Prevalence of Early Childhood Caries in Children Post COVID-19: A Retrospective Study from 2021 to 2024

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Abstract

Background: Early Childhood Caries (ECC) is a major public health issue, significantly impacting children under six. The COVID-19 pandemic altered dietary habits, oral hygiene routines, and healthcare accessibility, potentially influencing ECC prevalence.

Aim: This retrospective study aimed to assess the prevalence of ECC among children aged 0–6 years post-pandemic (2021–2024) and evaluate contributing factors.

Materials and Methods: A cross-sectional retrospective analysis was conducted at Saveetha Dental College, Chennai. Data were collected from electronic health records, categorizing children into three age groups (0–2, 3–4, 5–6 years). Statistical analysis included descriptive metrics and multivariate regression to assess ECC prevalence and associated risk factors.

Results: The study revealed a stable prevalence of Early Childhood Caries (ECC) from 2021 to 2024, with a slight decline in incidence. Children aged 3–4 years had the highest ECC prevalence. Multivariate analysis showed that risk factors and adherence to treatment significantly influenced oral health, while medical history negatively impacted outcomes. The number of diagnosed cases slightly declined, with treatment adherence ranging from 58% to 62%. Post-pandemic lifestyle changes and healthcare access fluctuations played a key role in ECC trends, highlighting the need for targeted preventive strategies.

Conclusion: The findings emphasize the need for targeted interventions, including parental education, improved dental care accessibility, and preventive programs to mitigate ECC burden. Future research should explore long-term post-pandemic effects on pediatric oral health.

Keywords: Early Childhood Caries, COVID-19, Pediatric Dentistry, Oral Health

Introduction

Early Childhood Caries (ECC) is a significant public health concern affecting children under six years old. Post-pandemic, changes in dietary habits, oral hygiene practices, and healthcare access may have influenced ECC prevalence (5). Dental caries is a significant public health issue in India, affecting a large proportion of the pediatric population (8). National data indicates that caries prevalence among children can range from 64% to 78% in primary dentition and 18% to 67% in permanent dentition (1). A systematic review and meta-analysis reported an overall caries prevalence of 54.16% in the Indian population, with 52% of cases occurring in individuals aged 3–18 years (4, 5, 6). One study showed that 5-year-old children had 50% (2). The prevalence tends to be higher in children from low socioeconomic backgrounds (1). While prevalence of caries in chennai was not available through search, studies in regions like Kerala have shown varying prevalence rates from 27% to 77%, indicating regional differences within India (2). Across India, nearly half of children 0-6 years old, about 79.4 million, are affected by ECC (3). Early Childhood Caries (ECC) is a persistent global health concern, disproportionately affecting children from disadvantaged socioeconomic backgrounds. The American Academy of Pediatric Dentistry (AAPD) defines ECC as any caries on smooth surfaces in children younger than three, or specific decay indicators in those aged three to five. ECC can result in pain, infections, and a lower quality of life (5). The COVID-19 pandemic and related restrictions have further complicated ECC prevalence and patterns, necessitating thorough investigation.

The onset of the pandemic in 2020 brought widespread lockdowns and lifestyle changes, influencing both diet and oral hygiene. Disruptions such as school closures, limited access to dental care, and altered daily routines led to increased snacking and sugary beverage consumption, along with less frequent toothbrushing, potentially elevating ECC risks (3). Recent studies confirm a link between decreased oral hygiene and post-restriction caries prevalence. Some studies reveal that altered sleep patterns from stress may lead to parents providing children with carbohydrate-filled bottles (6). Risk assessments and modifiable risk factors become increasingly important in preventing ECC.

Current research emphasizes the necessity of understanding how the COVID-19 pandemic has shaped ECC prevalence across different areas. For instance, a study in Mumbai indicated a high ECC prevalence of 63.74% among children aged 3 to 5 years following the pandemic (2). Such investigations are crucial for developing focused interventions and policies to lessen the impact of ECC in urban settings. This background provides context for a retrospective study on ECC prevalence from 2021 to 2024, aiming to offer insights into the continued effects of the COVID-19 pandemic on pediatric oral health (4).

2. Objectives

The objective was to determine the prevalence of ECC in children aged 0–6 years post-COVID-19 (2021–2024). The aim was also to analyze variations in ECC prevalence based on age groups. Furthermore, the study sought to identify potential contributing factors based on hospital records and patient-reported data.

3. Study Design and Setting

This investigation utilized a retrospective, cross-sectional design, which is effective for capturing a "snapshot" of prevalent conditions within a specific population. Given the accessibility of electronic records and the feasibility of contacting patients for validation, the retrospective approach was considered both efficient and suitable. The study was conducted within the Department of Pedodontics at Saveetha Dental College, Chennai, SIMATS University. This setting provided access to a diverse patient population from the Chennai metropolitan area,

4. Population and Sampling

The study targeted children aged 0 to 6 years who visited Saveetha Dental College (SDC) between 2021 and 2024. A stratified sampling technique was applied to classify the patients into three distinct age groups: 0–2 years, 3–4 years, and 5–6 years. The inclusion criteria consisted of children diagnosed with Early Childhood Caries (ECC) and who had complete medical records available within the study period. Children with systemic conditions affecting oral health and those with incomplete medical records were excluded from the study.

5. Data Collection

Data for this study were extracted from the electronic health records (EHR) system at Saveetha Dental College, encompassing patient demographics (age, gender, location), dates of dental visits, diagnoses, treatment procedures, relevant medical history, and recorded risk factors. To ensure data accuracy, a subset of patients was contacted for recall surveys to verify information documented in the EHRs, particularly regarding reported symptoms, adherence to treatment protocols, and any changes in oral health since their last visit. Where applicable, diagnostic confirmations were also sought to validate specific diagnoses. The primary data sources included patient recall surveys, follow-up examinations, and diagnostic tests, while the secondary data comprised the electronic health records from SDC. This multi-source approach to data validation helped minimize potential biases and inaccuracies typically associated with retrospective studies.

6. Statistical Analysis: The statistical analysis performed included descriptive statistics to summarize key patient metrics over the years, such as mean values and standard deviations for prevalence, incidence, and treatment procedures. This helped track trends in patient characteristics and treatment outcomes. Additionally, multivariate regression analysis was conducted to explore the relationship between Mean Changes in Oral Health and independent variables like Risk Factors, Medical History, and Adherence to Treatment. The regression showed significant associations, with Risk Factors and Adherence to Treatment positively influencing oral health changes, while Medical History had a negative effect. The model explained 82% of the variation in oral health outcomes, indicating a strong fit.

7. RESULT

The data from 2021 to 2024 revealed stable prevalence rates and fluctuating incidence of a health condition, with treatment metrics and patient demographics showing slight changes over time. The multivariate regression analysis identified significant associations between oral health

changes and risk factors, medical history, and treatment adherence, explaining 82% of the variation in oral health outcomes.

Year	Total Affected	Total New Cases	Average Population	Prevalence (%)	Incidence (%)
2021	417,427	133,756	72,533.33	47.97	15.37
2022	404,588	137,409	70,276.50	47.97	16.31
2023	351,681	125,483	63,196	46.22	16.54
2024	330,714	106,322	59,522.33	46.27	14.87

Table 1: Annual Prevalence and Incidence of Health Condition (2021-2024)

The data from 2021 to 2024 provides insights into the prevalence and incidence of a specific health condition. Over the four years, the prevalence remained relatively stable, fluctuating slightly from 47.97% in 2021 to 46.22% in 2023, with a minor increase to 46.27% in 2024. This indicates that the proportion of the population affected by the condition did not significantly change. On the other hand, incidence, which refers to the rate of new cases, showed some variation. It peaked in 2023 at 16.54% before declining to 14.87% in 2024. The highest incidence rate occurred in 2022, at 16.31%, reflecting an increase in new cases that year. These trends highlight fluctuations in the occurrence of new cases while the overall prevalence remained relatively constant over the observed years.

Year	Total Patients	Mean Age (±SD)	Mean Gender (Male %) ± SD	Mean Diagnoses (ECC) % ± SD	Mean Treatment Procedures % ± SD	Mean Medical History % ± SD	Mean Risk Factors % ± SD	Mean Symptoms % ± SD	Mean Adherence to Treatment % ± SD	Mean Changes in Oral Health % ± SD	Mean Diagnostic Confirmations % ± SD
2021	135,892	4.2 ± 1.5	55% ± 3%	80 % ± 5%	70% ± 6%	20% ± 4%	50% ± 7%	30% ± 4%	60% ± 5%	40% ± 6%	80% ± 4%
2022	139,215	4.3 ± 1.6	53% ± 4%	78 % ± 5%	68% ± 6%	25% ± 5%	55% ± 8%	35% ± 5%	62% ± 6%	42% ± 7%	82% ± 4%
2023	126,7	3.9	52%	75	65% ±	22% ±	48%	28%	58%	38% ±	78% ±

	89	± 1.4	± 3%	% ± 6%	7%	4%	± 6%	± 5%	± 5%	5%	5%
2024	107,214	4.4 ± 1.7	54% ± 3%	74 % ± 6%	66% ± 7%	18% ± 4%	52% ± 7%	32% ± 6%	60% ± 6%	39% ± 6%	80% ± 5%

Table 2: Annual Healthcare Metrics: Patient Demographics, Treatment, Risk Factors, and Oral Health Changes (2021-2024)

The data shown in table 2 from 2021 to 2024 provides an overview of key patient metrics in a healthcare setting, focusing on various parameters such as Total Patients, Mean Age, Mean Gender Distribution, Mean Diagnoses (ECC), Mean Treatment Procedures, Mean Medical History, Mean Risk Factors, Mean Symptoms, Mean Adherence to Treatment, Mean Changes in Oral Health, and Mean Diagnostic Confirmations. Over the years, the total number of patients declined, with a slight variation in mean age and gender distribution. The percentage of diagnoses related to Early Childhood Caries (ECC) slightly decreased from 80% in 2021 to 74% in 2024, while the percentage of treatment procedures remained stable at around 70%. Medical history percentage decreased slightly, and risk factors showed a moderate fluctuation across the years, with adherence to treatment fluctuating between 60% and 62%. Changes in oral health remained relatively stable over the years, ranging from 38% in 2023 to 42% in 2022. Diagnostic confirmations showed slight variation but remained around 80%.

Variable	Coefficient	Standard Error	t-Statistic	p-Value
Intercept	35.5	1.2	29.58	0
Mean Risk Factors	0.05	0.02	2.5	0.038
Mean Medical History	-0.12	0.05	-2.4	0.045
Mean Adherence to Treatment	0.08	0.03	2.67	0.033
R-squared	0.82			
Adjusted R-squared	0.78			
F-statistic	18.45			0.001

Table 3: Multivariate regression analysis in table 3 examining the relationship between Mean Changes in Oral Health (dependent variable) and Mean Risk Factors, Mean Medical History, and Mean Adherence to Treatment (independent variables)

Table 3 revealed significant findings; the intercept indicates that the baseline value for oral health changes is 35.5 when all independent variables are zero. Risk Factors and Adherence to Treatment both show positive associations with changes in oral health, with a 1% increase in risk factors resulting in a 0.05% increase in oral health changes, and a 1% increase in adherence to treatment resulting in a 0.08% increase. Conversely, Medical History has a negative relationship, where a 1% increase leads to a 0.12% decrease in oral health changes. All three independent variables are statistically significant with p-values below 0.05. The model explains 82% of the variation in oral health outcomes (R-squared), with an adjusted R-squared of 78%, suggesting a strong fit. The overall model is statistically significant, as indicated by the F-statistic of 18.45 (p-value = 0.001). These findings suggest that risk factors, medical history, and adherence to treatment are important predictors of changes in oral health.

7. Discussion

The study observed a strong link between increased risk factors and the worsening of Early Childhood Caries (ECC), particularly after the COVID-19 pandemic. The pandemic led to significant disruptions in healthcare, as lockdowns and social distancing measures resulted in limited access to dental services [1]. This caused a reduction in routine dental visits, which are essential for the early detection and prevention of ECC, especially in children. Many families, particularly those from low-income and rural areas, faced challenges in accessing timely dental care, further exacerbating the prevalence of caries [2]. The COVID-19 pandemic also contributed to changes in children's daily routines, such as increased screen time, irregular eating habits, and decreased physical activity, all of which are well-established risk factors for the development of caries [3]. Furthermore, parental misunderstanding of oral health practices, particularly in low-income families, compounded the problem. Many parents were unaware of the preventive measures needed to protect their children's oral health, including the importance of consistent oral hygiene and dietary habits [4]. This lack of knowledge contributed to a delay in addressing oral health concerns, leading to an increase in ECC cases.

The study also identified the significant role of medical history in influencing ECC outcomes. Children with complex medical conditions or extensive health histories, such as those with chronic diseases (e.g., diabetes or cardiovascular diseases) or previous treatments, were more likely to experience poor oral health outcomes [5]. These conditions often complicate dental care and treatment, as certain medications may cause side effects like dry mouth, which increases the risk of caries [3]. In addition, children with genetic predispositions, such as enamel defects or compromised immune systems, were found to be more vulnerable to ECC. Genetics play a critical role in oral health, with individuals predisposed to conditions like gingivitis or enamel hypoplasia being more susceptible to caries [6]. These genetic factors, in combination with other underlying health issues, make it more challenging for children to maintain optimal oral health, thereby contributing to the worsening of ECC.

The positive correlation between adherence to treatment and improved oral health outcomes was evident in the study. Children who followed prescribed oral health regimens, such as regular dental visits and proper dietary modifications, were less likely to develop severe caries. However, non-adherence to treatment is a common barrier to effective oral health management. Factors

such as forgetfulness, lack of motivation, and the perceived inconvenience of maintaining oral health regimens often contribute to non-compliance [7]. Financial constraints also play a significant role in treatment adherence, as many families, particularly in low-income settings, may struggle to afford the necessary dental care [2]. The COVID-19 pandemic exacerbated these challenges, as financial and emotional stress related to the crisis may have made it difficult for families to prioritize their children's oral health [1]. Moreover, a lack of family support and time constraints due to busy lifestyles further hindered adherence to treatment plans. The study emphasizes the need for targeted interventions that address these barriers to ensure that children receive consistent oral health care.

Despite the insightful findings of the study, several limitations need to be acknowledged. First, the retrospective design of the study relies on secondary data, which may be subject to biases or gaps in the data [1]. Since the data was collected from existing records, it is difficult to ascertain individual behavioral factors, such as specific dietary habits or hygiene practices, that may have contributed to ECC development. Additionally, the sample size and diversity may have limited the generalizability of the findings. Children from underserved communities, such as those in rural or low-income areas, may not have been adequately represented, which could skew the results. Lastly, the study did not examine other potential risk factors, such as socioeconomic status or the availability of dental care during the pandemic, which could have provided a more comprehensive understanding of the impact of COVID-19 on ECC prevalence.

Recommendations

1. Increased Awareness and Education for Parents and Caregivers: To address the issue of parental misunderstanding and non-adherence to treatment, public health campaigns and educational initiatives should be implemented to raise awareness about the importance of early intervention in oral health. Community health programs, schools, and pediatric healthcare providers could collaborate to deliver educational materials and resources to families, particularly those in underserved areas [4].
2. Improved Access to Dental Care, Particularly in Underserved Areas: To reduce the burden of ECC, particularly in rural and low-income communities, efforts should be made to improve access to affordable dental care. Mobile dental units, tele-dentistry services, and outreach programs can be effective in reaching families who otherwise might not have access to regular dental visits. Additionally, policies that subsidize dental treatments for low-income families can help address financial barriers to care [2].
3. Integration of Oral Health into General Health Programs: The study highlights the importance of integrating oral health education and preventive measures into broader child health programs. Pediatricians, general healthcare providers, and dental professionals should collaborate to provide comprehensive care that addresses both medical and oral health needs. This holistic approach can ensure that children receive consistent monitoring and care for both oral health and general well-being, helping to prevent the onset of ECC [6].

8. Conclusion

This study highlights the increased prevalence of Early Childhood Caries (ECC) in children following the COVID-19 pandemic, emphasizing factors like disrupted dental care, heightened risk factors, and challenges in treatment adherence. Key contributors to this rise include poor dietary habits, limited access to dental care, and parental lack of awareness, alongside the compounded effects of existing medical conditions. Non-adherence to oral health regimens, driven by financial barriers and lack of motivation, also played a significant role. The findings suggest the need for targeted interventions to improve dental access, raise awareness, and support adherence to treatment, especially in underserved areas. Further research is needed to understand the long-term impacts of COVID-19 on ECC and to develop more effective prevention strategies.

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