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Patterns of dental caries in primary dentition: a scoping review

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Abstract

Background and objectives: This study aimed to systematically identify and map the contemporary research evidence on the characteristics of dental caries patterns observed in the primary dentition.

Methods: Informed by the PRISMA-ScR protocol, a scoping review was conducted. Peer-reviewed original research publications published in English within the 2000-2024 period were eligible for inclusion in the review. Online databases PubMed and Google Scholar were searched and supplemented by secondary material. Both authors devised and approved data charting processes. Article selection was mutually agreed upon, matched, and duplicates eliminated. Articles were not excluded based on their methodological quality.

Results: Twenty-two primary dentition studies from 14 countries were included. Most (n=21) were cross-sectional with an age range of 0 to 6 years. Caries patterns were both age- and caries-level dependent. Caries was most prevalent in 5-year-old children on the occlusal surfaces of mandibular second molars and maxillary second molars, the proximal surfaces of mandibular first molars and maxillary first molars, the cervical area of the labial surface, and the proximal surfaces of maxillary incisors.

Conclusion: Despite the differences in research conducted in various countries over the previous 25 years, the data on caries patterns revealed in this study are comparable, which is crucial for selecting appropriate preventive strategies.

Introduction

Dental caries that develop in early childhood was previously known as nursing caries or baby-bottle caries. However, an expert group developed the term "early childhood caries" (ECC) in the 1990s to represent the disease's multifaceted aetiology (Drury *et al*., 1999). ECC is one of the most frequent chronic diseases in children and a significant threat to global public health, with an estimated prevalence of 46.2% in primary dentition (Kazeminia *et al*., 2020). Every year, New Zealand's community oral health services collect oral data on 5-year-old children. According to the most recent data available on the Ministry of Health's website (Ministry of Health, 2025), 58.3% of children were caries-free in 2023, and the average dmft (d-decayed, m-missing due to decay, f-filled cavity) was 1.95. Early Childhood Caries is defined as the presence of one or more decaying (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child aged 71 months or under. Any signs of smooth-surface caries in children aged <3 years indicate severe early childhood caries (S-ECC). From ages 3 to 5 years, S-ECC has an age-specific definition. For those aged 3 years, it is defined as one or more cavitated, missing, or filled smooth surfaces in primary maxillary front teeth, or a decayed, missing, or filled score of >4, while for children aged 4 years, it is defined as having a score >5, and for those aged 5 years, it is defined with a score >6 (Drury *et al*., 1999; American Academy of Paediatric Dentistry, 2016).

Caries risk assessment is essential for individualised care and ethical professional judgement. Multiple caries risk factors have been identified and include susceptible teeth, visible plaque, sugary foods, brushing and flossing habits, fluoride exposure, salivary flow and pH, orthodontic and prosthodontic appliances, previous caries experience, current caries activity, parental and sibling caries statuses, socioeconomic status, oral health literacy, and access to dental care (American Academy of Pediatric Dentistry, 2023; American Dental Association, 2018; Kanagaratnam and Schluter, 2019). Studies examining the heritability of dental caries in both children and adults have also revealed the critical role of genetics in dental caries (Bretz *et al*., 2005; Cogulu and Saglam, 2022). Along with these variables, understanding caries patterns is vital for guiding clinicians and policymakers to enable prompt prevention.

Caries patterns refer to the distribution and characteristics of dental caries within the oral cavity, including surface and teeth susceptibility. Caries patterns in primary teeth are linked to specific risk factors, such as dietary patterns in children (Douglass *et al*., 2001). Research on permanent teeth supports the notion that caries experience patterns can be attributed to specific risk factors (Shaffer *et al*., 2013). However, conventional caries indices, such as dmft and dmfs, overlook the differences in dental surface susceptibility to caries and the differential influence of risk factors on these surfaces.

Understanding caries patterns in primary and permanent dentitions is crucial for selecting optimal treatments, particularly preventative therapy, and avoiding the sequelae associated with dental caries. Identification, description, and the synthesis of this body of evidence are needed, highlighting any similarities and differences between studies. A recent systematic review and meta-analysis (He *et al*., 2024) identified and assessed the caries pattern in preschool children. This scoping review, which includes this latest study, attempts to identify and map available studies on the vulnerability of teeth and dental surfaces in primary dentition in children aged six years and younger.

Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols for Scoping Reviews (PRISMA-ScR) served as the foundation for this study (Tricco *et al*., 2018). The study protocol was not prospectively registered but can be requested from the corresponding author, SK.

The following research question was formulated: "What are the characteristics of dental caries patterns in primary dentition (tooth and surface susceptibility to caries)?" The principal three words in the question were dental caries, pattern, and primary dentition. SK conducted a preliminary literature search to determine the key words in the study question. The key terms for these words found in the search were "dental caries", "tooth decay", caries, "caries pattern", "dental caries pattern", " dental caries classification", "primary dentition", "primary teeth", "deciduous dentition", and "deciduous teeth". These keywords were agreed upon following a discussion amongst both authors. Publications with these keywords in the title and/or in the abstract were included.

Studies were considered eligible if they met the following criteria: (1) they were published between 2000 and 2024 (to focus on the most recent research findings); (2) they were published in the English language; (3) they were peer-reviewed (to ensure quality); and (4) they were conducted in children aged 0-6 years. However, studies were considered invalid if (1) their titles and/or abstracts did not include one or more of the primary search terms; (2) their objectives did not include examining the caries pattern alone or in conjunction with other information; (3) they did not examine the caries pattern after the implementation of a preventive measure; (4) they contained no new or original findings; or (5) they included an undifferentiated mixture of children aged under and over six years. Articles were not excluded on methodological quality grounds.

Both authors selected two primary databases (namely PubMed and Google Scholar) to perform this scoping investigation, and both databases were thoroughly searched for literature explaining aspects of dental caries patterns in primary dentition. SK developed the search strategies, which were improved upon in partnership with PS. The PubMed search was conducted on February 18, 2025, and included key and MeSH terms, as well as specific filters (Table 1).

The Google Scholar search was conducted on February 19, 2025, with the advanced search settings that included the same keywords; the term "permanent dentition" was excluded. The full article with keywords was preferred over the title option, which displayed only a few articles. Articles of all types, especially those written in English between 2000 and 2024, were searched.

Grey literature was considered if it had been peer-reviewed. To locate additional relevant material, the secondary search analysed the reference lists of selected significant papers as well as the connected articles indicated beneath each article. Furthermore, PubMed and Google Scholar were utilised to look for relevant publications that cited the essential papers, and the results were recorded.

Before examining the complete texts, SK evaluated the titles and abstracts of all articles found via the PubMed and Google Scholar searches and decided which publications to include and which to discard. Only articles with the principal keywords in the title and/or abstract were considered for further screening. PS assessed the findings, and differences between the two writers concerning the selection of publications were resolved through discussion and agreement. All selected papers from PubMed and Google Scholar were entered into a Microsoft Excel spreadsheet, with duplicates removed. Before beginning to screen for potential relevance, both authors discussed the screening and exclusion criteria and reached an agreement on the final format. Full-text versions of relevant articles that had not previously been found via database searches were obtained and evaluated for inclusion. SK selected only pertinent ones that did not meet the exclusion criteria, while PS analysed the findings before agreeing on a final selection.

The study's authors devised and agreed on a data-charting form collaboratively. SK created a data charting form in Microsoft Excel to methodically chart data items such as authorship, study type, country, age group, number of participants, prevalence of caries, mean dmft, study design, and brief findings on the various aspects of the caries pattern that affect various teeth and their surfaces from various articles. SK's data-charting form was extensively reviewed by PS, and discrepancies were discussed and resolved. The data charting form's material was updated multiple times depending on the authors' conversations and the evaluation of new papers or PDFs. The authors' conversations enabled the final data to be verified and agreed upon.

Since the vulnerability of teeth and their surfaces to caries varies with age, the selected primary dentition study articles were arranged by age, from infancy to 6 years old, along with the measures used and summary findings.

Results

Participants

The PRISMA-ScR flow diagram appears in Figure 1, along with reasons for article exclusion. The search returned 24 PubMed articles and 189 Google Scholar articles, a total of 213 publications. While fifteen PubMed publications had the primary key phrases in the title and/or abstract, nine did not have them and were excluded. Twenty-eight Google Scholar articles had the keywords in the title and/or abstract, and 161 Google Scholar papers were removed because their titles and/or abstracts did not include the primary key phrases.

Five duplicate articles were found between PubMed and Google Scholar, leaving a total of 38 articles. A further 21 articles were excluded as four were not in English, seven had no focus on caries pattern, five were on children aged above 6 years, two contained no new information, and three were not original articles (Table 2). This left 17 studies. The secondary search identified five additional articles, resulting in 22 eligible studies.

The data charting form (Table 3) summarises the 22 studies included within this scoping review. Eligible studies covered 14 countries, including India (n=5), the United

Table 1. Search details and history undertaken in PubMed on 18 February 2025.

Search	Query	Results
#37	Search: #34 AND #35 AND #36 Filters: English, Humans, Child: birth-18 years, Infant: birth-23 months, Infant: 1-23 months, Preschool Child: 2-5 years, from 2000/1/1–2024/12/31 ((“primary dentition”[Title/Abstract] OR “deciduous dentition”[Title/Abstract] OR “primary teeth”[Title/Abstract] OR “deciduous teeth”[Title/Abstract] OR “tooth, deciduous”[MeSH Terms]) AND (“humans”[MeSH Terms] AND 2000/01/01:2024/12/31[Date–Publication] AND “english”[Language] AND (“infant”[MeSH Terms] OR “child”[MeSH Terms] OR “adolescent”[MeSH Terms] OR “infant”[MeSH Terms] OR “infant”[MeSH Terms:noexp] OR “child, preschool”[MeSH Terms])) AND ((“dental caries patter*”[Title/Abstract] OR “dental caries classification*”[Title/Abstract] OR “caries patter*”[Title/Abstract]) AND (“humans”[MeSH Terms] AND 2000/01/01:2024/12/31[Date–Publication] AND “english”[Language] AND (“infant”[MeSH Terms] OR “child”[MeSH Terms] OR “adolescent”[MeSH Terms] OR “infant”[MeSH Terms] OR “infant”[MeSH Terms:noexp] OR “child, preschool”[MeSH Terms]))) AND ((“dental caries”[Title/Abstract] OR “caries”[Title/Abstract] OR “dental cavity”[Title/Abstract] OR “tooth decay”[Title/Abstract] OR “dental caries”[MeSH Terms] OR “Dental Caries Susceptibility”[MeSH Terms]) AND (“humans”[MeSH Terms] AND 2000/01/01:2024/12/31[Date–Publication] AND “english”[Language] AND (“infant”[MeSH Terms] OR “child”[MeSH Terms] OR “adolescent”[MeSH Terms] OR “infant”[MeSH Terms] OR “infant”[MeSH Terms:noexp] OR “child, preschool”[MeSH Terms]))) AND ((humans[Filter]) AND (2000/1/1:2024/12/31[pdat]) AND (english[Filter]) AND (allchild[Filter] OR allinfant[Filter] OR infant[Filter] OR preschoolchild[Filter])) Translations humans[Filter]: humans[MH] english[Filter]: english [LA] allchild[Filter]: (infant [MH] OR child [MH] OR adolescent [MH]) allinfant[Filter]: infant [MH] infant[Filter]: infant [MH:noexp] preschoolchild[Filter]: child, preschool [MH] humans[Filter]: humans[MH] english[Filter]: english [LA] allchild[Filter]: (infant [MH] OR child [MH] OR adolescent [MH]) allinfant[Filter]: infant [MH] infant[Filter]: infant [MH:noexp] preschoolchild[Filter]: child, preschool [MH] humans[Filter]: humans[MH] english[Filter]: english [LA] allchild[Filter]: (infant [MH] OR child [MH] OR adolescent [MH]) allinfant[Filter]: infant [MH] infant[Filter]: infant [MH:noexp] preschoolchild[Filter]: child, preschool [MH]	24
#36	Search:”Dental caries” [tiab] OR caries [tiab] OR “dental cavity” [tiab] OR “tooth decay” [tiab] OR “Dental Caries”[Mesh] OR “Dental Caries Susceptibility”[Mesh] Filters: English, Humans, Child: birth-18 years, Infant: birth-23 months, Infant: 1-23 months, Preschool Child: 2-5 years, from 2000/1/1–2024/12/31 (“dental caries”[Title/Abstract] OR “caries”[Title/Abstract] OR “dental cavity”[Title/Abstract] OR “tooth decay”[Title/Abstract] OR “dental caries”[MeSH Terms] OR “Dental Caries Susceptibility”[MeSH Terms]) AND ((humans[Filter]) AND (2000/1/1:2024/12/31[pdat]) AND (english[Filter]) AND (allchild[Filter] OR allinfant[Filter] OR infant[Filter] OR preschoolchild[Filter]))	14,787
#35	Search: “dental caries patter*”[tiab] OR “Dental caries classification*”[tiab] OR “caries patter*” [tiab] Filters: English, Humans, Child: birth-18 years, Infant: birth-23 months, Infant: 1-23 months, Preschool Child: 2-5 years, from 2000/1/1–2024/12/31 (“dental caries patter*”[Title/Abstract] OR “dental caries classification*”[Title/Abstract] OR “caries patter*”[Title/Abstract]) AND ((humans[Filter]) AND (2000/1/1:2024/12/31[pdat]) AND (english[Filter]) AND (allchild[Filter] OR allinfant[Filter] OR infant[Filter] OR preschoolchild[Filter]))	46
#34	Search: “primary dentition”[tiab] OR “deciduous dentition” [tiab] OR “primary teeth”[tiab] OR “deciduous teeth”[tiab] OR “tooth, deciduous”[MeSH] Filters: English, Humans, Child: birth-18 years, Infant: birth-23 months, Infant: 1-23 months, Preschool Child: 2-5 years, from 2000/1/1–2024/12/31 (“primary dentition”[Title/Abstract] OR “deciduous dentition”[Title/Abstract] OR “primary teeth”[Title/Abstract] OR “deciduous teeth”[Title/Abstract] OR “tooth, deciduous”[MeSH Terms]) AND ((humans[Filter]) AND (2000/1/1:2024/12/31[pdat]) AND (english[Filter]) AND (allchild[Filter] OR allinfant[Filter] OR infant[Filter] OR preschoolchild[Filter]))	6,197

Table 2. Selected PubMed and Google Scholar articles merged after the elimination of five duplicates.

		Accepted/ rejected	Accepted	Rejected	Reasons for rejection
1	Ahmad S, Khan H, Khan M, Maryam W. (2015). Prevalence and patterns of early childhood caries among school children in Peshawar. *Journal of Khyber College of Dentistry*. 6:36-39.	✓	1		
2	Benelli KDRG, Chaffee BW, Kramer PF, Knorst JK, Ardenghi TM, Feldens CA. (2022). Pattern of caries lesions and oral health-related quality of life throughout early childhood: a birth cohort study. *European Journal of Oral Sciences.* 130:e12889.	X		1	No relevance
3	Campus G, Solinas G, Strohmenger L, Cagetti MG, Senna A, Minelli L, Majori S, Montagna MT, Reali D, Castiglia P. (2009). National pathfinder survey on children’s oral health in Italy: pattern and severity of caries disease in 4-year-olds. *Caries Research.* 43:155-162.	X		1	No relevance

4	Chandan GD, Saraf S, Sangavi N, Khatri A. (2018). Pattern of dental caries in 3-6-year-old children using decayed, missing, filled surface index and hierarchical caries pattern system: a descriptive study. *Journal of the Indian Society of Pedodontics and Preventive Dentistry*. 36:108-112.	X		1	No relevance
5	Deshpande A, Deshpande N. (2012). Similar caries pattern in monozygotic twins: role of nature and/or nurture. *European Journal of General Dentistry*. 1:104-108.	X		1	No relevance
6	Douglass JM, Tinanoff N, Tang JM, Altman DS. (2001). Dental caries patterns and oral health behaviors in Arizona infants and toddlers. *Community Dentistry and Oral Epidemiology*. 29:14-22.	✓	1		
7	Du M, Bian Z, Guo L, Holt R, Champion J, Bedi R. (2000). Caries patterns and their relationship to infant feeding and socio-economic status in 2–4-year-old Chinese children. *International Dental Journal.* 50:385-389.	X		1	No relevance
8	Elfrink ME, Veerkamp JS, Kalsbeek H. (2006). Caries pattern in primary molars in Dutch 5-year-old children. *European Academy of Paediatric Dentistry*. 7:236-240.	✓	1		
9	Escobar-Paucar GM, Ramírez-Puerta BS, Álvarez-Sánchez LG. (2019). Caries patterns in primary dentition in 3-to 5-year-old children. Medellín, Colombia. *Revista Facultad de Odontología Universidad de Antioquia.* 31:47-56.	✓	1		
10	Feldens CA, Braga VS, Kramer PF, Vítolo MR, Rodrigues PH, de Barros Coelho EMR, Chaffee BW. (2023). Primary dentition caries patterns as predictors of permanent dentition caries: a prospective cohort study. *Caries Research*. 57:167-176.	X		1	No relevance
11	Gudipaneni RK. (2019). Pattern and severity of early childhood caries among preschool children in northern region, Saudi Arabia: a cross-sectional study. *Pesquisa Brasileira em Odontopediatria e Clínica Integrada.* 19:e4622.	✓	1		
12	He S, Yon MJY, Liu F, Lo ECM, Yiu CKY, Chu CH, Lam PPY. (2024). Prevalence of caries patterns in the 21st century preschool children: a systematic review and meta-analysis. *Journal of Evidence-Based Dental Practice.* 24:101992.	X		1	Not original study
13	Im KW, Lee KH, Ra JY, An SY, Kim Y H. (2010). Tooth surface caries patterns in the primary dentition according to breast or bottle feeding. *Journal of the Korean Academy of Pediatric Dentistry.* 37:151-158.	X		1	Not in English
14	Jeong SY, Lee KH, Ra JY, An SY, Kim YH. (2010). Dental caries patterns in the primary dentition: a cluster analysis and a multidimensional scaling analysis. *Journal of the Korean Academy of Pediatric Dentistry.* 37:159-167.	X		1	Not in English
15	Khan NB, Al-Ghannam NA, Al-Shammery AR, Wyne AH. (2001). Caries in primary school children: prevalence, severity and pattern in Al-Ahsa, Saudi Arabia. *Saudi Dental Journal.* 13:71-74.	X		1	Above 6 years
16	Manal AM, AlKattan H, ALBukhari L, El Meligy O. (2019). Assessment of dental decay in a group of children in Jeddah, Kingdom of Saudi Arabia. *International Journal of Clinical Pediatric Dentistry*. 12: 423.	X		1	Above 6 years
17	Mbawalla HS, Nyamuryekung'e KK, Mtaya-Mlangwa M, Masalu JR. (2023). Dental caries pattern amongst Tanzanian children: National Oral Health Survey. *International Dental Journal*. 73:731-737.	X		1	Above 6 years
18	Medina-Solís CE, Herrera MDS, Rosado-Vila G, Minaya-Sánchez M, Vallejos-Sánchez AA, Casanova-Rosado JF (2004). Tooth loss and patterns of caries in preschool children of a suburban community of Campeche-2001. *Acta Odontológica Venezolana.* 42:165-170.	X		1	Not in English
19	Olczak-Kowalczyk D, Turska-Szybka A, Strużycka I, Gozdowski D, Bachanek T, Kaczmarek U. (2017). Caries pattern in three-year old preschool children. *Dental and Medical Problems.* 54:241-246.	✓	1		
20	Omotuyole A, Oredugba F, Sote E, Jaja S, Olagundoye O, Kuye O. (2022). Dental caries, its pattern and association with oral hygiene and body mass index among preschoolers in Lagos, Nigeria. *LASU Journal of Dental Sciences*. 2:20-26.	X		1	Above 6 years
21	Paul TR. (2003). Dental health status and caries pattern of preschool children in Al-Kharj, Saudi Arabia. *Saudi Medical Journal*. 24:1347-1351.	✓	1		
22	Psoter WJ, Pendrys DG, Morse DE, hang H, Mayne ST. (2006). Associations of ethnicity/race and socioeconomic status with early childhood caries patterns. *Journal of Public Health Dentistry*. 66:23-29.	X		1	No relevance
23	Psoter WJ, Zhang H, Pendrys DG, Morse DE, Mayne ST. (2003). Classification of dental caries patterns in the primary dentition: a multidimensional scaling analysis. *Community Dentistry and Oral Epidemiology*. 31:231-238.	X		1	No new information
24	Psoter WJ, Morse DE, Pendrys DG, Zhang H, Mayne ST. (2004). Historical evolution of primary dentition caries pattern definitions. *Pediatric Dentistry*. 26:508-511.	X		1	No new information
25	Psoter WJ, Pendrys DG, Morse DE, Zhang HP, Mayne ST. (2009). Caries patterns in the primary dentition: cluster analysis of a sample of 5,169 Arizona children 5–59 months of age. *International Journal of Oral Science.* 1:189-195.	✓	1		
26	Rai A, Sundas S, Dhakal N, Khapung A. (2024). Assessment of severity and pattern of early childhood caries using ICDAS II criteria: a descriptive cross-sectional study. *Journal of Nepal Medical Association.* 62:639-645.	✓	1		
27	Rao NC, Bhardwaj VK, Sharma KR. (2010). Prevalence pattern of dental caries among five-year-old school going children in Shimla city, Himachal Pradesh-A cross sectional study. *Indian Journal of Oral Sciences*. 1:7.	X		1	No new information
28	Sachdeva A, Punhani N, Bala M, Arora S, Gill GS, Dewan N. (2015). The prevalence and pattern of cavitated carious lesions in primary dentition among children under 5 years age in Sirsa, Haryana (India). *Journal of International Society of Preventive and Community Dentistry.* 5:494-498.	X	1		
29	Saravanan S, Madivanan I, Subashini B, Felix JW. (2005). Prevalence pattern of dental caries in the primary dentition among school children. *Indian Journal of Dental Research.* 16:140-146.	✓	1		

30	Sharma KR, Bhardwaj VK. (2011). Prevalence of dental caries and its pattern among five year old school going children in Shimla city, Himachal Pradesh. *Journal of Indian Association of Public Health Dentistry.* 9:S539-S543.	✓	1		
31	Sowole A, Sote E, Folayan M. (2007). Dental caries pattern and predisposing oral hygiene related factors in Nigerian preschool children. *European Academy of Paediatric Dentistry*. 8:206-210.	✓	1		
32	Srivastava VK, Badnaware S, Kumar A, Khairnar M, Chandel M, Bhati V, Gupta P, Sonal S, Ramasamy S. (2024). Prevalence of most caries-susceptible area on individual primary tooth surface: an observational study. *Journal of Clinical Pediatric Dentistry*. 48:111-120.	✓	1		
33	Srivastava VK. (2020). Prevalence and pattern of caries in primary anterior teeth of preschool children: an observational study. *Journal of the Indian Society of Pedodontics and Preventive Dentistry*. 38:26-33.	✓	1		
34	Tsai AI, Chen CY, Li LA, Hsiang CL, Hsu KH. (2006). Risk indicators for early childhood caries in Taiwan. *Community Dentistry and Oral Epidemiology*. 34:437-445.	✓	1		
35	Tsai AI, Hsiang CL, Johnsen DC. (2000). Caries levels and patterns in the primary dentition of preschool children in Taiwan. *Chang Gung Medical Journal*. 23:22-27.	X		1	Not in English
36	Vanobbergen J, Lesaffre E, García-Zattera MJ, Jara A, Martens L, Declerck D. (2007). Caries patterns in primary dentition in 3-, 5- and 7-year-old children: spatial correlation and preventive consequences. *Caries Research*. 41:16-25.	X		1	Above 6 years
37	World Health Organization. (2017). *WHO expert consultation on public health intervention against early childhood caries: report of a meeting, Bangkok, Thailand, 26-28 January 2016* (No. WHO/NMH/PND/17.1). World Health Organization.	X		1	Not original study
38	Wyne AH, Al-Ghannam NA, Al-Shammery AR, Khan NB. (2002). Caries prevalence, severity and pattern in pre-school children. *Saudi Medical Journal.* 23:580-584.	✓	1		
	Total		**17**	**21**	

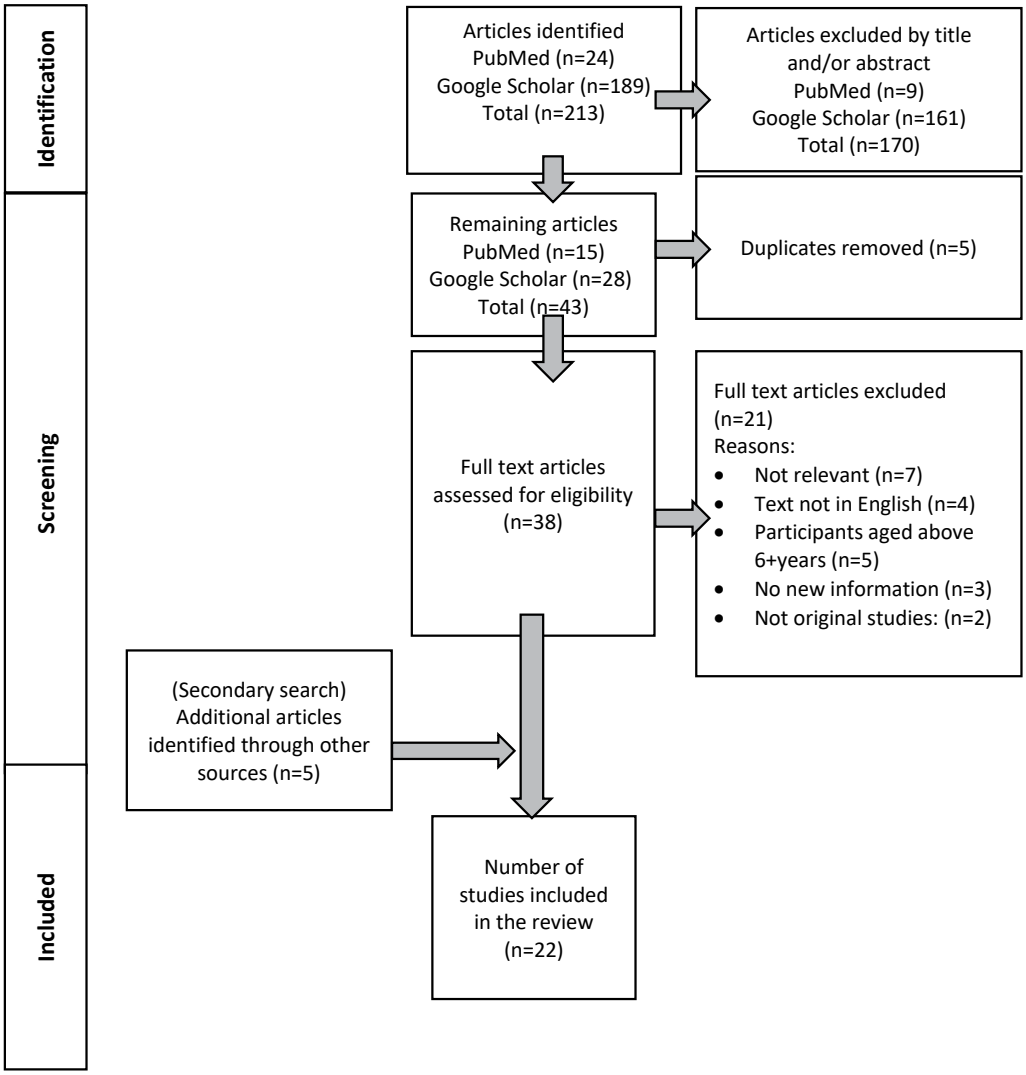

Figure 1. PRISMA-ScR flow diagram for the scoping review process.

Table 3. Data Charting Form: Studies included in the scoping review (n=19), with key findings arranged by age.

Study attributes: Lead author (year) Study design Country Age range (n participants) Caries prevalence/dmft	Key findings
Thitasomakul et al. (2006) Longitudinal Thailand 9-18 mth (n=599) Caries prevalence 2.0%, 22.8%, and 68.1% in 9, 12-, and 18-mth olds (respectively)	Dental caries initiated at 3-6 months after tooth eruption, and carious lesions developed continuously over time. By 18 months, 35.0% of the teeth and 14.9% of the surfaces were affected by caries. Buccal surfaces were the most affected surfaces (44.9%), followed by the lingual (24.2%), mesial (20.0%), and distal surfaces (8.9%).
Douglass et al. (2001) Cross-sectional Arizona, USA 6-36 mth (n=2,428) Caries prevalence 25%	Maxillary anterior caries developed as early as 10–12 months of age. Fissure caries of the molars, either alone or with maxillary anterior caries, was seen as early as 13-15 months of age. Posterior proximal caries was seen as early as 19-21 months and was only present in conjunction with the other patterns.
Sobiech et al. (2021) Cross-sectional Warsaw, Poland 12-36 mth (n=496) Caries prevalence 44.8% mean dmft: 2.6	Carious lesions were most often found on the central maxillary incisors (34.2%) and the first molars of both arches (21.0%, including 23.5% for the maxilla and 18.6% for the mandible). Carious lesions were most often found on the labial surfaces of the maxillary incisors (19.1%) and occlusal surfaces of first molars (19.4%). Caries rates in maxillary teeth and tooth surfaces were higher than those in the mandible. The distribution of caries was symmetrical on the left and right sides of the dental arches. The youngest age group (12-18 months) was most affected by maxillary incisors (13.7%), followed by maxillary canines, while maxillary and mandibular first molars and mandibular incisors were less likely to be affected. Carious lesions are most common in children aged 18-24 months, primarily on the labial surfaces of maxillary incisors and occlusal surfaces of first molars. In children aged 24-30 months, the highest percentage of carious teeth was found in maxillary incisors (42.2%), followed by maxillary molars (20.5%) and mandibular molars (19.5%). Carious lesions were most often found on labial and palatal surfaces of maxillary incisors. In the 30-36-month age group, carious maxillary teeth (27.1%) were almost twice as high as in the mandible (14.7%). The highest percentages of carious teeth were found in maxillary incisors (37%), mandibular molars (28.2%), and maxillary molars (22.8%). Carious lesions were mainly located on the labial and palatal surfaces of maxillary incisors and occlusal surfaces of molars.
Olczak-Kowalczyk et al. (2017) Cross-sectional Poland 3 years (n=353) Mean dmft: 4.5	More caries was recorded in mandibular molars, followed by maxillary central incisors and maxillary molars. Symmetrical distribution was noticed. Among the 2,426 surfaces of caries, 31.8% were proximal, 29.3% smooth, and 38.3% occlusal surfaces. The percentages of occlusal surfaces of molars with caries were second mandibular molars 12%, first mandibular molars 10.6%, first maxillary molars 8.1%, and second maxillary molars 8.0%. Mandibular molars were more frequently affected by caries, followed by maxillary central incisors and the maxillary molars. Of the surfaces affected by caries, 31.9% were proximal, 29.3% were smooth, and 38.3% were occlusal surfaces.
Sachdeva et al. (2015) Cross-sectional (Only cavitated carious lesions) Haryana, India Up to 5 years (n=576) Caries prevalence 33.8%	Higher caries prevalence was noticed in maxillary anterior teeth and mandibular posterior teeth. Primary second molars showed the highest caries prevalence in both arches. Mandibular molars (13.7%), maxillary molars (8.4%), and maxillary anterior teeth (5.5%) were predominantly affected. Mandibular anterior teeth were least affected. On comparing the right and left sides of the oral cavity, the pattern of cavitated carious lesions showed a bilateral phenomenon.
Escobar-Paucar et al. (2019) Cross-sectional Medellin, Colombia 3-5 years (n=548) Caries prevalence 76.5% mean dmft: 3.7	The occlusal surface showed the highest values of caries lesion experience, varying from 17.7% to 36.1%. The maxillary smooth anterior surfaces were affected from 0.2% to 17.2%, while mandibular smooth anterior surfaces showed the lowest values, from 0.0% to 6.8%. In maxillary anterior teeth, the lingual surfaces were the least affected. The percentage of dental caries experience in second molars varies from 37.1% to 42%, while in mandibular central and lateral incisors the values range from 1.8% to 4.6%. The analysis of caries experience by tooth type showed that maxillary second molars were the most impacted teeth (39.5%), followed by mandibular molars (39.2%), maxillary first molars (29.0%), and maxillary central incisors (23.2%). The lowest values were observed in the mandibular central and lateral incisors, with 2.0% and 3.8%, respectively. Most affected areas were occlusal surfaces in molars and labial or facial surfaces in maxillary incisors. Among 3-year-olds, the maxillary and mandibular second molars were most impacted, followed by the mandibular first molars, maxillary first molars, and maxillary central incisors. For 4-year-olds, the second molars remain the most affected teeth, followed by the mandibular first molars, but the maxillary central incisors show higher proportions of caries lesions than the maxillary first molars. By age 5 years, mandibular second molars were the most affected tooth type, followed by the maxillary second molars, the mandibular first molars, the maxillary first molars, and the maxillary central incisors.

Njoroge et al. (2010) Cross-sectional Kiamba, Kenya 3-5 years (n=336) 59.5% of the sample Mean dmft: 2.5 Caries prevalence 3 years: 47% Caries prevalence 4 years: 55% Caries prevalence 5 years: 63%	Caries was more common in maxillary teeth compared to mandibular teeth. Mandibular molars (40%) were the most afflicted teeth, followed by maxillary molars (25%) and maxillary incisors (25%). The least affected teeth were the maxillary canines (2%) and mandibular incisors. The most common tooth types for caries were molars (65.7%), incisors (28.4%), and canines (5.9%).
Srivastava et al. (2024) Cross-sectional Purvanchal, India 3-5 years (n=186) Not available	The prevalence of caries-susceptible areas was considerably greater in maxillary teeth (maxillary teeth: 41.7% vs. mandibular teeth: 30.7%) and anterior teeth (anterior teeth: 43.7% vs. posterior teeth: 28.4%). Among maxillary teeth, 37.1% of central incisors, 16.0% of lateral incisors, 38.4% of canines, 7.9% of first molars, and 0.6% of second molars were affected by caries. In mandibular teeth, 14.7% of central incisors, 6.9% of lateral incisors, 33.7% of canines, 33.0% of first molars, and 11.7% of second molars were affected. The prevalence of caries-susceptible regions on the right side was comparable to that on the left. The labio/bucco-mid-cervical and labio/bucco-central areas of the primary maxillary canine, as well as the mid-mesio-occlusal and mid-occlusal areas of the primary mandibular 1st molar, were more vulnerable to the initial carious lesion, with the maxilla being more commonly affected than the mandibular arch.
Wyne et al. (2002) Al-Ahsa, Saudi Arabia 3-5 years (n-322) Mean dmft: 2.9	The maxillary teeth with the highest caries prevalence were central incisors, followed by first molars. Canines were the least afflicted maxillary teeth. Caries prevalence was high in mandibular first molars, followed by second molars. Mandibular central incisors were least affected. Caries prevalence was high in mandibular first molars, followed by mandibular second molars and maxillary central incisors. The least affected teeth were mandibular central incisors.
Gudipaneni et al. (2019) Cross-sectional* Al-Jouf, Saudi Arabia 5 years (n=270) Caries prevalence not available	Among the posterior teeth, the mandibular first molar was the most commonly affected tooth, followed by the mandibular second molar, maxillary second molar, and maxillary first molar. In the maxillary arch, the most affected tooth was the second molar (82.2%), followed by the first molar (75.6%), central incisor (33.3%), canine (28.9%), and lateral incisor (22.2%). In the mandibular arch, the first molar (93.3%) was the most affected tooth, followed by the second molar (88.5%), canine (20%), central incisor (4.4%), and lateral incisor (2.2%). Regarding carious surfaces, the occlusal surface was most highly involved in the maxillary arch, followed by distal, mesial, buccal, lingual, labial, palatal, and incisor surfaces. In the mandibular arch, the occlusal surface was the most highly involved surface, followed by the distal, buccal, lingual, and mesial surfaces.
Elfrink et al. (2006) Cross-sectional Netherlands 5-years (n=692) Caries prevalence 49% mean dmft: 2.5	Caries prevalence between surfaces of first and second primary molars only Second primary molars, even after being corrected for caries in the pits and buccal/palatal fissures of this molar, are more affected by caries than first primary molars, and the differences in caries prevalence are the largest on the occlusal surface. On proximal surfaces, the first primary molars had significantly more caries than the second primary molars.
Saravanan et al. (2015) Cross-sectional Pondicherry, India 5 years (n=1,009) 44.4% of the sample	The caries prevalence was higher in the mandibular arch. Caries was more prevalent in the anterior region of the maxillary arch and the posterior region of the mandibular arch. The second molar had a higher caries experience than the first molars in both arches. The caries attack follows a specific pattern: mandibular molars (21.7%), maxillary molars (10.1%), and maxillary anterior teeth (6.5%) were predominantly affected by caries, whereas the mandibular anterior teeth (0.4%) were least affected. When comparing caries prevalence in relation to the right and left sides of the oral cavity, dental caries occurs predominantly as a bilateral phenomenon.
Sharma et al. (2011) Cross-sectional Shimla city Himachal Pradesh, India 5 years (n=800) Caries prevalence 44.3%	Caries prevalence was 26.5% in the maxillary arch and 36.1% in the mandibular arch. Comparison of caries between the arches in the anterior segment revealed that caries attack was higher in the maxillary arch. It was higher in the mandibular arch than the maxillary arch among the posterior teeth. On comparing the right and left sides of the oral cavity, it was found that the caries occurred in a bilateral pattern. When caries prevalence was compared between anterior and posterior teeth, it was higher in the posterior segment than in the anterior segment. The pattern of prevailing dental caries was that mandibular molars (21.7%), maxillary molars (10.1%), and maxillary anterior teeth (6.5%) were predominantly affected, whereas the mandibular anterior teeth were least affected (0.4%).
Ferro et al. (2009) Cross-sectional Veneto, Italy 5 years (n=348) Caries prevalence 42% mean dmft 1.8	Caries in anterior teeth (12%) most often involved the maxilla and was rare in mandibular anterior teeth. The most affected anterior teeth were central incisors (buccal surfaces), while the least affected ones were canines. The most commonly affected teeth were mandibular molars (78%), followed by the maxillary molars. The surfaces of the molars most often affected were the occlusal (52%). Proximal surfaces were affected more in the first than in the second primary molars. Dental caries occurred most often in the maxilla (53.6%). Almost all caries in the mandible was in molars (95.5%). A comparison of caries prevalence in the right and left sides of the oral cavity showed a symmetrical distribution localised on molars, most often in the occlusal surfaces.

Paul (2003) Cross-sectional Al-Kharj, Saudi Arabia 5-years (n=103) Caries prevalence 83.5% Mean dmft:7.1	The most commonly affected teeth with caries were mandibular first (61.2%) and second molars (60%), and the least affected were mandibular lateral incisors (7.7%). Among maxillary molars, 53.4% of first molars and 48% of the second molars were affected. Caries prevalence was higher in maxillary central and lateral incisors compared to mandibular central and lateral incisors. Caries was found bilaterally in all of the teeth.
Psoter et al. (2009) Cross-sectional Arizona, USA 5-59 mth (n=5,171) Caries prevalence not available	The analysis identified four different patterns: (i) smooth surfaces (other than the maxillary incisors); (ii) maxillary incisors; (iii) occlusal surfaces of first molars; and (iv) pits and fissures of second molars.
Tsai et al. (2006) Cross-sectional Taiwan 0-6 years (n=981) Caries prevalence 46% Mean deft: 1.0	Caries patterns across all age groups are distributed as follows: 3.98% of children at age 2 fit the facial-lingual caries pattern; that is, 78% of the caries-positive children. For children of age 3 years, 30% (50.5% of the caries-positive children) fit the facial-lingual pattern, and 24% (42% of the caries-positive) of children fall into the pit and fissure caries pattern. Also at this age level, 5% of the children experienced facial-lingual and molar approximal caries. At age 4 years, the facial-lingual and molar approximal pattern increased approximately 2.6 times that of the 3-year-olds (13.3% vs. 5.1%), and the molar approximal pattern increased 4 times (3.6% vs. 0.9%). Overall, the percentage of children affected by the molar approximal caries pattern is the lowest among 3- and 4-year-olds (0.9% and 3.6%, respectively). At age 5 years, the percentage of both molar approximal and facial-lingual molar approximal caries patterns increased to 13% and 40%, respectively. At age 6 years, more than half of the children experienced facial-lingual molar approximal caries. The other caries patterns were evenly distributed among the age groups, ranging from 11% to 15%. The percentage of children in the facial-lingual category decreased with age (3- to 6-year-olds). However, an increase in the percentage of children experiencing facial-lingual molar approximal caries was seen. The percentage of children in the caries-free category decreased steadily from ages 3 to 5 years.
Sowale et al. (2007) Cross-sectional Lagos, Nigeria 6-71 mth (n=389) Caries prevalence 10.5%	The likelihood of having maxillary incisal caries was eight times higher than that of having mandibular incisal caries. Of maxillary incisor teeth with caries, 12.2% of the central and lateral incisors were severely damaged, 34.1% had buccal surface caries, and 53.7% had proximal caries. Of the mandibular incisors with caries, 33.3% were severely broken down, whereas 66.7% had proximal caries. There were more mandibular molars with caries than maxillary molars (41 vs. 16); in maxillary molars, 62.5% of teeth had occlusal surface caries only, 31.3% of carious teeth involved one proximal surface, and 6.2% had two proximal surface involvements. In the mandible, 70.7% of teeth had occlusal caries, 26.8% had caries involving one proximal surface, and 2.4% had two proximal surfaces involved. There were 34.5% carious maxillary first molars and 65.5% mandibular first molars, 21.6% maxillary second molars, and 78.5% mandibular second molars. The odds of a second mandibular primary molar being carious was 4 times greater than having a second maxillary molar carious.
Rai et al. (2024) Cross-sectional* Nepal 24-71 mths (n-200) Caries prevalence not available	Assessing the pattern/location of caries of individual tooth type, the occurrence in maxillary central incisors (multi-surface caries) was 41.0%, the occurrence in the occlusal surface of the mandibular second molars was 37.8%, and that in maxillary second molars was 36%. The mandibular second molars were the most typically afflicted teeth (74%), whereas the mandibular lateral incisors were the least affected (9.04%).
Srivastava (2020) Analytical observational (anterior maxillary and mandibular teeth) Purvanchal, India 3-6 years (n=900) Caries prevalence ranged from 2% to 40.7% in anterior teeth	Mandibular central incisors, lateral incisors, and canines had a fourfold, eightfold, and fivefold decreased risk of acquiring caries compared to maxillary central, lateral, and canines, respectively. Right maxillary and mandibular anterior teeth had more prevalence of caries as compared to their left counterparts.
Ahmad et al. (2015) Cross-sectional Peshawar, Pakistan 3-6 years (n=406) Caries prevalence 88.9%	Three patterns were identified: the breastfeeding habit-associated pattern (72.5%), the molar proximal pattern (13.9%), and the molar occlusal and pit fissure/hypoplastic pattern (13.6%).
Hasim et al. (2010) Cross-sectional Ajman, United Arab Emirates 5-6 years (n=1,036) Caries prevalence 76.4% mean dmft: 4.9	Caries experience was more prevalent in the maxillary anterior and mandibular posterior teeth. The teeth most frequently affected by caries were mandibular second molars, and the least affected were mandibular central incisors. The prevalence of bilateral molar caries was 18.0% for maxillary first molars, 23.2% for maxillary second molars, 28.3% for mandibular first molars, and 29.7% for mandibular second molars.

Abbreviations: mth, months; OH, oral health; USA, United States of America; dmft, decayed, missing, and filled primary teeth. deft: decayed, extracted, and filled primary teeth. Note: *children attending dental clinics.

States of America (n=2), Saudi Arabia (n=3), and Poland (n=2); see Table 2. Twenty-one studies (n=21) were cross-sectional analyses, with just one employing a longitudinal design. Table 2 also gives children's age range across the eligible studies, which varied considerably, ranging from 9-to-18-month-olds to 5-6-year-olds. Few studies were conducted on children who attended clinics. The majority of research used mixed-age groups, with the exception of those including 9-, 12-, and 18-month-olds, 3-year-olds, and 5-year-olds. Few studies in mixed-age groups reported data for each cohort separately. The search found no studies specific to children aged two, four, or six years. All of the studies included in this review employed clinical examinations to detect caries, not radiography.

Dental caries patterns

Findings were described under the concepts of teeth/surfaces, pattern categorisation, and symmetry. *Teeth/surfaces*: caries patterns by age. Table 3 houses all the selected studies together with summaries of their key characteristics. Stratified by age groups, a detailed summary of their primary dentition findings follows.

9-, 12-, and 18-month-olds: The teeth acquired caries on maxillary incisors at 3-6 months after initial eruption, and carious lesions developed continuously over time (Thitasomakul *et al*., 2016). The buccal surface of the maxillary incisors was the most affected , followed by lingual, mesial, and distal surfaces, respectively. First molar teeth were also found to have caries.

6-36-month-olds: Maxillary anterior caries appeared as early as 10 to 12 months of age. Fissure caries in the molars, either alone or in combination with maxillary anterior caries, were discovered as young as 13 to 15 months of age (Douglass *et al*., 2001). Posterior proximal caries appeared as early as 19 to 21 months and were only discovered in combination with the other forms.

12-36-month-olds: Carious lesions were most often seen on the central maxillary incisors, followed by the first molars of both arches, with the maxilla showing greater rates than the mandible (Sobiech *et al*., 2021). Carious lesions were more frequently observed on the labial surfaces of maxillary incisors and the occlusal surfaces of first molars. Caries appeared symmetrically on both the left and right sides of the dental arch.

3-year-olds: Caries was most commonly seen in mandibular molars, followed by maxillary central incisors and maxillary molars (Olczak-Kowalczyk *et al*., 2017). The prevalence of caries was more on the occlusal surfaces, followed by proximal and smooth surfaces. A symmetrical distribution of caries on both sides was found.

Under 5-year-olds: Only cavitated lesions were included in this investigation (Sachdeva *et al*., 2015). The mandibular molars, followed by the maxillary molars and maxillary anterior teeth, were most impacted. The mandibular anterior teeth were the least damaged. Comparing the right and left sides of the oral cavity, the pattern of cavitated carious lesions showed a bilateral phenomenon.

3-5-year-olds: The eligible four studies (Escobar-Paucar *et al*., 2019; Njoroge *et al*., 2010; Srivastava *et al*., 2024; and Wyne *et al*., 2002) yielded consistent findings. Escobar-Paucar *et al*. (2019) found that the maxillary second molars, followed by mandibular molars, maxillary first molars, and maxillary central incisors, were affected by caries. Most affected areas were occlusal surfaces in molars and labial or facial surfaces in maxillary incisors. Njoroge *et al*. (2010) found that mandibular molars were the most affected teeth, followed by maxillary molars and maxillary incisors. In both studies, the least affected teeth were the mandibular incisors. The study by Srivastava *et al*. (2024) found that the prevalence of caries-susceptible areas on each primary tooth was significantly higher in maxillary teeth compared with mandibular teeth and in anterior teeth compared with posterior teeth. Wyne *et al*.'s 2002 study revealed that central incisors and first molars were the maxillary teeth with the highest caries prevalence, while canines were the least affected. Mandibular first molars and second molars had the highest caries prevalence, while mandibular central incisors were least affected.

5-year-olds: Caries attack was more prevalent in the anterior section of the maxillary arch compared to the mandibular arch (Elfrink *et al*., 2006; Saravanan *et al*., 2015; Sharma *et al*., 2011; Ferro *et al*., 2009; Gudipaneni *et al*., 2019; and Paul, 2003). The central incisors (buccal surfaces) were the most severely affected anterior teeth. The mandible's anterior teeth were the least damaged by caries. Comparison of caries between the arches in the posterior segment revealed that caries attack was higher in the mandibular arch. The pattern of prevailing dental caries was that mandibular molars, maxillary molars, and maxillary anterior teeth. Occlusal surfaces of the second molars were the most commonly affected. Proximal surfaces were affected more in the first molars than in the second molars. In four studies quoted, the second molar had a higher caries experience than the first molars in both arches. However, in the studies by Gudipaneni *et al*. (2019) and Paul (2003), the mandibular first molar was the most commonly affected tooth, followed by the mandibular second molar, maxillary second molar, and maxillary first molar. On proximal surfaces, the first primary molars had significantly more caries than the second primary molars.

6-to-71-month-olds: According to Sowale *et al*. (2007), the prevalence of caries in maxillary incisor teeth was eight times higher than in mandibular incisal teeth. A mandibular second molar was four times more likely to be carious than a maxillary second molar. Caries was most prevalent in mandibular second molars, followed by mandibular first molars, maxillary first molars, and maxillary second molars. Caries were more common on occlusal surfaces than proximal surfaces in both arches, among molars. The mandibular molars had more occlusal caries, whereas the maxillary molars had more proximal caries between the arches.

24-to-71-month-olds: Caries was most commonly seen in the maxillary central incisors, followed by mandibular second molars and maxillary second molars (Rai *et al*., 2024). The mandibular second molars suffered the most damage, whereas the mandibular lateral incisors were the least impacted.

3-to-6-year-olds: The prevalence and patterns of dental caries were investigated only in the maxillary and

mandibular primary anterior teeth (Srivastava *et al*., 2020). Maxillary and mandibular right anterior teeth had more caries prevalence as compared to their left counterparts. Maxillary anterior teeth had more prevalence of caries as compared to mandibular anterior teeth.

5-6-year-olds: Caries was more common in maxillary anterior and mandibular posterior teeth (Hasim *et al*., 2010). The teeth most commonly impacted by caries were mandibular second molars, whereas mandibular central incisors were least affected.

Categorisation of caries patterns:

3-6-year-olds: According to the study by Ahmad *et al*. (2015), three patterns were identified: the breastfeeding habit-associated pattern (maxillary anterior pattern/ faciolingual pattern and faciolingual molar pattern) (72.5%), the molar proximal pattern (13.9%), and the molar occlusal and pit fissure/hypoplastic pattern (13.6%).

5-to-59-month-olds: Using cluster analysis, Poster *et al*. (2009) identified four caries patterns: smooth surfaces (other than the maxillary incisors), maxillary incisors, occlusal surfaces of first molars, and pit fissures of second molars. However, they did not provide the empirical caries pattern distribution for their sample.

Under the age of 6 years: Tsai *et al*. (2006) defined caries patterns as caries-free or having one of four patterns, namely, pit and fissure caries, facial/lingual caries, molar proximal caries, or facial/lingual molar proximal lesions. Among 2-year-olds, 4.0% had the facial-lingual caries pattern, accounting for 78% of caries-positive children. For 3-year-olds, 30% (50.5% of caries-positive children) fitted the facial-lingual pattern, whereas 24% (42% of caries-positive children) fitted the pit and fissure caries pattern. At this age, 5% of children developed facial-lingual or molar approximal caries. Among 4-year-olds, the facial-lingual and molar approximal patterns increased approximately 2.5 times that of 3-year-olds (13.3% vs. 5.1%), with the molar approximal pattern growing over time (3.6% vs. 0.9%). Overall, children aged three and four had the lowest prevalence of molar approximal caries (0.9% and 3.6%, respectively). Among 5-year-olds, the percentage of both molar approximal and facial-lingual molar approximal caries patterns dramatically increased to 13% and 40%, respectively. Lastly, for 6-year-olds, more than half of the children experienced facial-lingual molar approximal caries. Other caries patterns were evenly distributed among the age groups, ranging from 11% to 15%.

Symmetry

Six studies explicitly considered caries symmetry: Sobiech *et al*. (2021) among 12-36-month-olds; Srivasta *et al*. (2024) among 3-5-year-olds; and Sarvanan *et al*. (2005), Ferro *et al*. (2009), Paul (2003), and Sharma *et al*. (2011) among 5-year-olds. All found that caries occurs bilaterally in children's primary dentition.

Discussion

Despite the diverse array of evidence derived from multiple countries using a variety of approaches, including widely differing sample sizes, age cohorts, techniques for diagnosing and documenting caries, and study types, parallels in findings were identified. Moreover, these shared caries patterns were linked to both age and caries levels. This is congruent with the findings of the systematic review and meta-analysis of caries trends (He *et al*., 2024), which showed that caries patterns are constant across socioeconomic level and geographical location.

Primary teeth emerge in the following order: incisors, first molars, canines, and second molars between the ages of 6 and 30 months. At the age of six years, the central incisors are generally the first to spontaneously exfoliate, followed by the lateral incisors, first molars, and mandibular canines. The age range of 0-6 years was chosen in this review to prevent mixed dentition beyond 6 years and to match with the age defined in the criteria of early childhood caries proposed by the American Academy of Paediatric Dentistry in 2016. As new teeth emerge in the oral cavity, the prevalence and severity of caries rise, depending on dietary and oral hygiene habits, as well as access to dental care. The length of time primary teeth remain in the oral cavity is associated with increased caries level risk, assuming all other risk factors remain constant. This suggests that the optimal age to evaluate caries patterns in primary teeth is five years old, when all primary teeth have maximal exposure. It is notable that caries prevalence at this age substantially differs between countries; whereas caries prevalence among similarly aged 5-year-olds was 42% in Italy (Ferro *et al*., 2009) and 89.5% in Saudi Arabia (Paul, 2003), it was around 44% in two Indian studies (Saravanan *et al*., 2005; Sharma *et al*., 2011). This review found that caries was most prevalent in 5-year-olds on the occlusal surfaces of mandibular second molars, followed by maxillary second molars, proximal surfaces of mandibular first molars, maxillary first molars, the cervical area of the labial surface, and the proximal surfaces of maxillary incisors. Two studies presented categorisations for caries patterns, and Tsai and colleagues (2006) documented how that changed over age. All studies reporting on symmetry reported that caries develops bilaterally in the primary dentition.

These findings on patterns of dental caries in primary dentition described in the previous paragraph would contribute to better dental care for children. Examination of the cervical area of the labial surface and proximal surfaces of maxillary incisors is recommended beginning at 6 months of age due to the early onset of caries. The first primary molars are more susceptible to caries on the proximal surfaces; hence, radiographs should be taken at a young age. To prevent caries on the occlusal surface of the second molars, appropriate preventive treatment should be considered. Given that hypomineralisation of deciduous second molars contribute to the prevalence of dental caries (Elfrink *et al*., 2010), dental teams working with children need to be familiar with the signs of hypomineralised second molars, and it is critical to reinforce preventive advice and provide suitable treatment. Caries seldom effect mandibular incisors, but if they occur, the dental team should be aware of potential causes such as neglect, systemic disorders, or enamel defects.

This scoping review was broad-based, inclusive, and transparent and followed the PRISMA-ScR standards (Peters *et al*., 2021; Tricco *et al*., 2018). However, the

scoping review did have limits. Article quality was not assessed, which might have resulted in the inclusion of low-quality studies. Furthermore, only peer-reviewed content was included, not editorials, letters to the editor, reviews, comments, and non-peer-reviewed grey literature. Additionally, articles written in languages other than English were excluded. All of these might have led to the exclusion of some significant original study findings. However, despite the different populations and approaches used to evaluate caries patterns, the overall results were similar. This diversity of people and methodologies, yet uniformity of outcomes, adds to the robustness of the patterns outlined here.

There are a number of significant gaps in the information on the caries pattern in primary dentition that is included in this review. With the second molar fully erupting between the ages of two and three years, primary teeth would be in close proximity to one another, which would facilitate the onset and spread of proximal caries. Bitewing radiographs are used to detect proximal caries early on because visual inspection alone is insufficient to identify early proximal caries. None of the 22 studies cited in this review have addressed the use of dental radiography. Consequently, the caries prevalence in primary teeth would be underestimated, as would the caries patterns. A distinct and unmistakable pattern of dental caries will be found through additional longitudinal studies that track the same group of children from birth to age six years. Except for the Thailand study (Thitasomakul *et al*., 2006), none of the included studies were longitudinal in nature. Furthermore, the review failed to identify studies specifically addressing the caries pattern in children aged two, four, and six years. To resolve these limitations, longitudinal studies in children aged six months should be conducted annually until they reach the age of six years. Such studies, which ideally would include demographically diverse population groups, should have regular age-appropriate dental radiographs. In New Zealand, children regularly have their teeth examined and treated in community dental clinics, making such research feasible.

Understanding the patterns of dental caries in primary dentition is important for several notable reasons. Dental caries in primary dentition can have significant implications for a child's oral health and overall well-being (Peres *et al*., 2019). Early identification of patterns of caries allows for timely intervention and preventive measures, which can help mitigate the progression of decay and prevent complications (Watt *et al*., 2019). Dental caries in primary teeth can lead to pain, discomfort, and difficulty eating, speaking, and sleeping. Severe cases may result in infections, abscesses, and premature tooth loss, which can affect the development of permanent teeth and overall oral health. The findings of this research would be extremely beneficial to general dental practitioners and specialist paediatric dentists. Knowledge of dental caries patterns in the primary dentition aids in determining individual and population-level risk factors. This evidence can inform the development of targeted preventive strategies, such as fluoride treatments, dental sealants, and oral hygiene education, to reduce the incidence and severity of caries. Given the dental health inequity (Peres *et al*., 2019), identifying patterns of caries may allow for targeted interventions to address disparities in oral health and promote health equity. This scoping review demonstrates that dental caries patterns in primary dentition exist and that they progress in a predictable manner with age. By systematically mapping out the existing literature in this scoping review, we have provided an overview of the volume, nature, and distribution of research on this topic.

Conclusion

This comprehensive review empirically documents the stability of caries patterns in the primary dentition across multiple nations and continents, emphasising the necessity of a global approach to dental health programs, since comparable patterns may necessitate consistent caries prevention treatments. Further research is needed to address the shortcomings identified in this review. Furthermore, continuing collaboration among researchers from diverse locations might boost the efficiency of preventative strategies and lead to better oral health outcomes globally.

Author contributions

Conception and design of the study – KS, PS
Data collection – KS
Data analysis and interpretation – KS, PS
Drafting the article – KS
Critical revision of the article – KS, PS
Final approval of the version to be published – KS, PS

Conflict of interest statement

The authors declare no conflicts of interest.

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