Dental Public Health

Dental Caries in Children as a Public Health Problem – Literature Review

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Зъбен кариес при деца като проблем на общественото дентално здраве – обзор

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Abstract:

Dental caries in children is one of the most common chronic diseases, posing a significant public health problem. Influenced by factors at individual, family, and community levels, the protection of oral health in children faces various challenges. More than 530 million children worldwide suffer from dental caries in the temporary dentition. Despite being largely preventable, dental caries remains the most common chronic disease globally, significantly affecting children from lower socio-economic groups. Dental caries negatively impacts children's daily lives, causing pain, impaired function, and sleep disturbances. According to public health definitions, a disease qualifies as a public health problem if it meets certain conditions, including high prevalence, significant individual and societal impact, and preventability. Dental caries in children meets these criteria, highlighting the urgent need for effective public health interventions to address this pervasive issue. This review provides comprehensive information on dental caries in children, including its prevalence and the impacts on the child's life, family, and society, as derived from the latest research studies on this topic.

Keywords: *caries in children, dental public health, OHRQoL*

Резюме:

Кариесът при децата е едно от най-често срещаните хронични заболявания и е съществен проблем за общественото здраве. Оралното здраве при децата се влияе от различни фактори на индивидуално, семейно и обществено ниво. Повече от 530 милиона деца по света страдат от кариес на временните зъби. Въпреки че кариесът е до голяма степен предотвратим, той остава най-честото хронично заболяване в света, което значително засяга децата от по-ниските социално-икономически групи. Кариесът негативно влияе върху ежедневието на децата, причинявайки болка, нарушена функция и проблеми със съня. За да бъде квалифицирано като обществен здравен проблем дадено заболяване, то трябва да отговаря на определени условия: висока заболеваемост, значително въздействие върху индивида и обществото, и заболяването трябва да е предотвратимо. Кариесът при децата отговаря на тези критерии, което подчертава спешната необходимост от ефективни обществени здравни интервенции за справяне с този проблем. Този преглед предоставя изчерпателна информация за кариеса при децата, включително неговата честота и влияние върху живота на детето, на семейството и обществото, въз основа на най-новите изследвания по тази тема.

Ключови думи: *кариес при деца, обществено дентално здраве, OHRQoL*

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Dental caries in children is one of the most prevalent chronic diseases. According to the FDI, oral health encompasses a person's ability to speak, smile, smell and taste, feel, chew, swallow, and express a range of emotions through facial expressions with confidence and without pain, discomfort, or disease in the craniofacial area [1].

Modern concepts indicate that dental caries in children are influenced by various factors at the individual, family, and community levels [2]. It is important to note that maintaining oral health in children involves numerous challenges due to their reliance on parents, guardians, or caregivers. Globally, over 530 million children suffer from dental caries in their primary dentition [3].

Dental caries remains the most common chronic disease worldwide and ranks as the tenth most common condition in children, despite being largely preventable [4]. Although the overall prevalence of dental caries is declining in some countries, there is a concerning trend of increasing social inequality. Children from lower socio-economic backgrounds are more likely to experience tooth decay compared to those from higher socio-economic backgrounds [5]. In the United Kingdom, dental caries is the most frequent reason for hospital admissions of children requiring treatment under general anesthesia [6]. Dental caries has been associated with numerous adverse effects, significantly impacting children's daily lives, including pain, impaired function, and sleep disturbances [7].

According to Sheiham and Watt, determining whether a disease constitutes a public health problem requires meeting four conditions: if the prevalence of the disease in the population is high or increasing, or when the prevalence is low but the condition is serious (criterion 1); the disease should have a tangible impact on the individual (criterion 2) and on society, for example through direct costs of treatment or indirect costs of losing jobs and school days (criterion 3); and the disease must be preventable or have effective treatment (criterion 4) [8].

Prevalence of Dental Caries in Children (Criterion 1)

Globally, dental caries impacts 60-90% of children, although the prevalence of the disease is not uniformly distributed across different regions [9]. The most widely utilized metric for evaluating the severity of caries is the average number of decayed, missing, and filled teeth (DMFT or dmft for primary dentition). According to the World Health Organization (WHO) Global Oral Health Report, the worldwide average DMFT value for 12-year-olds stands at 1.67, with significant geographical variations observed both between and within countries. For instance, in the Americas and Belize, the average DMFT value for 12-year-olds is 0.6, whereas in Ecuador it rises to 6.3. Within Europe, the DMFT values range from 0.7 to 7.8 [9].

A notable limitation of many epidemiological studies is their focus on overall DMFT/dmft scores, which reflect individuals' entire lifetime experiences with caries rather than current levels of untreated disease. Additionally, disparate thresholds and criteria for diagnosing tooth decay across studies complicate comparisons between populations. Nevertheless, Kassebaum and colleagues [4] performed a meta-analysis of existing literature to synthesize data on global untreated caries. Their study revealed that in 2015, untreated caries in primary dentition affected 9% of children globally, equating to 621 million individuals, thus ranking as the tenth most prevalent childhood disease. In permanent dentition, caries emerged as the most common disease worldwide, affecting 35% of the population [4].

Impact of dental caries on the individual (criterion 2)

The impact of dental caries on the individual is well documented and ranges from symptoms such as pain or difficulty eating, to stunted growth and development, missing days of school and falling behind academically, as well as poor performance in school.

Pain.

Pain is probably the most commonly reported symptom of dental caries by patients. Slade has published a review that looks at the results of epidemiological studies containing data on tooth decay-related pain in children and adolescents [10]. The review included 17 studies conducted in the United States, Canada, Australia, England and Wales, with 5-33% of participants reporting experiencing tooth pain. Later, a study was conducted in Brazil to clarify whether participants had ever experienced tooth pain in their lives and found that by the age of six, 36-71% of children with tooth decay had experienced toothache, and by the age of 12, this proportion increased to 65-85% [11].

Complications of untreated dental carious lesion

If untreated, the carious lesion can advance from the dentin to the pulp, causing reversible or irreversible inflammation and eventually necrosis. This progression can lead to conditions such as periapical periodontitis or cyst formation. These outcomes may result in additional pain, abscesses, or phlegmons in the facial area, and fever. In severe instances, there is a risk of life-threatening airway obstruction, particularly in children who are immunocompromised or have other health conditions, such as heart defects.

Impact on Normal Growth in Children

It has been proposed that growth and dental caries may be interconnected due to common influencing factors such as nutrition, parenting, and environmental aspects. Recent studies have indicated that higher incidences of untreated dental caries are correlated with significantly lower weight and height for age in children, even after adjusting for other demographic and social variables [12, 13]. The precise mechanism connecting dental caries to suboptimal physical growth and weight gain remains unclear. Several pathways may explain how dental caries can contribute to insufficient weight gain in children. Pain or discomfort from untreated tooth decay can impact children's eating habits, leading to difficulties in feeding or selective eating, which in turn may reduce food intake and affect growth [12]. Additionally, increased levels of cytokines associated with chronic inflammation, such as pulpitis or periodontitis, can result in anemia by suppressing erythropoiesis in the bone marrow. Moreover, it has been suggested that sleep disturbances caused by tooth decay pain may influence glucocorticosteroid production, subsequently affecting growth [12].

Impact on School Absences and Class Performance

The pain caused by dental caries has been demonstrated to negatively affect regular school attendance. A study on a group of 8-year-old schoolchildren in the UK indicated that 11.5% of those who had recently experienced tooth pain were also absent from school due to the discomfort [10]. Additionally, children who visit the dentist for treatment are also absent from school, with the same study finding that 42% of these 11.5% end up visiting the dentist [10].

Rebelo and colleagues conducted a meta-analysis examining the evidence on the impact of dental caries on school absences and class performance [14]. Eighteen studies from nine different countries were included. The authors found that children with tooth decay performed worse at school compared to their peers in 44% of cases and were absent more frequently in 57% of cases [14]. The articles included in the survey are all observational in nature and do not consider the potential impact of other factors such as socio-economic status.

Impact on Quality of Life

Recent years have seen efforts to evaluate the impact of dental diseases on an individual's overall quality of life [15]. Dental caries cause pain and impaired function, which negatively influence the daily activities of children and their families. Gilchrist and colleagues found that tooth decay significantly impacts children's daily lives, with eating and sleeping being most frequently affected [7]. Additionally, it has been reported that toothache adversely affects children's quality of

life in other ways, including communication with others, school attendance, participation in games with peers, and emotional well-being. It can lead to feelings of insecurity and complexes due to perceived differences from peers [15]. To measure the impact of caries and its treatment on individuals' daily lives, various tools have been developed to assess the quality of life associated with oral health (OHRQoL).

Impact of Dental Caries on Society (Criterion 3)

Dental caries not only significantly affects individuals but also has substantial implications for families and society.

Impact on the Family

Research indicates that the presence of both multiple and complicated dental carious lesions adversely affect Oral Health-Related Quality of Life (OHRQoL) in children and their families [16, 17]. Abanto et al. discovered that parents of children with multiple carious lesions were concerned that their child's poor dental aesthetics might hinder their equal start in life [17]. Furthermore, studies have demonstrated that children with high rates of carious lesions require increased parental attention, leading to reported disruptions in family life and higher incidences of work absenteeism among parents [17]. Parents who understand that dental caries is preventable often experience guilt regarding the poor condition of their child's teeth [17].

Economic impact

Listle and colleagues explore both the direct costs of treatment and healthcare services, along with the indirect costs such as work absences related to dental disease treatment worldwide [18]. Their findings indicate that the global economic burden of dental diseases amounted to $442 billion in 2010, with $298 billion stemming from direct treatment costs and another $144 billion from indirect costs due to reduced labor productivity [18]. They reported that in Western Europe, the total direct costs reached $91 billion, and the indirect costs added another $41 billion [18]. The authors estimated that 17% of these expenses were attributed to dental caries in permanent dentition [18].

Data on the overall societal costs of treating carious lesions in children is limited. However, in the UK, the expenses for carious lesions treatment under general anesthesia are well documented. In England alone, there were approximately 42,000 hospitalizations of children under 16 diagnosed with dental caries in 2017/18 [19]. This number represents an 8% increase from the previous year (19). The NHS's estimated cost for this treatment is £30 million [19].

Dental caries is a preventable disease with proven effective treatment (criteria 4)

Prevention of Dental Caries

Dental caries is a multifactorial disease, meaning its progression can be prevented and slowed through various methods. Consequently, the prevention of dental caries is a significant objective in strategies to enhance the oral health of the population. Substantial evidence supports the prevention of tooth decay at both individual and societal levels, forming the foundation of global oral health improvement programs [20].

In Scotland, the Childsmile programme was introduced in 2006. It combines multiple preventive approaches targeted at all children, with specific attention to certain priority groups. The programme includes free daily supervised brushing in kindergartens and priority primary schools, distribution of free toothbrushes and toothpaste, and accessibility to primary dental care [21]. This initiative has been associated with considerable improvements in children's oral health in Scotland in recent years. The latest report indicates that the prevalence of tooth decay in primary school-age children (aged 4-7 years) decreased from 55% in 2003 to 31% in 2016 [22].

Similarly, Wales launched the 'Designed to Smile' programme in 2009, which has led to re-

ductions in both the incidence and severity of the disease. Schools participating in this programme have reported fewer children with dental caries and a lower number of decayed teeth per child [23].

Strategies for caries prevention can be categorized into three main areas: increasing fluoride intake, reducing sugar consumption, and applying sealants [24-26]

Treatment of carious lesions

Traditional treatment approaches for carious lesions in primary teeth can be divided into three categories. The first approach is the complete removal of carious tooth tissue followed by restoration placement. In some cases, treatment for complicated caries lesions, such as pulpitis or periodontitis, may be necessary. If the tooth cannot be restored, extraction may be considered. The second approach involves "sealing" the carious lesion in the tooth using adhesive restoration or a preformed metal crown (the Hall technique). The third approach is preventative, utilizing non-operative techniques to stabilize lesions by leveraging the reversible nature of the disease. There is currently no consensus on which of these approaches is the most effective clinically [27,28]. Regardless of which approach has been proven to be most effective, providing dental care to children can be challenging, especially when treatment needs are large and there are additional behavioral, social, or medical aggravating factors.

In conclusion, addressing the multifaceted nature of dental caries through comprehensive prevention and treatment strategies is crucial. By prioritizing public health initiatives and embracing evidence-based practices, we can significantly reduce the economic burden and improve the oral health outcomes for populations worldwide.

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