



Impact of Maternal Oral Health on Infant Oral Outcomes: A Concise Narrative Review (2015–2025).

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ABSTRACT

Background: Maternal oral health may influence infant oral outcomes through biological, behavioral, and social pathways. Clear synthesis of recent, freely accessible evidence can inform prenatal and early-life preventive strategies.

Objective: To synthesize PubMed/PMC (2015–2025) free full-text evidence on the association between maternal oral health (caries, periodontal disease, oral microbiota, oral health literacy) and infant oral outcomes (early childhood caries [ECC], enamel defects, microbial colonization, and birth-related factors).

Methods: I searched for PubMed/PMC for human studies published between 1 January 2015 and September 2025 using combinations of terms for maternal oral health and infant outcomes. Filters: English, free full text (PMC). Both original research and review articles reporting maternal exposures and infant outcomes for children aged 0–2 years were eligible. Data were extracted into a standardized spreadsheet and synthesized narratively.

Results: Twenty PMC-accessible articles met inclusion. Evidence consistently supports maternal to infant microbial transmission of cariogenic organisms. Multiple observational studies report positive associations between untreated maternal caries and higher ECC risk in offspring. Maternal periodontal disease is associated with adverse pregnancy outcomes; evidence for a direct independent effect on infant ECC is mixed. Maternal oral-health literacy, behaviors, and access to prenatal dental care emerged as modifiable pathways and intervention targets.

Conclusions: Maternal oral health appears to be an important determinant of early infant oral outcomes. Priorities include prenatal dental-care access, maternal oral-health education, and longitudinal intervention trials to determine whether improving maternal oral health reduces ECC incidence.

Keywords: maternal oral health; early childhood caries; *Streptococcus mutans*; prenatal dental care; infant oral health; narrative review.

Introduction

Early life represents a pivotal period for oral-health trajectories. Maternal oral health can shape infant oral outcomes through multiple pathways: direct vertical microbial transmission (e.g., *Streptococcus mutans*), shared household behaviors and dietary patterns, and pregnancy-related biological mechanisms (e.g., systemic inflammation associated with maternal periodontal disease that may influence pregnancy outcomes). Understanding these linkages is important for designing preventive strategies that begin in pregnancy and extend into the first years of life.

This concise narrative review synthesizes accessible literature (PubMed/PMC, 2015–2025) that examined maternal oral-health exposures and infant oral outcomes (children aged 0–2 years). My goal is to summarize consistent findings, highlight mechanistic pathways, identify modifiable intervention points, and suggest priorities for future research and policy.

Methods

Search strategy and eligibility:

I searched PubMed/PMC for articles published between 1 January 2015 and September 2025 using combinations of keywords for maternal oral health (e.g., 'maternal oral health', 'maternal caries', 'periodontal disease') and infant outcomes (e.g., 'early childhood caries', 'ECC', 'enamel hypoplasia', '*Streptococcus mutans*'). Filters: human studies, English language, and free full text available via PMC. Both original research and review articles reporting maternal exposures and infant outcomes for children aged 0–2 years were included.

Screening and data extraction:

Titles and abstracts were screened for relevance. Full texts for potentially eligible studies were retrieved. Data were extracted into a standardized spreadsheet recording: author/year, country, study design, sample size, maternal exposure(s), infant outcome(s), principal finding(s), effect measures when reported, and study limitations. Because included studies varied in design and outcome measurement, I performed a narrative synthesis organized by a priori themes: microbial transmission, maternal caries and ECC, periodontal disease and pregnancy/infant outcomes, and maternal knowledge/behavior/interventions.

Reporting:

This manuscript follows a concise narrative review format rather than a systematic review or meta-analysis;

methods are oriented toward transparent reproducibility (search dates and filters provided) rather than exhaustive quantitative pooling.

Results

Included studies:

Twenty PMC-accessible articles published between 2015–2025 met the inclusion criteria. A full study-level extraction table is provided in Table 1.

Table 1: Extracted data from included studies (2015–2025): Maternal oral health and infant oral outcomes
This table summarizes the 20 studies included in the narrative review, detailing study design, country, exposures, outcomes, main findings, and limitations.

Study ID (Author, Year)	Study Design	Country	Sample Size	Maternal Exposures	Infant Outcomes	Main Findings	Effect Size	Limitations
Foxman et al., 2023	Prospective cohort	USA	271 pairs	Untreated maternal caries, oral hygiene	Early Childhood Caries (ECC)	Maternal untreated caries predicted ECC incidence in children up to 3 years.	Adjusted OR = 2.3 (95% CI 1.2–4.1)	Limited to one region; self-reported hygiene
Latifi-Xhemajli et al., 2021	Cross-sectional (microbial)	Kosovo	150 pairs	Maternal Streptococcus mutans count	Infant S. mutans colonization	Higher maternal bacterial load correlated with early infant colonization.	$r = 0.69$ ($p < 0.01$)	Cross-sectional; no follow-up
de Souza et al., 2015	Cross-sectional	Brazil	197 pairs	Maternal caries status	ECC presence	Children of mothers with active caries had 2× higher ECC risk.	OR = 2.1 ($p < 0.05$)	Residual confounding (diet, SES)
Damle et al., 2016	Genotyping study	India	90 pairs	Maternal S. mutans genotypes	Infant S. mutans detection	80% of child isolates matched maternal strains.	—	Small sample size
Azevedo et al., 2023	Narrative review	Portugal / Netherlands	—	Maternal microbiota, feeding, oral hygiene	Infant oral microbiota	Maternal microbiome and early behaviors shape infant microbiota.	—	Narrative synthesis only

BaniHani et al., 2021	Cross-sectional KAP survey	Jordan	400 mothers	Oral health literacy, treatment barriers	Care-seeking for child oral problems	Low maternal knowledge linked to delayed child dental visits.	—	Self-reported data
Haque et al., 2023	Observational	Bangladesh	420 pairs	Maternal caries, education, SES	ECC in 3–5 yr olds	Lower maternal education and untreated caries linked with higher ECC odds.	Adjusted OR = 2.7 (95% CI 1.4–5.0)	Convenience sampling
Childers et al., 2017	Genotyping study	USA	83 pairs	Maternal S. mutans genotypes	ECC presence	Shared genotypes in 70% of dyads, supporting vertical transmission.	—	Small sample
Nizar et al., 2022	Observational	Pakistan	202 pairs	Maternal S. mutans carriage	Child S. mutans carriage and caries	Positive association between maternal carriage and child colonization/carries.	OR = 2.8 (p = 0.01)	Cross-sectional
Yenen & Ataçağ, 2019	Narrative review	Turkey	—	Pregnancy oral-care awareness	Oral-health recommendations	Summarized safe dental care practices during pregnancy.	—	Review; no quantitative synthesis
Kumar et al., 2023	Policy review	USA	—	Maternal-child health programs	Integrated oral-health outcomes	Advocated integration of dental care in maternal-child programs.	—	Commentary
Rai & Tiwari, 2018	Systematic review	Multi-country	—	Parental (esp. maternal) behaviors	ECC development	Maternal oral-health habits are major ECC determinants.	—	Heterogeneous studies
Anil & Anand, 2017	Review	Global	—	Risk factors for ECC	ECC prevention	Emphasized maternal hygiene and feeding as modifiable risks.	—	Narrative review
Alade et al., 2021	Cross-sectional	Nigeria	412 pairs	Maternal psychosocial stress, decision-making	Child ECC	Maternal stress and low autonomy increased ECC odds.	OR = 1.9 (p = 0.04)	Limited control for confounders

Daalderop et al., 2018	Overview of systematic reviews	Global	—	Maternal periodontal disease	Preterm birth, low birth weight	Periodontal disease associated with preterm and LBW.	Pooled OR \approx 1.6	Review overlap
Zhang et al., 2022	Systematic review + meta-analysis	Global	—	Periodontal disease	Adverse neonatal outcomes	Linked with preterm and LBW; consistent findings.	Pooled OR = 1.76 (95% CI 1.3–2.2)	Publication bias possible
Alrashdi, 2024	Systematic review	Global	—	Maternal nutrition & lifestyle	Child oral health	Maternal diet and habits influence infant oral microbiome.	—	Qualitative synthesis
Yang et al., 2024	Pilot prospective cohort	China	35 pairs	Prenatal total oral rehabilitation	Maternal & infant oral health	PTOR improved maternal oral health and reduced infant bacteria.	—	Small pilot
Córdova-Carrillo et al., 2024	Review	Mexico	—	Breastfeeding, maternal bacteria	Infant <i>S. mutans</i> colonization	Breast milk may limit early cariogenic colonization.	—	Narrative review
Kamolchaiwanch et al., 2025	Observational	Thailand	300 pairs	Maternal oral-health literacy	Child brushing, diet	Higher maternal literacy linked to better child behaviors.	$\beta = 0.42$ ($p < 0.001$)	Self-reported data

1) Evidence for maternal to infant microbial transmission

Multiple culture-based and genotyping studies show that mothers frequently carry the same cariogenic strains found in their infants, and infants born to mothers with higher cariogenic bacterial loads are more likely to be colonized earlier. Studies using *S. mutans* isolation or molecular genotyping (e.g., Damle et al., 2016; Latifi-Xhemajli et al., 2021; Childers et al., 2017; de Souza et al., 2015) demonstrate marked mother–child strain similarity and earlier infant colonization in higher-load maternal cases. Reviews and syntheses (e.g., Azevedo et al., 2023) contextualize transmission alongside behavioral routes such as shared utensils and feeding practices.

2) Maternal caries and association with early childhood caries

Several cohort and cross-sectional studies report positive associations between maternal untreated caries and

the presence or risk of ECC in offspring (e.g., Foxman et al., 2023; de Souza et al., 2015; Haque et al., 2023). Although effect sizes and adjustment covariates vary across studies, the general trend indicates that children of mothers with active caries or high caries experience are at greater risk of early caries development, often mediated by shared behavioral risk factors.

3) Maternal periodontal disease and pregnancy / infant outcomes

Systematic reviews and meta-analyses (e.g., Daalderop et al., 2018; Zhang et al., 2022) identify associations between maternal periodontal disease and adverse pregnancy outcomes (preterm birth, low birth weight). These pregnancy outcomes are risk factors for broader child health vulnerabilities and may indirectly influence oral-health trajectories. Evidence directly linking maternal periodontal disease to infant ECC is less consistent; heterogeneity in periodontal measures and timing of assessment limits firm conclusions.

4) Maternal knowledge, behaviors, and prenatal dental-care interventions

Maternal oral-health literacy and care-seeking behavior associate with infant oral-health behaviours and early outcomes (e.g., BaniHani et al., 2021; Alade et al., 2021; Rai & Tiwari, 2018). Emerging intervention and pilot cohort data (e.g., Yang et al., 2024; small-pilot PTOR designs) suggest prenatal dental rehabilitation and maternal education may improve maternal oral status and hold promise for downstream infant benefits; however, large-scale randomized trials remain limited.

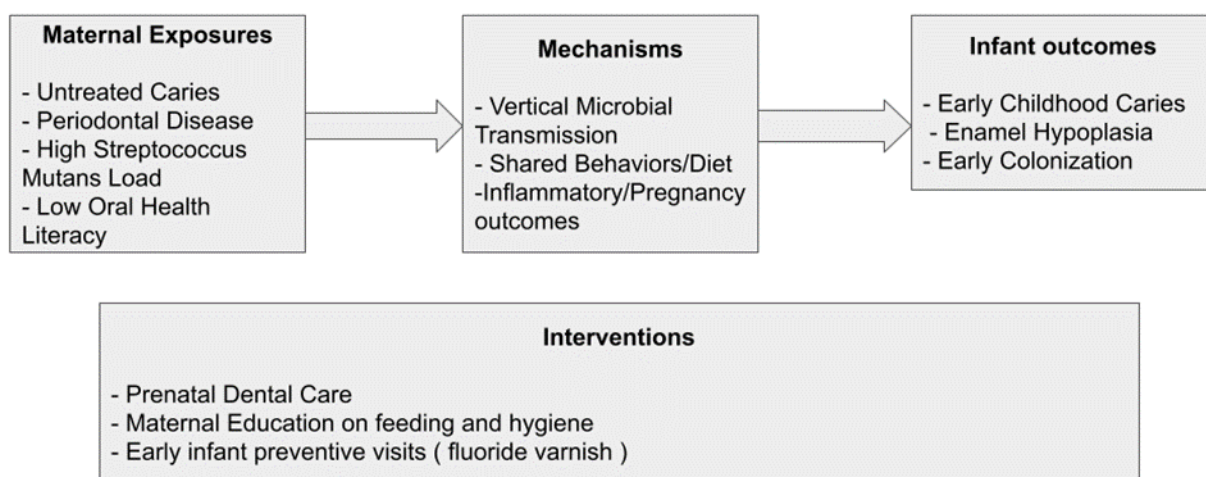


Figure 1: Conceptual model : Pathways linking maternal oral health to infant oral outcomes.

Discussion

Synthesis:

Across PMC-accessible literature from 2015–2025, three consistent messages emerge. First, vertical transmission of cariogenic organisms from mother to child is well-documented and is a plausible proximal mechanism for early colonization and subsequent ECC risk. Second, untreated maternal caries is repeatedly associated with higher ECC prevalence or risk in children; much of this effect is plausibly mediated by household behaviors and shared environments. Third, while maternal periodontal disease is associated with adverse pregnancy outcomes in several syntheses, its direct role in infant ECC is less uniform in the literature.

Mechanisms and pathways:

The strong evidence for mother–child microbial sharing does not exclude the importance of behavioral and social determinants. Feeding practices (prolonged bottle feeding, nighttime feeding with cariogenic liquids), hygiene behaviours, and socio-economic constraints shape exposure to cariogenic risk. Inflammatory pathways linked to periodontal disease may influence fetal development or birth outcomes, thus indirectly affecting infant vulnerability.

Implications for practice:

Findings support integrating oral-health promotion into antenatal care: prenatal oral-health screening, provision of needed dental care during pregnancy, and maternal education about feeding and hygiene can be pragmatic, potentially high-impact interventions. Early infant preventive visits (starting in infancy) and caregiver education should be embedded into maternal and child health programs.

Limitations of the evidence and this review:

The primary literature is dominated by observational designs, often with small or convenience samples and differing outcome definitions and microbial methods, limiting comparability and causal inference. This review intentionally limited inclusion to free full-text PMC articles to ensure reproducibility and accessibility; this approach may have excluded high-quality paywalled research. Our narrative approach prioritized clarity and synthesis over quantitative pooling.

Research priorities:

High-priority studies include longitudinal cohorts measuring serial maternal and infant microbiomes with standardized ECC outcomes, and randomized or pragmatic trials testing prenatal maternal dental treatment or maternal-behavior interventions with infant ECC as an outcome. Implementation studies are also needed to

identify how best to integrate oral health into routine pregnancy care, especially in low-resource settings.

Conclusions

Maternal oral health, particularly untreated caries and high cariogenic bacterial load is an important determinant of early infant oral outcomes. Strengthening prenatal dental-care access, improving maternal oral-health literacy, and implementing maternal-targeted preventive interventions are promising public-health strategies to reduce early childhood caries. High-quality longitudinal and interventional studies are needed to establish causality and inform policy.

Author contribution:

Dr. Saurabh Hire conceived the review, performed the search and data extraction, drafted the manuscript, and prepared the table and figure.

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Conflicts of interest: The author declare no conflicts of interest.

Ethics: This study is a narrative review of published literature and did not require institutional review board approval.

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