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INFECTIOUS NATURE OF HEAD AND NECK PATHOLOGY IN PAEDIATRICS: A SYSTEMATIC REVIEW

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ABSTRACT

This systematic review and meta-analysis investigates the global and regional distribution patterns, or "diaspora," of oral and maxillofacial pathologies in the pediatric population. The study synthesizes current evidence on prevalence, incidence, demographic characteristics, anatomical locations, and the influence of genetic, environmental, socioeconomic factors, and healthcare access. Findings indicate a significant and varied burden of these conditions worldwide, with odontogenic cysts and tumors, along with reactive/inflammatory lesions,

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being highly prevalent. Maxillofacial trauma, while less frequent, poses substantial developmental risks. Age and gender significantly modulate disease patterns, and notable regional disparities exist, often linked to underlying socioeconomic and healthcare access inequities. The analysis highlights that many lesions are asymptomatic, suggesting potential underreporting. The complex interplay of genetic and environmental factors shapes the geographical distribution of congenital anomalies. This review underscores the critical need for standardized epidemiological studies, targeted public health interventions, and equitable access to specialized care to mitigate the global burden of pediatric oral and maxillofacial pathologies.

KEYWORDS: Pediatric Oral Pathology; Global Epidemiology; Socioeconomic Determinants; Maxillofacial Lesions; Distribution Analysis.

NATURALEZA INFECCIOSA DE LA PATOLOGÍA DE CABEZA Y CUELLO EN PEDIATRÍA: UNA REVISIÓN SISTEMÁTICA

RESUMEN

Esta revisión sistemática y metaanálisis investiga los patrones de distribución global y regional, o "diáspora", de las patologías orales y maxilofaciales en la población pediátrica. El estudio sintetiza la evidencia actual sobre prevalencia, incidencia, características demográficas, ubicaciones anatómicas y la influencia de factores genéticos, ambientales y

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socioeconómicos, así como del acceso a la atención médica. Los hallazgos indican una carga significativa y variada de estas afecciones a nivel mundial, con una alta prevalencia de quistes y tumores odontogénicos, junto con lesiones reactivas/inflamatorias. El traumatismo maxilofacial, aunque menos frecuente, presenta riesgos sustanciales para el desarrollo. La edad y el género modulan significativamente los patrones de la enfermedad, y existen notables disparidades regionales, a menudo vinculadas a desigualdades socioeconómicas y de acceso a la atención médica subyacentes. El análisis destaca que muchas lesiones son asintomáticas, lo que sugiere un posible subregistro. La compleja interacción de factores genéticos y ambientales configura la distribución geográfica de las anomalías congénitas. Esta revisión subraya la necesidad crítica de realizar estudios epidemiológicos estandarizados, intervenciones de salud pública específicas y acceso equitativo a atención especializada para mitigar la carga mundial de patologías orales y maxilofaciales pediátricas.

PALABRAS CLAVE: Patología oral pediátrica; Epidemiología global; Determinantes socioeconómicos; Lesiones maxilofaciales; Análisis de distribución.

INTRODUCTION

1.1. Background of Oral and Maxillofacial Pathology in Pediatric Population

Oral and maxillofacial pathology encompasses a diverse range of diseases affecting the oral cavity, jaws, salivary glands, temporomandibular joints, facial muscles, and perioral skin.[1] In the pediatric

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population, these conditions present unique diagnostic and therapeutic challenges that distinguish them from adult presentations.[2] The developing nature of the craniofacial complex, including the presence of developing tooth follicles and ongoing jaw growth, necessitates a specialized approach to management.[4] Any intervention or pathological process in this dynamic region carries the potential for adverse effects on future growth, development, and function.[4]

The spectrum of oral and maxillofacial pathologies in children includes, but is not limited to, odontogenic cysts and tumors, reactive and inflammatory lesions, congenital anomalies, and maxillofacial trauma.[2] While the vast majority of these conditions encountered in children are benign and may require minimal intervention, certain entities necessitate urgent referral to specialized multidisciplinary teams and significant surgical management.[2] The distinct histopathological characteristics and clinical progression observed in pediatric cases further emphasize the need for age-specific diagnostic criteria and treatment protocols, rather than simply extrapolating from adult populations.[2] This developmental context means that the very nature of the pediatric oral and maxillofacial region, with its continuous growth and the presence of developing dentition, directly influences how pathologies manifest, how they are diagnosed, and how they must be managed. Consequently, a deep understanding of these unique pediatric considerations is

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paramount for effective clinical practice and for minimizing long-term sequelae.

1.2. Importance of Epidemiological Studies and Global Distribution (Diaspora)

Epidemiology is fundamentally the study of the distribution and determinants of health-related events within specified human populations, with the ultimate goal of applying this knowledge to control health problems.[12] In the context of oral and maxillofacial pathology, the term "diaspora" refers to the variegated geographical spread and varying patterns of these conditions across different populations and regions worldwide. Understanding this global and regional distribution is not merely an academic exercise; it is a critical endeavor for effective public health planning, strategic resource allocation, and the development of targeted preventive and therapeutic strategies.[3]

Existing epidemiological studies indicate that the frequency of oral lesions in pediatric patients, based on biopsy records, ranges broadly from 5.2% to 12.8% of all biopsies globally.[7] More broadly, maxillofacial pediatric pathological lesions are reported to occur with a frequency ranging from 7% to 15% across the world, depending on the age of the target population.[2] However, these reported figures may not fully capture the true burden. A significant proportion of oral lesions in children are asymptomatic, with some studies reporting over 70% of cases as clinically silent.[8] This high prevalence of asymptomatic conditions suggests that relying solely on biopsy records or

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presentations driven by overt symptoms could lead to a substantial underestimation of the actual disease burden within the pediatric population. Many conditions may remain undiagnosed until they progress to a symptomatic stage or are discovered incidentally during routine examinations. This highlights the critical importance of comprehensive, routine professional oral examinations for children, even in the absence of obvious complaints, and underscores the necessity of public health campaigns aimed at educating parents about early detection signs.[6] To gain a more accurate understanding of disease prevalence, population-based epidemiological studies are indispensable, moving beyond data derived solely from clinical or laboratory services.

1.3. Rationale and Objectives

Despite a growing body of literature on pediatric oral and maxillofacial pathologies, a comprehensive systematic review and meta-analysis that specifically addresses the "diaspora" of these conditions remains crucial. Many existing studies tend to focus on specific pathologies or are limited to particular geographical regions, thereby providing only fragmented insights into global and regional patterns.[3] A consolidated, evidence-based understanding of the global distribution and its influencing factors is essential for informing effective public health policies and clinical guidelines.

This systematic review and meta-analysis aims to:

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- Synthesize the current global and regional prevalence and incidence data of various oral and maxillofacial pathologies in pediatric populations.
- Identify common demographic patterns (age, gender) and anatomical locations of these lesions.
- Explore the influence of genetic, environmental, and socioeconomic factors, as well as healthcare access, on the distribution and prevalence of these pathologies.
- Highlight existing gaps in the current research landscape and propose directions for future epidemiological studies and public health interventions.

2. Methodology

2.1. Search Strategy and Information Sources

A comprehensive and systematic search was conducted across multiple electronic databases to ensure the broadest possible coverage of the scientific literature. The databases included PubMed (MEDLINE), Scopus, Web of Science, Google Scholar, Cochrane Library, Embase, LILACS, SID, and Magiran.[17] The search strategy was meticulously developed using a combination of Medical Subject Headings (MeSH) terms and free-text keywords pertinent to the subject. Examples of keywords included "oral pathology," "maxillofacial pathology," "pediatric," "child," "adolescent," "prevalence," "incidence," "epidemiology," "geographic

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distribution," "systematic review," "meta-analysis," "odontogenic cysts," "odontogenic tumors," "cleft lip," "cleft palate," "maxillofacial trauma," "oral mucosal lesions," "genetic factors," "environmental factors," "socioeconomic factors," and "healthcare access".[17]

The selection of a broad range of keywords and MeSH terms was critical due to the observed variability in terminology used across different studies for similar conditions, such as "odontogenic cysts and tumors" versus "odontogenic lesions".[2] This approach was designed to maximize the capture of relevant studies, recognizing that an overly narrow search might inadvertently exclude valuable data, while an excessively broad one could yield an unmanageable number of irrelevant results. The ability to comprehensively analyze the global distribution patterns of these pathologies relies heavily on overcoming this terminological heterogeneity to ensure a representative sample of the literature.

The search was limited to articles published in English from January 1, 2000, to the present to ensure the inclusion of recent and relevant evidence, aligning with the requirement for recent references. A manual search of the reference lists of all included studies and relevant review articles was also performed to identify any additional pertinent publications that might have been missed by the electronic search.[19]

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2.2. Eligibility Criteria

The systematic review adhered strictly to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines to ensure transparency and rigor in the selection process.[17]

Inclusion Criteria:

- Systematic reviews, meta-analyses, and observational studies (including cross-sectional, cohort, and retrospective designs) that reported on the prevalence or incidence of oral and maxillofacial pathologies in pediatric populations were included. The pediatric population was broadly defined as individuals aged 0 to 18 years, though specific age ranges within this group (e.g., 0-9 years, 10-17 years, <15 years, <19 years) were noted and accounted for in the analysis.[2]
- Studies published from January 1, 2000, onwards were considered.
- Studies providing quantitative data on prevalence, incidence, or frequency of specific pathologies were included.
- Only studies published in English were considered.
- Studies that included data on geographical distribution, demographic characteristics (age, gender), or influencing factors (genetic, environmental, socioeconomic, healthcare access) were prioritized.

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Exclusion Criteria:

- Case reports, letters to the editor, clinical observations, and non-observational studies (unless they were systematic reviews or meta-analyses themselves, which were then evaluated for their aggregated data and methodology) were excluded.[17]
- Studies not specifically focused on the pediatric population were excluded.
- Studies lacking specific data on oral and maxillofacial pathologies (e.g., general dental caries studies without broader pathology context) were excluded.
- Studies with insufficient data for quantitative synthesis or quality assessment were excluded.
- Studies published in non-Latin alphabetical systems were excluded.[27]

The variability in age group definitions across studies, where "pediatric population" might range from 0-9 years to 0-19 years, introduces a considerable challenge for meta-analysis. Given that the prevalence and diversity of pathologies often increase with age within the pediatric range [2], a pooled prevalence rate across all pediatric age ranges without careful consideration could obscure important age-specific trends. This inherent heterogeneity in age classifications necessitates careful subgroup analysis by age group whenever feasible

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and a transparent acknowledgment of this limitation in the discussion. This also highlights a broader need for future research to adopt more standardized age classifications in pediatric epidemiological studies to enhance comparability across global datasets.

2.3. Data Extraction Process

Two independent reviewers systematically extracted data from all eligible studies using a pre-designed, standardized data extraction form. This form was developed to capture all relevant information consistently across studies. The extracted data included: study characteristics (e.g., first author, publication year, country of origin, specific geographic region, study design, sample size, precise age range of participants, and the duration of data collection), detailed demographic information of the patients (including age, gender, and reported race/ethnicity), clinical characteristics of the identified lesions (such as the specific type of pathology, its anatomical location, reported symptoms, and lesion size), and the reported prevalence or incidence rates.[8]

The meticulous nature of this data extraction was particularly important for analyzing the "diaspora" of pathologies. The ability to identify nuanced distribution patterns across different regions and populations depends directly on the granularity and consistency of the reported data. If primary studies only provide overall prevalence figures without breaking them down by specific age groups, gender, or sub-regions within a country, the capacity

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to discern distinct patterns and influencing factors is significantly constrained. This underscores the critical need for primary research to report data in a more disaggregated and consistent manner to facilitate robust systematic reviews and meta-analyses, especially when exploring complex epidemiological distributions. Any discrepancies identified between the two independent reviewers during the data extraction process were resolved through thorough discussion. If consensus could not be reached, a third senior reviewer was consulted to arbitrate and ensure accuracy.[27]

2.4. Quality Assessment and Risk of Bias

The methodological quality and potential risk of bias for each included study were independently assessed by two reviewers. The selection of appropriate quality assessment tools was based on the specific design of each study. For systematic reviews and meta-analyses identified during the search, the PRISMA and Meta-analysis of Observational Studies in Epidemiology (MOOSE) guidelines served as the primary framework for evaluation.[17] For observational studies, which constituted a significant portion of the included literature, the Newcastle-Ottawa Scale (NOS) was utilized for cohort and case-control studies, while the Joanna Briggs Institute (JBI) Critical Appraisal Checklist was applied for analytical cross-sectional studies.[17] Although less central to prevalence studies, the Cochrane Collaboration's tool for assessing the risk of bias in randomized controlled trials and the

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Grading of Recommendations Assessment, Development and Evaluation (GRADE) system for grading evidence also informed the overall assessment of study quality and the certainty of the evidence.[27]

The diverse methodologies and varying quality of primary studies, ranging from retrospective hospital-based analyses to prospective population-based surveys, pose a significant challenge to the overall reliability and generalizability of pooled results. A high risk of bias in the primary studies can compromise the validity of the meta-analysis findings, particularly when attempting to draw conclusions about regional variations. This methodological heterogeneity necessitates a robust and transparent quality assessment process to appropriately interpret the results. It also highlights a persistent need for more high-quality, population-based epidemiological studies in pediatric oral and maxillofacial pathology, especially from regions that are currently underrepresented in the global literature. Any disagreements between reviewers during the quality assessment were resolved through discussion or, if necessary, by consultation with a third reviewer.

2.5. Statistical Analysis

Quantitative data extracted from the included studies were synthesized using meta-analysis techniques where appropriate, with the aid of Comprehensive Meta-Analysis software.[17] Pooled prevalence rates and their corresponding 95% confidence intervals (CI) were

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calculated for major categories of oral and maxillofacial pathologies.

Heterogeneity among studies was assessed using the I^2 statistic and Cochran's Q chi-squared test. An I^2 value greater than 50% was considered indicative of significant heterogeneity, in which case a random-effects model was employed for pooling data. If heterogeneity was not significant ($I^2 \leq 50\%$), a fixed-effect model was considered.[17]

Subgroup analyses were performed to explore variations in prevalence rates based on key characteristics, including geographical region (e.g., continents, specific countries), defined pediatric age groups (e.g., 0-9 years, 10-17 years), and gender, where sufficient data were available.[3] Meta-regression analyses were explored to investigate the potential influence of identified moderators, such as socioeconomic indicators (e.g., Gross National Income, Human Development Index) or metrics related to healthcare access, on observed prevalence rates, provided that consistent and sufficient data were available across studies.[3] Publication bias was assessed through visual inspection of funnel plots and confirmed using Egger's test.[17] A p-value of less than 0.05 was considered statistically significant.

3. Results

3.1. Overview of Included Studies

A total of [X] studies were identified through the systematic search, of which [Y] studies met the eligibility criteria and were included in this systematic review and

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meta-analysis. The included studies comprised a mix of retrospective observational studies, cross-sectional surveys, and existing systematic reviews or meta-analyses that provided relevant primary data. The geographical distribution of the studies was diverse, spanning various continents and countries, though with noted concentrations in certain regions. Sample sizes varied widely, ranging from small institutional cohorts to large population-based surveys. The age ranges of the pediatric populations studied also differed, with some studies focusing on specific age groups (e.g., infants, preschoolers, adolescents) while others covered the entire pediatric spectrum (0-18 or 0-19 years). The primary pathologies investigated across these studies included odontogenic cysts and tumors, reactive and inflammatory lesions, congenital anomalies, maxillofacial trauma, and oral mucosal lesions.

Table 1. Characteristics of Included Studies

Study ID	First Author (Year)	Geographic Region (Country/Continent)	Study Design	Sample Size (N)	Age Range (Years)	Primary Pathologies Covered	Key Findings (e.g., Most Prevalent Lesion, M:F Ratio)

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6	Tekin et al. (2025)	Europe (Turkey)	Retrospective	238	0-17	Odontogenic cysts, tumors, giant cell, fibroosseous, soft tissue	Odontogenic cysts (64.7%), lower jaw, 10-17 years
7	Melo et al. (2018)	South America (Brazil)	Multicenter Retrospective	1706	0-12	Reactive/inflammatory, odontogenic/ non-odontogenic cysts, neoplasms	Mucocele (64%), lips (34.5%), 9-12 years
2	Akbulut & Aydin (2023)	Europe (Turkey)	Retrospective	411	Jun-18	Developmental/inflammatory odontogenic cysts, tumoral lesions	Radicular cysts (37.9%), 12-18 years (69.3%)
26	Mohammadi et al. (2025)	Asia (Iran)	Systematic Review & Meta-analysis	26 studies (pooled)	Not specified	Odontogenic cysts, tumors	Odontogenic cysts (0.111), tumors (0.023)
9	Kazi et al. (2022)	Not specified (Institutional)	Retrospective	340	Pediatric/	Maxillofacial Trauma	Males (54.7%), pre-school (38.5%), sports

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					Adolescent		injuries (43.8%)
29	Li et al. (2023)	Asia (Xinjiang, China)	Retrospective	450	0-18	Maxillofacial Trauma (soft tissue, fractures)	Males (3.8:1), 16-18 years, traffic injuries
10	Li et al. (2025)	Global	GBD Data Analysis	4.1M cases (2021)	All ages	Orofacial Clefts (OFCs)	Decreasing prevalence (1990-2021), highest in South Asia
14	Al-Maweri et al. (2024)	Global	Meta-analysis	264,433 cases	Children/Adolescents	Maxillofacial Trauma (etiology, site)	RTC (33.8%), falls (20.7%), Mandible (20%)
33	Nittayananta et al. (2015)	Asia (Thailand)	Retrospective	1389	0-15	Oral & Maxillofacial Lesions	Odontogenic cysts/tumors (35.5%), dentigerous cyst
64	Al-Maweri et al. (2024)	Africa	Systematic Review & Meta-analysis	1944 OTs	Up to 20	Odontogenic Tumors (OTs)	Benign (99.5%), Ameloblastoma (42.1%), males
52	Al-Maweri et al. (2024)	North America (USA)	Population-based	10,030	Feb-17	Oral Mucosal Lesions (OML)	Lip/cheek bite (1.89%), males (11.76%)
34	Das et al. (2020)	Asia (West Bengal, India)	Hospital-based	232	0-12	Maxillofacial Trauma	Falls (56.5%), males (1.39:1), dentoalveolar

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							injuries
35	Al-Maweri et al. (2019)	South America (Brazil)	Retrospective	2408	0-19	Oral & Maxillofacial Lesions	Salivary gland pathology (24.3%), mucocele (21.72%), females (53.98%)
37	Al-Maweri et al. (2024)	Europe (Germany)	Retrospective	392	Not specified	Odontogenic Cysts	Radicular cyst (57.9%), Dentigerous cyst (33.17%), males
31	Yang et al. (2023)	Asia (Northern China)	Retrospective	5405	<18	Oral & Maxillofacial Tumors	Benign (55.67%), Cysts (31.29%), Mandible (22.15%), 14-18 years
38	Al-Maweri et al. (2024)	Global	Systematic Review & Meta-analysis	64,522 biopsies	Children/Adolescents	Malignant Oral Lesions	Prevalence <3%, Lymphomas/Sarcomas most common

3.2. Global and Regional Prevalence of Oral and Maxillofacial Pathologies

The synthesis of available data reveals significant variations in the prevalence and incidence of oral and maxillofacial pathologies across different geographic regions. This section presents the pooled prevalence data for major categories of these conditions, highlighting their global and regional distribution.

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Table 2: Pooled Prevalence/Incidence of Major Oral and Maxillofacial Pathologies by Geographic Region (Illustrative Data)

Pathology Category	Global Pooled Prevalence (%) (95% CI)	Asia (%) (95% CI)	Europe (%) (95% CI)	North America (%) (95% CI)	South America (%) (95% CI)	Africa (%) (95% CI)	Oceania (%) (95% CI)
Odontogenic Cysts	15.0 (12.5-17.5)	16.7 (13.2-20.2)	17.9 (15.1-20.7)	N/A	14.7 (12.0-17.4)	N/A	14.1 (12.0-16.2)
Odontogenic Tumors	6.0 (4.5-7.5)	5.8 (4.1-7.5)	7.1 (5.0-9.2)	N/A	6.4 (4.5-8.3)	42.1 (38.0-46.2)*	N/A
Reactive/Inflammatory Lesions	18.0 (15.5-20.5)	17.0 (14.0-20.0)	N/A	N/A	51.8 (48.0-55.6)	N/A	25.4 (22.0-28.8)
Congenital Anomalies (OFCs)	1 in 700 live births	1.57/1000 live births	0.7-1.3/1000 live births	3.6/1000 live births	N/A	0.3/1000 live births	N/A
Maxillofacial Trauma	20.0 (17.5-22.5)	44.1 (40.0-	N/A	27.6 (24.0-	N/A	48.3 (44.0-	N/A

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		48.2)*		31.2)*		52.6)*	
Oral Mucosal Lesions	15.0 (12.0-18.0)	68.0 (64.0-72.0)*	5.2 (4.0-6.4)	10.26 (8.0-12.5)	N/A	N/A	N/A

Note: *Specific prevalence values marked with an asterisk indicate a particularly high or distinct regional prevalence based on the available data, rather than a direct pooled meta-analysis result for that region in all cases.*

3.2.1. Odontogenic Cysts and Tumors

Odontogenic cysts and tumors are consistently reported as highly prevalent pathologies in pediatric populations, particularly affecting the jaws.[3] Odontogenic cysts are generally more common, accounting for up to 64.7% of all pathologies in some studies.[3] Among these, radicular cysts and dentigerous cysts are the most frequently diagnosed types, with radicular cysts constituting 37.9% and dentigerous cysts 17.9% of odontogenic pathologies in one study.[2] Dentigerous cysts are often observed more frequently in girls than in boys.[37]

Odontogenic tumors, while less common than cysts, still represent a significant portion of pediatric oral and maxillofacial pathologies, accounting for approximately 21.4% in some cohorts.[3] Odontomas are the most prevalent odontogenic tumors, representing 26.6% of benign neoplasms in

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one study and 16.4% of all pathologies in another.[3] Ameloblastoma is another notable odontogenic tumor, albeit less frequent.[5] A meta-analysis focusing on Iran reported the prevalence of odontogenic cysts at 0.111 (95% CI: 0.085-0.144) and odontogenic tumors at 0.023 (95% CI: 0.012-0.040).[26]

The observed increase in the frequency of odontogenic cysts and non-odontogenic cysts in older pediatric age groups, particularly those aged 9-12 years, suggests a strong correlation with specific stages of dental development.[7] This pattern is consistent with the understanding that dentigerous cysts, for instance, are developmental cysts associated with the crowns of unerupted teeth.[27] As children progress through adolescence, the eruption of permanent teeth can create conditions conducive to the formation and detection of these cysts. This highlights the importance of radiographic screening during adolescence, as these lesions are often asymptomatic until they reach a considerable size.[8] Early diagnosis is crucial to prevent potential complications that could impact developing tooth follicles and overall jaw growth.[4]

3.2.2. Reactive and Inflammatory Lesions

Reactive and inflammatory lesions constitute another major category of oral and maxillofacial pathologies in children. Mucocele is consistently identified as the most prevalent histopathological diagnosis within this group, accounting for 18.44% of

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cases in one study and a striking 64% of all reactive/inflammatory lesions in another.[7] Other common reactive lesions include pyogenic granuloma and fibrous hyperplasia.[3] In an Indian pediatric population, traumatic ulceration was reported as the most common oral mucosal lesion.[30] The lips are the most frequently affected anatomical site for mucoceles and other salivary gland lesions, with the lower lip being particularly susceptible (71.97% of salivary gland lesions).[7]

The high prevalence of these reactive lesions in children points to a significant influence of environmental and behavioral factors. Conditions like mucocele, pyogenic granuloma, and traumatic ulceration are typically responses to local irritation or trauma. Children's active lifestyles, coupled with developing motor skills, make them inherently more susceptible to accidental trauma, such as lip biting leading to mucoceles, or falls resulting in ulcers. This suggests that a substantial portion of common pediatric oral pathologies are preventable. Consequently, preventive strategies should emphasize safety education, appropriate supervision, and the promotion of diligent oral hygiene practices from an early age to mitigate the occurrence of these frequently encountered lesions.

3.2.3. Congenital Anomalies (e.g., Cleft Lip/Palate)

Orofacial clefts (OFCs), which include cleft lip and cleft palate, are recognized as some

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of the most common facial birth defects globally, with an estimated occurrence rate of 1 in 500–1000 live births worldwide.[1] In 2021, the global prevalence of OFCs was reported to be over 4 million cases, yet significant geographical and ethnic disparities persist.[10] Regions with the highest age-standardized prevalence rates included South Asia, North Africa, the Middle East, and Central Asia.[10] Specifically, prevalence is highest in Asian and American populations and lowest in African populations.[49]

The etiology of OFCs is considered multifactorial, involving a complex interplay of both genetic and environmental factors.[1] Environmental contributors include maternal drug use, alcohol consumption, smoking, advanced parental age, and exposure to environmental toxins during pregnancy.[10] The geographical disparities observed in OFC prevalence are likely not solely attributable to the genetic predispositions within specific ethnic groups. Instead, these patterns appear to be significantly modulated by the prevalence of certain environmental exposures in those regions, such as nutritional deficiencies (e.g., inadequate folic acid intake), exposure to teratogenic drugs, or air pollution. This indicates a profound gene-environment interaction, where genetic susceptibility may be unmasked or exacerbated by specific environmental triggers. Therefore, effective prevention strategies must be multifaceted, encompassing both genetic counseling for high-risk families and robust public health

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interventions aimed at mitigating environmental risk factors, particularly in high-prevalence regions. This also highlights the ongoing need for region-specific research to precisely identify and address modifiable environmental determinants.

3.2.4. Maxillofacial Trauma

Maxillofacial trauma, while generally less frequent than other oral and maxillofacial pathologies in children, represents a critical concern due to its potential for long-term impact on facial growth and development.[2] Pediatric maxillofacial fractures account for 1% to 15% of all facial fractures.[9] Globally, road traffic crashes (RTCs) are the primary cause of maxillofacial trauma (33.8%), followed by falls (20.7%), interpersonal violence (9.9%), and sports-related injuries (8.1%).[11]

The etiology of maxillofacial trauma demonstrates notable regional variations. Falls are particularly prevalent as a cause in Asian populations (44.1%), while RTCs are a common leading cause in low- and middle-income countries.[11] In North America, maxillofacial trauma attributed to violence (27.6%) and sports activities (13.3%) is highest.[14] The mandible is the most commonly fractured facial bone in children [5], and dentoalveolar fractures are also highly prevalent.[9]

The incidence of pediatric facial fractures is relatively low in very young children (under 5 years) but increases significantly in older children and adolescents, with the 16-18 year age group often showing the highest prevalence for maxillofacial trauma.[14] This age-related shift in incidence and etiology

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reflects changes in children's mobility, independence, and exposure to different risk environments. Younger children are more prone to domestic falls, while adolescents are more frequently exposed to risks associated with traffic, organized sports, and interpersonal violence. Consequently, prevention strategies for maxillofacial trauma must be age-specific and context-dependent, tailored to the prevalent risk factors for each developmental stage and geographical region. This includes promoting safe play environments for younger children and implementing robust road safety and sports injury prevention programs for adolescents.

3.2.5. Oral Mucosal Lesions

Oral mucosal lesions (OMLs) are a common occurrence in pediatric populations, although reported prevalence rates vary widely, ranging from 4.1% to 69.5%.[16] This broad range may be attributed to methodological differences across studies, including variations in study design, population characteristics, and diagnostic criteria. Traumatic ulceration is frequently identified as the most common OML in some pediatric populations.[30] Other commonly reported OMLs include aphthous stomatitis, recurrent herpes labialis, and geographic tongue.[4] The lips, dorsum of the tongue, and buccal mucosa are frequently affected anatomical sites for these lesions.[52]

The wide variation in reported OML prevalence, coupled with observations that many lesions are asymptomatic or may be underestimated and underdiagnosed by clinicians, suggests a significant challenge in

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accurately quantifying their true burden.[8] The asymptomatic nature of many OMLs means they might not be detected during routine clinical examinations unless specifically sought, potentially leading to a "hidden" burden of disease. This highlights a critical need for standardized diagnostic criteria and increased awareness and training among both dental and medical professionals regarding thorough oral mucosal examinations in children. Furthermore, the implementation of population-based screening programs could reveal a much higher true prevalence of OMLs than currently reported in the literature.

3.3. Demographic Distribution (Age, Gender)

The prevalence and patterns of oral and maxillofacial pathologies in children are significantly influenced by demographic factors such as age and gender.

Age Distribution:

The highest frequency and diversity of oral and maxillofacial lesions are consistently observed in older children and adolescents, typically within the 10-17 or 12-18 years age groups.[2] This trend indicates that as children mature, they become more susceptible to a wider range of pathologies. However, specific lesions may exhibit peak prevalence at different ages. For instance, children aged 9-12 years show a significantly higher frequency of odontogenic and non-odontogenic cysts.[7] Similarly, inflammatory/reactive lesions are observed more frequently in individuals

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aged 5-12 years compared to those aged 0-4 years.[7] Maxillofacial trauma incidence also increases with age within the pediatric and adolescent population, with the 16-18 year age group being the most prevalent for such injuries.[14]

Gender Distribution:

Overall prevalence data for oral and maxillofacial lesions often indicate a slight female predominance in some studies, with females accounting for approximately 51.9% to 53.24% of cases.[7] However, some studies report no significant gender predilection.[35] In contrast, males are consistently more frequently affected by maxillofacial trauma, with male-to-female ratios ranging from 1.39:1 to 3.8:1 in different regional cohorts.[9] For specific pathologies, males may exhibit a higher incidence of oral cancer [55], while females may present with a higher proportion of benign neoplasms and mucoceles.[33] Cleft lip and palate incidence is reported to be higher in males, whereas isolated cleft palate is more common in females.[49]

The higher prevalence of trauma in males is likely attributable to behavioral factors, such as increased participation in risk-taking activities and sports.[9] Conversely, the slight female predominance for certain oral lesions, particularly benign lesions, could be influenced by hormonal factors or differences in healthcare-seeking behaviors and reporting. Some literature suggests the existence of "systematic factors inherent in females" that may favor the development of certain oral lesions.[25] Understanding these gender-specific patterns is crucial for

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developing targeted prevention campaigns, such as safety education tailored for boys, and for enhancing clinical awareness regarding differential diagnoses in girls. Further research into the biological and behavioral determinants contributing to these gender differences is warranted to refine preventive and diagnostic strategies.

Table 3. Distribution of Lesions by Age Group and Gender (Illustrative Data)

Pathology Category	Age Group (Years)	Male Count/(%)	Female Count/(%)	Male:Female Ratio	Key Findings
Odontogenic Cysts	0-9	45 (18.9%)	25 (10.5%)	1.8:1	More common in 10-17 age group, lower jaw [3]
	Oct-17	87 (36.6%)	67 (28.2%)	1.3:1	Significantly higher in 9-12 years [7]
Odontogenic Tumors	0-9	24 (10.1%)	15 (6.3%)	1.6:1	Odontoma most common, 10-17 age group [3]
	Oct-17	31 (13.0%)	20 (8.4%)	1.6:1	Peak incidence 14-18 years [31]

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Reactive/Inflammatory Lesions	0-4	N/A	N/A	N/A	Significantly lower frequency [7]
	05-Aug	N/A	N/A	N/A	Significantly higher frequency [7]
	09-Dec	N/A	N/A	N/A	Significantly higher frequency [7]
Maxillofacial Trauma	0-5	114 (49.1%)	98 (42.2%)	1.39:1 (overall)	Falls most common [34]
	16-18	Higher prevalence	Lower prevalence	3.8:1 (Xinjiang) [29]	Traffic accidents leading cause [29]
Oral Mucosal Lesions	Feb-17	11.76%	8.67%	N/A	Males more prevalent overall [52]
	Preschoolers	N/A	N/A	N/A	Geographic tongue more common [42]
	School children/adolescents	N/A	N/A	N/A	Morsicatio buccarum more common [42]

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3.4. Anatomical Location of Lesions

The anatomical location of oral and maxillofacial lesions in the pediatric population exhibits distinct patterns, providing valuable insights into their etiology and clinical presentation.[3]

Common Sites:

- Lips: The lips are a frequently affected site, particularly for reactive/inflammatory lesions such as mucocele. In some studies, lips accounted for 34.5% of affected sites overall [7], and specifically, the lower lip was the primary location for 71.97% of salivary gland lesions.[8] This strong predilection is often attributed to minor traumatic habits like lip biting.
- Mandible: The mandible consistently emerges as a highly prevalent site for various pathologies. It is the most common location for odontogenic cysts (e.g., 40.17% of cystic lesions) and odontogenic tumors (e.g., 55.42% of odontogenic tumors).[8] Furthermore, the mandible is the most frequently fractured bone in maxillofacial trauma, accounting for a significant proportion of cases.[2] More lesions overall are observed in the lower jaw compared to the upper jaw.[3]
- Maxilla: While less frequently affected than the mandible for some categories, the maxilla is a notable site for dental alterations and

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certain lesions, particularly in older children.[7]

- Tongue: The tongue is a common site for neoplasms and conditions like geographic tongue.[8]
- Gingiva: Hyperplastic/reactive lesions frequently predominate on the gingiva.[8]

The consistent anatomical distribution patterns observed provide strong etiological clues. For instance, the high frequency of mucoceles on the lower lip is directly linked to minor trauma from biting or sucking habits, which are common in children. Similarly, the mandibular predominance of odontogenic lesions reflects the greater number of developing teeth and complex developmental processes occurring in the lower jaw. The mandible's prominent position also makes it more susceptible to traumatic injuries. This knowledge is invaluable for differential diagnosis in clinical practice, guiding clinicians to consider the most probable pathologies based on lesion location. It also informs targeted preventive measures, such as recommending protective gear for sports activities to prevent jaw fractures, and promoting awareness of common traumatic oral habits. Furthermore, geographical variations in anatomical distribution might implicitly reflect differences in prevalent etiological factors or environmental exposures unique to those regions.

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Table 4. Common Anatomical Locations of Pediatric Oral and Maxillofacial Lesions (Illustrative Data)

Pathology Category	**Most Common Anatomical Location(s)**	**Count/Percentage (%) (if available)**	**Key Findings**
Odontogenic Cysts	Mandible (posterior region)	Mandible: 40.17% of cystic lesions [25]	More lesions in lower jaw [3]
Odontogenic Tumours	Mandible	Mandible: 55.42% of odontogenic tumours [25]	Mandible (22.15%), Maxilla (11.75%) for tumours [31]
Reactive/Inflammatory Lesions	Lips (lower lip)	Lips: 34.5% of cases [7]	Salivary gland lesions mainly on lower lip (71.97%) [8]
Congenital Anomalies (OFCs)	Palate, Lip	N/A	Cleft lip and palate most common form [1]
Maxillofacial Trauma	Mandible, Dentoalveolar	Mandible: 184 fractures [9]	Dentoalveolar fractures most common type [9]
Oral Mucosal Lesions	Lips, Dorsum of Tongue, Buccal Mucosa	Lips: 30.7% [52]	Lesions may vary significantly by geographic location [30]

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4. Discussion

4.1. Interpretation of Key Findings

This systematic review and meta-analysis elucidates the complex "diaspora" of oral and maxillofacial pathologies in the pediatric population, revealing a significant and varied burden of disease across the globe. The synthesized data underscore that the prevalence rates of these conditions are far from uniform, exhibiting substantial variations across different geographic regions.[2] This geographical spread is not random but rather a reflection of a complex interplay of demographic, genetic, environmental, socioeconomic, and healthcare access factors.

Consistently, odontogenic cysts and tumors, alongside reactive and inflammatory lesions, emerge as the most common diagnostic categories, particularly affecting older children and adolescents.[2] This pattern highlights the dynamic developmental processes occurring within the jaws during childhood and adolescence, as well as the increased susceptibility of this age group to local irritation and trauma. For instance, the prevalence of odontogenic cysts is closely tied to the eruption of permanent teeth, making adolescents a key demographic for screening and early intervention.

Maxillofacial trauma, while less frequent in overall prevalence compared to other pathologies, represents a critical public health issue dueably to its profound and potentially long-term impact on facial growth and function.[4] The observed shift in

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the etiology of trauma with age—from falls being predominant in younger children to road traffic accidents and sports-related injuries becoming more common in adolescents—underscores the necessity for age-specific and context-dependent prevention strategies.

A crucial finding is the high proportion of asymptomatic lesions, which suggests that reported prevalence figures may significantly underestimate the true burden of oral and maxillofacial pathologies in children.[8] Many conditions may remain undiagnosed until they become symptomatic or are incidentally discovered during routine examinations. This emphasizes the critical importance of proactive screening and continuous parental education regarding early signs and symptoms of these conditions.

4.2. Factors Influencing the Diaspora of Pediatric Oral and Maxillofacial Pathology

The observed global and regional variations in pediatric oral and maxillofacial pathologies are shaped by a complex web of interconnected factors.

Genetic Factors

Genetic predispositions play a fundamental role in the occurrence and distribution of several oral and maxillofacial pathologies. This is most evident in congenital anomalies such as cleft lip and palate, which are recognized as multifactorial disorders involving both genetic mutations and chromosomal abnormalities.[1] The geographical disparities in the prevalence of

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orofacial clefts, for instance, are not solely explained by the genetic makeup of certain ethnic groups. Instead, these patterns are significantly influenced by how specific genetic vulnerabilities interact with local environmental exposures. This means that genetic susceptibility can be expressed or exacerbated by environmental triggers present in different regions, such as nutritional deficiencies (e.g., inadequate folic acid intake), exposure to teratogenic drugs, or air pollution.[10] This gene-environment interaction helps to explain why certain genetically predisposed populations might exhibit higher disease rates in particular environmental contexts.

Beyond congenital anomalies, hereditary factors contribute to various other conditions. Certain syndromes, including Down syndrome, Beckwith–Wiedemann syndrome, Duchenne muscular dystrophy, and Neurofibromatosis type I, are known to have associated oral and maxillofacial manifestations.[1] Furthermore, genetic factors can influence an individual's susceptibility to common oral diseases like dental caries and periodontal disease by affecting critical host factors such as tooth structure, immune response, and salivary composition.[50] The emerging field of gene sequencing offers promising avenues for identifying specific genetic risk factors and informing personalized treatment approaches in dentistry.[58] The recognition of this genetic-environmental synergy underscores the need for integrated research that considers both genetic and environmental data. Public health

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interventions should therefore not only focus on reducing environmental risk factors but also explore the potential for genetic screening and counseling for high-risk families, particularly for severe congenital anomalies.

Environmental Factors

Environmental factors exert a substantial influence on the prevalence and patterns of oral and maxillofacial pathologies in children. These factors encompass a range of exposures and conditions, including inadequate exposure to fluoride, the widespread availability and affordability of high-sugar foods, and limitations in access to oral healthcare services.[24]

Oro-dental trauma, a significant component of maxillofacial pathology, is directly influenced by environmental elements such as unsafe playgrounds, prevalent risk-taking behaviors among youth, road accidents, and acts of violence.[24] The observed geographical variations in the prevalence of maxillofacial trauma reflect underlying differences in socioeconomic conditions, cultural norms, and legislative environments across regions.[11] For instance, a higher incidence of falls in Asian populations compared to more sports-related injuries in North America points to distinct environmental and behavioral contexts influencing trauma patterns.[14]

Maternal health and lifestyle during pregnancy also represent critical environmental determinants. Poor maternal nutrition, tobacco consumption, alcohol use, and obesity during pregnancy have

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been linked to an increased risk of congenital anomalies, including orofacial clefts.[24] While less directly tied to pediatric populations in the provided literature, broader environmental factors such as air pollution, occupational exposures, and sun exposure are recognized determinants for oral cancer development in the general population.[59]

The social and physical environments in which children live can profoundly shape their health behaviors and access to care.[60] For example, studies have demonstrated that community water fluoridation and the use of fluoride-containing products are particularly effective in reducing the incidence of dental caries in lower socioeconomic areas, highlighting the direct impact of environmental public health interventions.[60] Crucially, unlike genetic factors, many environmental determinants are modifiable. This means that the observed "diaspora" of certain pathologies, such as dental caries and various forms of trauma, can be directly attributed to variations in these modifiable environmental factors across different regions. This provides clear targets for public health interventions, including community water fluoridation programs, comprehensive sugar reduction campaigns, and injury prevention initiatives tailored to local environmental contexts. Effective implementation of such interventions has the potential to significantly reduce regional disparities in oral health outcomes.

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Socioeconomic Factors

Socioeconomic status (SES) consistently emerges as a powerful determinant of pediatric oral health outcomes, demonstrating a direct correlation with the prevalence of various oral and maxillofacial pathologies. Children from lower SES backgrounds consistently experience higher rates of dental caries and poorer oral health-related quality of life (OHRQoL).[16] This is influenced by a cascade of interconnected factors, including parental education levels, household income, food security, and the characteristics of the neighborhood environment.[16] For example, children residing in food-insecure households exhibit a higher prevalence of untreated dental caries [44], and living in a deprived neighborhood is strongly associated with increased caries prevalence.[44]

Beyond dental caries, socioeconomic disparities significantly influence the incidence and outcomes of maxillofacial trauma, with underprivileged areas often bearing a disproportionately higher burden.[11] This pattern suggests that SES acts as a fundamental determinant, shaping a series of factors—such as dietary habits, oral hygiene practices, access to preventive care, and the safety of living environments—that directly impact the prevalence and severity of oral and maxillofacial pathologies. The "diaspora" of disease is therefore deeply intertwined with global and regional socioeconomic inequalities. Regions with lower socioeconomic profiles often exhibit higher

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prevalence rates of various oral health issues, which can further exacerbate health and developmental setbacks, perpetuating a cycle of disparity. This is particularly concerning for conditions that directly impact essential functions like eating and speaking, as well as facial aesthetics, which can have profound effects on a child's overall well-being and future opportunities.[7] Consequently, addressing oral health disparities requires upstream interventions that tackle the root causes of socioeconomic inequality, such as improving parental education, ensuring food security, and investing in community resources, rather than solely focusing on clinical treatments. Policies aimed at reducing poverty and improving access to education can yield significant, far-reaching benefits for pediatric oral health.

Healthcare Access

Access to healthcare services is a critical modulator of the prevalence and outcomes of pediatric oral and maxillofacial pathologies, with significant disparities observed globally. Barriers to accessing dental care are a pressing concern, particularly for children and racial/ethnic minorities, with approximately one-third of the U.S. population facing such obstacles.[2] Children with disabilities, who often have complex needs, experience poorer oral health and encounter specific barriers, including professional unwillingness, fear of dental procedures, high treatment costs, and inadequate dental facilities.[63]

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In low- and middle-income countries, disparities in access to specialized care are particularly pronounced.[11] Many African countries, for instance, have historically neglected oral health in their national health strategies, leading to a severe shortage and maldistribution of oral health professionals.[18] This lack of access to timely and appropriate care can lead to delayed diagnosis and treatment, which in turn results in more severe disease progression, increased complications, and poorer prognoses.[26] The inequitable access to healthcare directly contributes to the observed "diaspora" of pathologies, not only in terms of reported prevalence but also in the severity of conditions and their long-term impact on affected children. Regions with limited access will likely have higher rates of untreated, advanced disease and associated complications, even if the initial incidence of certain pathologies is comparable to areas with better access. Therefore, improving access to oral healthcare services, particularly preventive and early diagnostic services, is paramount. This necessitates comprehensive policy interventions, the integration of oral health into broader primary care initiatives, and proactive efforts to address financial, systemic, and geographical barriers, especially in underserved populations and low-income countries.

4.3. Regional Disparities and Their Implications

The findings of this review unequivocally demonstrate significant geographical variations in the prevalence and patterns of

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pediatric oral and maxillofacial pathologies across continents and countries.[2] For instance, the prevalence of cleft lip and palate is notably higher in Asian and American populations compared to African populations.[49] Similarly, the primary etiologies of maxillofacial trauma differ significantly by region, with falls being more prevalent in Asian countries and violence or sports-related injuries dominating in North America.[14] Oral cancer incidence also shows marked variations across countries.[55]

These disparities are not random but are intrinsically linked to underlying differences in socioeconomic conditions, prevailing cultural practices, specific environmental exposures, and the robustness of healthcare infrastructure.[3] Low- and middle-income countries often bear a disproportionately high burden of these conditions.[10] The "diaspora" of pathology is not a static phenomenon; rather, it often operates within a negative feedback loop. Regions with higher prevalence of oral and maxillofacial pathologies, frequently driven by existing socioeconomic disadvantages and limited healthcare access, may experience further health and developmental setbacks. This perpetuates a cycle of disparity, as these conditions can significantly impact a child's ability to eat, speak, and participate socially, thereby affecting their overall quality of life and long-term developmental potential.[7] This highlights the urgent need for global health equity initiatives that specifically prioritize pediatric oral health in vulnerable regions. Interventions must be culturally sensitive

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and seamlessly integrated into broader health and development programs to effectively break this cycle of disparity.

4.4. Limitations of the Current Literature

Despite the comprehensive nature of this systematic review, several limitations within the current body of literature on pediatric oral and maxillofacial pathology warrant acknowledgment.

- Methodological Heterogeneity: A significant challenge lies in the considerable variations in study designs, data collection methods, and age group definitions across the included studies. Differences between retrospective institutional reviews and prospective population-based surveys, or reliance on biopsy records versus clinical examinations, limit direct comparability and the ability to perform robust meta-analysis pooling.[8]
- Geographical Gaps: There remains a notable scarcity of comprehensive epidemiological data from many regions globally, particularly from low- and middle-income countries and specific sub-regions within continents.[3] This fragmentation of data significantly limits the ability to fully map the "diaspora" of these pathologies and understand their true global burden.
- Underreporting of Asymptomatic Lesions: The reliance on clinical presentation or biopsy records in many studies may lead to an

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underestimation of the true prevalence of asymptomatic conditions in the pediatric population.[8]

- Lack of Longitudinal Studies: The majority of available studies are cross-sectional, providing only snapshots of prevalence at a given time. This limits the ability to understand the incidence, natural history, and progression of these pathologies over time within a pediatric cohort.
- Limited Data on Specific Influencing Factors: While the influence of socioeconomic status, genetic predispositions, and environmental factors is acknowledged, detailed quantitative data on their specific impact and complex interplay with the development and prevalence of oral pathologies are often limited or inconsistently reported across studies.[16]

These limitations highlight critical areas for future research and underscore the need for standardized methodologies, broader geographical coverage, and a greater focus on longitudinal studies to provide a more comprehensive and accurate understanding of pediatric oral and maxillofacial pathology worldwide.

4.5. Clinical and Public Health Implications

The findings from this systematic review carry significant clinical and public health implications, providing actionable insights

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for improving pediatric oral health outcomes globally.

- Early Detection and Diagnosis: The high prevalence of asymptomatic lesions, coupled with the increasing diversity of pathologies observed with age, underscores the critical need for routine, thorough oral examinations in all pediatric patients.[6] Many lesions, if left undetected, can lead to significant morbidity. Therefore, educating parents and caregivers on early signs and symptoms of oral and maxillofacial pathologies is crucial to facilitate timely presentation and diagnosis.[6]
- Targeted Prevention Strategies: Understanding the age-specific and region-specific etiologies of pathologies, such as the shift from falls to road traffic accidents as primary causes of trauma in different age groups or regions, allows for the development of highly tailored prevention campaigns.[9] Addressing modifiable environmental and socioeconomic risk factors is paramount. This includes promoting good oral hygiene practices, advocating for balanced nutrition with reduced sugar intake, and creating safer physical environments (e.g., playgrounds, road safety measures).[24]
- Resource Allocation and Policy Development: The identified

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regional disparities in disease burden necessitate an equitable distribution of healthcare resources. Integrating oral health into national health policies, particularly in low- and middle-income countries where the burden is often disproportionately high, is essential.[7] This includes improving access to specialized pediatric oral and maxillofacial care, which is currently a significant barrier for many vulnerable populations.[28] Policies should aim to reduce financial and systemic barriers to care, ensuring that all children, regardless of their socioeconomic background or geographical location, have access to necessary diagnostic and treatment services.

- Interdisciplinary Collaboration: Effective management and prevention of pediatric oral and maxillofacial pathologies require a truly collaborative approach. This involves seamless communication and cooperation among pediatric dentists, oral and maxillofacial surgeons, pathologists, geneticists, public health officials, and other medical specialists.[2] Such interdisciplinary teams can provide comprehensive care, from early diagnosis and treatment to long-term follow-up and rehabilitation, and contribute to a more holistic understanding of disease

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determinants and prevention strategies.

5. Conclusion

This systematic review and meta-analysis provides a comprehensive overview of the "diaspora" of oral and maxillofacial pathologies in the pediatric population, highlighting their complex global and regional distribution patterns. The findings reveal a significant and varied burden of these conditions worldwide, with odontogenic lesions and reactive/inflammatory conditions being highly prevalent, particularly in older children and adolescents. Maxillofacial trauma, while less frequent overall, remains a critical public health concern due to its potential long-term impact on facial development, with age- and region-specific etiologies.

The observed geographical disparities are not random but are intricately shaped by a multifaceted interplay of demographic characteristics, genetic predispositions, environmental exposures, socioeconomic factors, and access to healthcare. The high proportion of asymptomatic lesions suggests a potential underestimation of the true disease burden, emphasizing the urgent need for proactive screening and parental education. Furthermore, the analysis underscores that the distribution of congenital anomalies like orofacial clefts is a product of complex gene-environment interactions, requiring integrated preventive approaches.

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Ultimately, mitigating the global burden of pediatric oral and maxillofacial pathologies necessitates a concerted, multi-pronged public health response. This includes implementing standardized, population-based epidemiological studies to fill existing data gaps, particularly in underserved regions. Crucially, strategies must focus on early detection, targeted prevention campaigns tailored to specific age groups and regional risk factors, and ensuring equitable access to specialized oral healthcare services for all children. Recognizing the profound impact of broader social and environmental determinants on pediatric oral health outcomes is fundamental to developing effective, sustainable interventions that promote health equity worldwide.

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