, policymakers, and communities is essential to reduce the burden of dental caries and improve the oral health outcomes of children worldwide.

References

Filstrup SL, Briskie D, da Fonseca M, et al. Early childhood caries and quality of life: child and parent perspectives. Pediatr Dent. 2003;25:431–440. [PubMed] [Google Scholar]

Pahel TB, Rozier RG, Slade G. Parental perceptions of children's oral health: The Early Childhood Oral Health Impact Scale. Hlth Qual Life Outcomes. 2007;5:6–16. doi: 10.1186/1477-7525-5-6. [DOI] [PMC free article] [PubMed] [Google Scholar]

Li S, Malkinson S, Allison PJ. Testing responsiveness to change for the early childhood oral health impact scale (ECOHIS) Community Dent Oral Epidemiol. 2008;36:542–48. doi: 10.1111/j.1600-0528.2008.00434.x. [DOI] [PubMed] [Google Scholar]

Vargas CM, Monajemy N, Khurana P, et al. Oral health status of preschool children attending Head Start in Maryland, 2000. Pediatric Dent. 2002;24:257–263. [PubMed] [Google Scholar]

Edelstein BA, Vargas CM, Candelaria D, et al. Characteristics of children visiting emergency rooms at dental schools. Pediatric Dent. 2006;28:431–437. [PubMed] [Google Scholar]

Agency for Healthcare Research and Quality. Dental Services-Mean and Median Expenses per Person with Expense and Distribution of Expenses by Source of Payment: United States, 2006. Medical

Expenditure Panel Survey Component Data. 2009 July 06; Generated interactively. [Google Scholar]
Ladrillo TE, Hobdell MH, Caviness C. Increasing prevalence of emergency department visits for pediatric dental care 1997-2001. JADA. 2006;137:379–85. doi: 10.14219/jada.archive.2006.0188. [DOI] [PubMed] [Google Scholar]
American Academy of Pediatric Dentistry. Policy on early childhood caries (ECC): unique challenges and treatment options. Pediatr. Dent.30, 44–46, (2008).
Tinanoff N. Introduction to the conference: Innovations in the prevention and management of early childhood caries. Pediatr. Dent. 2015;37:198–199. [PubMed] [Google Scholar]
Dean, J. A., Avery, D. R. & McDonald, R. E. McDonald and Avery's Dentistry for the Child and Adolescent (10th edition). 156 (Elsevier, 2016).
American Dental Association. Statement on early childhood caries http://www.ada.org/en/about-the-ada/ada-positions-policies-and-statements/ (2018).
Vos MB, et al. Added sugars and cardiovascular disease risk in children: a scientific statement from the American Heart Association. Circulation. 2017;135:e1017–e1034. doi: 10.1161/CIR.0000000000000439. [DOI] [PMC free article] [PubMed] [Google Scholar]
El Tantawi M, et al. Prevalence and data availability of early childhood caries in 193 United Nations Countries, 2007–2017. Am. J. Public Health. 2018;108:1066–1072. doi: 10.2105/AJPH.2018.304466. [DOI] [PMC free article] [PubMed] [Google Scholar]
Tinanoff N, et al. Early childhood caries epidemiology, aetiology, risk assessment, societal burden, management, education, and policy: global perspective. Int. J. Paediatr. Dent. 2019;29:238–248. doi: 10.1111/ipd.12484. [DOI] [PubMed] [Google Scholar]
Kazeminia M, et al. Dental caries in primary and permanent teeth in children's worldwide, 1995 to 2019: a systematic review and meta-analysis. Head. Face Med. 2020;16:1–21. doi: 10.1186/s13005-020-00237-z. [DOI] [PMC free article] [PubMed] [Google Scholar]
Uribe SE, Innes N, Maldupa I. The global prevalence of early childhood caries: a systematic review with meta-analysis using the WHO diagnostic criteria. Int. J. Paediatr. Dent. 2021;31:817–830. doi: 10.1111/ipd.12783. [DOI] [PubMed] [Google Scholar]
Phantumvanit P, et al. WHO global consultation on public health intervention against early childhood caries. Community Dent. Oral Epidemiol. 2018;46:280–287. doi: 10.1111/cdoe.12362. [DOI] [PubMed] [Google Scholar]
Min Quan D, et al. Dental caries status and its associated factors among 3-to 5-year-old children in China: a national survey. Chin. J. Dent. Res. 2018;21:167–179. doi: 10.3290/j.cjdr.a41076. [DOI] [PubMed] [Google Scholar]
Markovic, D. et al. How much country economy influences ECC Profile in Serbian children—a macro-level factor analysis. Front. Public Health7, 285 (2019). [DOI] [PMC free article] [PubMed]
Schwendicke F, et al. Socioeconomic inequality and caries: a systematic review and meta-analysis. J. Dent. Res. 2015;94:10–18. doi: 10.1177/0022034514557546. [DOI] [PubMed] [Google Scholar]
Haworth S, et al. Heritability of caries scores, trajectories, and disease subtypes. J. Dent. Res. 2020;99:264–270. doi: 10.1177/0022034519897910. [DOI] [PMC free article] [PubMed] [Google Scholar]
Silva, M. J. et al. Genetic and early-life environmental influences on dental caries risk: a twin study. Pediatrics143, e20183499 (2019). [DOI] [PMC free article] [PubMed]
Zhang S, et al. Dental caries status of Lisu preschool children in Yunnan Province, China: a cross-sectional study. BMC Oral Health. 2019;19:1–8. doi: 10.1186/s12903-018-0701-5. [DOI] [PMC free article] [PubMed] [Google Scholar]
Cho H, Lee H, Paik D, Bae K. Association of dental caries with socioeconomic status in relation to different water fluoridation levels. Community Dent. Oral Epidemiol. 2014;42:536–542. doi: 10.1111/cdoe.12110. [DOI] [PubMed] [Google Scholar]
Isaksson H, et al. Parental factors in early childhood are associated with approximal caries experience in young adults—A longitudinal study. Community Dent. Oral. Epidemiol. 2019;47:49–57. doi: 10.1111/cdoe.12421. [DOI] [PubMed] [Google Scholar]
Iheozor-Ejiofor, Z. et al. Water fluoridation for the prevention of dental caries. Cochrane Database Syst. Rev.2015, CD010856 (2015). [DOI] [PMC free article] [PubMed]
Folayan MO, et al. An ecological study on the association between universal health service coverage index, health expenditures, and early childhood caries. BMC Oral Health. 2021;21:1–7. doi: 10.1186/s12903-020-01362-6. [DOI] [PMC free article] [PubMed] [Google Scholar]
Heimisdóttir LH, et al. Metabolomics insights in early childhood caries. J. Dent. Res. 2021;100:615–622. doi: 10.1177/0022034520982963. [DOI] [PMC free article] [PubMed] [Google Scholar]
Lipton R, Schwedt T, Friedman B. GBD 2015 disease and injury incidence and prevalence collaborators.

Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet. 2016;388:1545–1602. doi: 10.1016/S0140-6736(16)31678-6. [DOI] [PMC free article] [PubMed] [Google Scholar]

Kassebaum N, et al. Global burden of untreated caries: a systematic review and metaregression. J. Dent. Res. 2015;94:650–658. doi: 10.1177/0022034515573272. [DOI] [PubMed] [Google Scholar]

Teng F, et al. Prediction of early childhood caries via spatial-temporal variations of oral microbiota. Cell Host Microbe. 2015;18:296–306. doi: 10.1016/j.chom.2015.08.005. [DOI] [PubMed] [Google Scholar]

Jiang W, Jiang Y, Li C, Liang J. Investigation of supragingival plaque microbiota in different caries status of Chinese preschool children by denaturing gradient gel electrophoresis. Microb. Ecol. 2011;61:342–352. doi: 10.1007/s00248-010-9753-z. [DOI] [PubMed] [Google Scholar]

Chen Y, Li Y, Zou J. Intrageneric and intergeneric interactions developed by oral Streptococci: pivotal role in the pathogenesis of oral diseases. Curr. Issues Mol. Biol. 2019;32:377–434. doi: 10.21775/cimb.032.377. [DOI] [PubMed] [Google Scholar]