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Review

Caregiver-Mediated Determinants of Oral Health in Children with Autism Spectrum Disorder: A Scoping Review of Home Hygiene, Dietary Practices, Dental Access and Family Impact

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Abstract

Background: Children with Autism Spectrum Disorder experience oral-health concerns related to sensory hypersensitivity, behavioral inflexibility, food selectivity, reduced cooperation and manual dexterity. This scoping review explored the published literature to summarize the evidence regarding caregiver-mediated determinants of oral health in children with ASD. **Materials and Methods:** We searched PubMed/MEDLINE, Scopus, Embase, and Google Scholar from database inception to April 10, 2026. Additional records were identified through citation tracking, reference list checking, gray literature searching, and manual searching. Studies of primary data on children or adolescents with ASD reporting caregiver-mediated oral health behaviors, barriers, facilitators, or outcomes were included. The charted data were synthesized thematically and presented descriptively. **Results:** Twenty-three primary studies were included. Evidence has shown that tooth brushing is often facilitated with the help or supervision of a caregiver due to sensory sensitivities, refusal behaviors, poor cooperation, or decreased manual dexterity among children with ASD. Exposure to sugar, food selectivity, and preference for soft or sweet foods are common caregiver-mediated oral health risk behaviors reported among children with ASD. **Conclusion:** Childhood ASD-related oral health may be integrally related to caregiver-provided homecare, food-based, access-related, and family-level determinants. The suggested conceptual framework should be viewed as hypothesis-generating and evidence-informed rather than as an established causal pathway. The findings should be interpreted cautiously because of methodological heterogeneity across the included studies, the predominance of cross-sectional designs, and the limited direct measurement of caregiver burden or parental stress. **Clinical application:** Due to caregiver mediation of oral health problems in children with ASDs, pediatric dental teams should partner with caregivers to enhance daily oral hygiene habits, decrease exposure to cariogenic diets and facilitate preventive dental attendance. Actionable steps may include customized tooth brushing instructions, caregiver training, visual schedules, reinforcement-based home routines, dietary counseling, ASD-sensitive communication, sensory-adapted appointments, and family centered dental care pathways.

Keywords: Autism spectrum disorder, Children, oral health, Caregiver burden, Parental stress, Tooth brushing, Dental access, Preventive dental care, Oral hygiene

1. Introduction

Autism Spectrum Disorder (ASD) refers to a complex neurodevelopmental disorder that presents as chronic problems in social communication and interaction as well as restricted repetitive behavior patterns and sensory atypicalities.[1-5] Globally, the World Health Organization estimates that approximately 1 in 127 people were on the autism spectrum in 2021.[6] Regional estimates vary according to screening methods and diagnostic ascertainment; in Saudi Arabia, a Riyadh-based study among children aged 2-4 years estimated ASD prevalence at 2.51%.[7] These symptoms may impact many areas of daily living, including hygiene, feeding practices, access to healthcare, and compliance with clinical care. Maintaining oral health in children with ASD may be difficult. [8-11] Toothbrushing, diet management, dental visits and preventive care typically necessitate ongoing caregiver participation and management, behavioral accommodations and coordination with dental providers. [12-14] Children with ASD can present with many oral-health issues including dental caries, plaque retention, gingivitis, bruxism, oral trauma, food pouching, self-injurious oral habits and toothbrushing challenges. [14-16] A recent study that examined oral-health status and dental-treatment needs in children with ASD found that children with ASD experienced significantly more toothbrushing challenges, poorer plaque scores, more detrimental oral habits and more traumatic dental injuries than their non-ASD counterparts. [11] Studies from different countries have reported that children with ASD may present with poor oral hygiene, gingivitis, dental caries, oral parafunctional habits and unmet treatment needs.[14-18]

A recent study examined oral health status and dental treatment needs in children with ASD found that children with ASD experienced significantly more tooth brushing challenges, poorer plaque scores, more detrimental oral habits and more traumatic dental injuries than their non-ASD counterparts. Studies from around the world have found that children with ASD may have poor oral hygiene, gingivitis, dental caries, oral parafunctional habits, and unmet treatment needs. [18]

Oral health behaviors and outcomes among children with ASD are impacted not only by biological or clinical determinants but also by routine home-care practices and family level factors. Due to factors such as sensory sensitivity, decreased manual dexterity, resistance to oral care, behavioral rigidity and difficulty following directions, toothbrushing among children with ASD often requires assistance or supervision from a parent. [2,5,8,18] Even in the general pediatric population, ICCMS-based caries-management guidance and pediatric toothbrushing-skill studies emphasize that children require caregiver supervision until sufficient manual dexterity and plaque-control ability are achieved, often around the early school years.[3,4] Therefore, caregiver involvement is even more important in children with ASD because sensory, behavioral, and communication-related difficulties may increase the need for daily oral hygiene support. According to data collected from students with ASD in Iran, 80% brushed their teeth with the help of their parents. Difficulty in brushing was ranked as the most common barrier to toothbrushing. [2] Similar trends were reported in a Libyan study, where most autistic children needed either partial or full assistance with toothbrushing. [18] These findings highlight the importance of caregivers in

the daily oral care routines of children with ASD. Oral hygiene among these children should be conceptualized not as an autonomous activity, but rather as a caregiver-mediated behavior that is contingent on parental knowledge, confidence, available time and stress levels. [21,22]

Dietary practices among children with ASD are considered caregiver-mediated habits that can impact oral health outcomes. Food selectivity, preference for soft or sweet foods, restrictive dieting, and opposition to diet change are commonly reported among children with ASD. These factors may place children with ASD at a higher risk of caries development and periodontal inflammation by prolonging their exposure to fermentable carbohydrates and limiting their intake of protective nutrients. A case-control study aimed at understanding the relationship between dietary sugar exposure and oral health status among children with ASD confirmed that diet is an important factor to consider when assessing oral health risks in this population. Recent findings assessed using structural equation modelling suggest that autism severity impacts dental health both directly and indirectly through mediating factors, such as willingness to brush teeth and diet quality. Of these factors, toothbrushing behavior was found to be the primary mediator. [23,24]

Access to dental care is another key concern for children with ASD and their families. Dental visits can be challenging due to communication barriers, sensory issues, anxiety or behavior problems, an insufficient number of trained dental providers, and a lack of availability of adapted dental services. [25,26] One review of the available literature regarding determinants of oral health status and access to effective treatment services among children with ASD found several articles identifying difficulty locating providers, inadequate professional knowledge and training, limited caregiver access to oral health literacy, poor insurance coverage, and failure to accommodate children's needs as common barriers. Parent-reported studies have similarly noted deficits in access to dental care and unpleasant dental visits for children with ASD, which can contribute to decreased attendance and prevention efforts. [9,11,27]

Parental involvement and caregiver concerns are paramount in understanding the oral health of children with ASD. Parents typically provide toothbrushing, dictate the level of cariogenic diet and therefore risk, arrange dental visits and communication with dental teams, respond to behavioral problems, and determine what preventive or treatment services are utilized. [1,28,29] One study from Saudi Arabia that explicitly investigated parental attitudes and willingness to provide oral care for children with ASD found associations between parental brushing supervision and plaque score, gingival disease, and caries in primary teeth. A positive parental attitude was associated with reduced sugar consumption, while parental comfort in providing oral care was inversely correlated with plaque and gingival scores. [26,30] These findings suggest that caregiver-related variables impact oral health outcomes through various pathways.

Furthermore, oral health problems experienced by children with ASD may influence the quality of life of both the children and their family members. Issues such as dental pain, untreated decay, halitosis, malocclusion, bruxism, problems with chewing, and discomfort during oral hygiene routines can increase caregiver burden and impair family functioning. [31-33] One parental-perspective study found that perceived poor oral health among children with ASD was significantly associated with lower child and family quality of life scores, which appeared to be moderated by the difficulty in accessing dental care and poor child cooperation during dental visits. In contrast, another study found that better oral health was significantly associated with better quality of life

among individuals with ASD, further corroborating the need for oral-health assessment and management to be incorporated into individuals' therapeutic and support protocols. [34,35]

Although oral health status and dental care barriers in children with ASD have been widely described, caregiver-mediated pathways linking home hygiene, diet, dental access, parental factors, and family impact remain insufficiently mapped. Therefore, a scoping review is warranted to synthesize this heterogeneous evidence and identify priorities for caregiver-cantered prevention and research.

1.1 Aim of The Review

This scoping review aimed to map and summarize the available evidence on caregiver-mediated factors related to oral health in children with ASD, including home oral hygiene behaviors, dietary practices, dental access, preventive dental care utilization, caregiver-related factors, and family impact.

1.2 Specific Objectives

- To synthesize evidence on caregiver correlates of oral hygiene/tooth brushing behaviors in children with ASD.
- To map the evidence on diet/dietary practices, including sugar exposure, food selectivity, and caregiver control over child eating/diet, as it relates to child oral health.
- To summarize barriers/facilitators to dental access and utilization of preventive dental care services.
- To evaluate the roles of parental attitudes, caregiver comfort, caregiver burden, and family factors on oral health behaviors and outcomes.
- To identify available evidence describing the impact of children's oral health on the quality of life of the family/caregiver experience.
- To identify gaps in the literature and propose future directions for caregiver-cantered oral health interventions for children with ASD.

2. Materials and Methods

This scoping review maps the available literature related to caregiver-mediated determinants of oral health among children with ASD. The scoping review protocol followed the recommended scoping review methodology and is presented in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines. This methodology was selected because the evidence is expected to be wide-ranging and include diverse study designs (i.e., cross-sectional, qualitative, mixed-methods, observational, and interventional studies). Therefore, rather than estimating a pooled effect size, this scoping review describes the extent, range, and nature of the evidence examining caregiver-mediated oral health-related behaviors among children with ASD.

2.1 Study Design

This scoping review maps the available literature related to caregiver-mediated determinants of oral health among children with ASD. The scoping review protocol followed the recommended scoping review methodology and is presented in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines. This methodology was selected because the evidence is expected to be wide-ranging and include diverse study designs (i.e., cross-sectional, qualitative, mixed-methods, observational, and interventional studies). Therefore, rather than estimating a pooled effect size, this scoping review describes the extent, range, and nature of the evidence examining caregiver-mediated oral health-related behaviors among children with ASD.

2.2 Protocol

The protocol was written before the search and screening were completed. The review protocol consisted of the review question, inclusion criteria, information sources, search strategy, screening process, data charting items, and synthesis. The protocol was not prospectively registered in a public registry. All methodological procedures, including database-specific search strategies and study selection techniques, are provided in the manuscript and Supplementary Table 1 for transparency and reproducibility. Amendments made to the review process were documented and used to prepare the manuscript.

2.3 Review Question

The main review question was as follows:

What evidence exists on caregiver-mediated factors related to oral health among children with ASD, including home oral hygiene, dietary practices, dental access, preventive care utilization, caregiver attitudes or burden, and family impact?

2.4 PCC Framework

The eligibility criteria were structured using the Population–Concept–Context (PCC) framework recommended for scoping reviews. The PCC framework and eligibility criteria are presented in Table 1.

Table 1. Population–Concept–Context Framework and Eligibility Criteria.

Population	Children and adolescents with autism spectrum disorder and their parents/caregivers	Adults with ASD only. studies where ASD-specific child data were not reported separately
Concept	Caregiver-mediated determinants of oral health, including assisted toothbrushing, caregiver knowledge, parental attitudes, caregiver comfort, caregiver burden, parental stress, dietary practices, dental access, preventive dental utilization, and family impact	General oral-health status studies without caregiver, family, homecare, diet, access, preventive care, or quality-of-life components
Context	Home, dental clinics, schools, autism centers, community programs, special-care dentistry settings, and healthcare systems in any country	Settings unrelated to oral health, dental care, ASD, or caregiving
Study designs	Cross-sectional, case-control, cohort, qualitative, mixed-methods, and intervention studies	Editorials, commentaries, opinion pieces, letters, abstracts without sufficient data, non-scientific reports, and secondary reviews not reporting primary data
Language and availability	English-language full-text articles	Non-English articles without translation; studies with unavailable full text or insufficient methodological information

2.5 Eligibility Criteria

2.5.1 Inclusion Criteria

We included studies that enrolled children or adolescents diagnosed with ASD and reported information regarding oral health, dental care, oral hygiene, dietary habits, dental access, preventive dental care, oral health-related quality of life, and family impact. Included studies also had to report at least one caregiver-mediated factor, including parent-assisted brushing, caregiver knowledge, parental attitudes toward care, caregiver comfort levels, parental stress, caregiver burden, family support, caregiver-reported barriers to oral health care, or caregiver health care decision-making for their child. We included original primary research studies of any design (cross-sectional, case-control, cohort, qualitative, mixed-methods, interventional, observational, and survey-based) that met our criteria. Only full-text articles in English were included. This restriction was applied because translation resources were not available, and it is acknowledged as a possible source of bias. Reviews and scoping reviews were used to gain background information, check references, and identify additional primary studies, but were not included in our evidence table. Only original primary research studies were included in the evidence synthesis and final review. Review articles, scoping reviews, systematic reviews, narrative reviews, and guidelines were used only for background context citation tracking and interpretation.

2.5.2 Exclusion Criteria

We excluded studies that (1) reported only on adults with ASD but did not provide data separately for children or adolescents; (2) reported only on oral health status without any caregiver/family/home care/dietary/access/outcomes quality of life component; (3) reported on children with disabilities but did not tease out findings specific to those with ASD; or (4) did not pertain to oral health, dental care, oral hygiene, diet, or dental service access. We excluded editorials, commentaries, letters/opinion pieces, non-scientific reports, and conference abstracts that did not provide sufficient data for summarization. We attempted to retrieve the full text of all articles; if we were unable to obtain the full text, we excluded the article from the review.

2.6 Information Sources

A literature search was performed using PubMed/MEDLINE, Scopus, Embase, and Google Scholar. Additional searches included citation tracking, reference-list screening of relevant reviews and included studies, gray literature searching, and manual searching of journals relevant to pediatric dentistry, special-care dentistry, disability, and autism. Gray literature and supplementary sources included Google Scholar, institutional repository searches, author-uploaded full-text sources where available, reference lists of relevant reviews, citation tracking of key included studies, and manual searches of relevant pediatric dentistry special care dentistry, disability, and autism-related journals. The reference lists of the included articles and citations of key papers were searched to enhance coverage and identify relevant studies not found through database searching, as were other relevant systematic and scoping reviews and grey literature where appropriate. Manual searches of journals specific to pediatric dentistry, special care dentistry, and disability and autism were conducted.

2.7 Search Strategy

The search strategy was developed using terms related to ASD, children, oral health, dental care, and caregiver-mediated determinants. The preliminary search strategy combined keywords and controlled vocabulary, where available. Search terms included synonyms for ASD, child and adolescent populations, oral health outcomes, dental care utilization, caregiver involvement, parental attitudes, caregiver burden, parental stress, family impact, oral health-related quality of life, diet, sugar exposure, and food selectivity. For Google Scholar, simplified keyword combinations were used, and the first 100–150 results for each search combination were screened for relevance because results beyond this range showed low topic specificity.

The preliminary PubMed/MEDLINE search string was as follows:

(“Autism Spectrum Disorder” OR autism OR ASD OR autistic) AND (child* OR adolescent* OR pediatric OR paediatric) AND (“oral health” OR dental OR dentistry OR “oral hygiene” OR toothbrushing OR brushing OR “dental caries” OR plaque OR gingivitis OR periodontal OR “preventive dental care” OR “dental attendance” OR “dental visit*” OR “dental access” OR “dental care utilization”) AND (parent* OR caregiver* OR mother* OR father* OR family) AND (“caregiver burden” OR “parental stress” OR “parenting stress” OR “caregiver strain” OR

"parental attitude*" OR "caregiver attitude*" OR "parental perception*" OR "caregiver perception*" OR "caregiver knowledge" OR "parental comfort" OR "parent-assisted brushing" OR "family impact" OR "quality of life" OR OHRQoL OR diet OR "sugar exposure" OR "food selectivity").

The search strategy was adapted for each database according to the database-specific syntax, indexing terms, and available search fields. Boolean operators, truncation, phrase searching, Medical Subject Headings, and equivalent controlled vocabulary were used where applicable. The final literature search was conducted on April 10, 2026. Searches covered records published from database inception to April 10, 2026, with no publication date restriction applied unless required by the database interface. Full database-specific search strategies, search dates, filters, and retrieved records are provided in Supplementary File 1.

2.8 Study Selection

All identified records were exported to reference management software, and duplicate records were deleted. Two stages of study selection were performed. Initially, the titles and abstracts of all records retrieved were screened independently by two reviewers according to the eligibility criteria. Articles deemed potentially relevant by at least one reviewer were retrieved in full text and independently assessed according to the eligibility criteria by two reviewers for final inclusion in this review. Any discrepancies between the reviewers were discussed. In cases where no consensus could be reached, a third reviewer made the decision. The study selection process is presented in full using a PRISMA flow diagram.

2.9 Data Charting Process

A data-charting form was developed and refined through piloting the included studies. The form was modified as necessary throughout the review process to ensure complete and consistent data collection. The captured data included the first author and year of publication, study location, study design, sample size, age range, ASD diagnostic criteria, ASD severity reported, and type of caregiver respondent (parent, mother, father, caregiver, provider, etc.). The oral health outcomes assessed included dental caries, plaque, gingivitis, oral hygiene status, bruxism, and oral health-related quality of life. Home-care factors included tooth brushing frequency, parental help and brushing barriers, and oral hygiene routines. The dietary factors included sugar exposure, food selectivity, diet quality, and intake of cariogenic foods. Dental-access-related factors included attendance for dental care, preventive dental visits, dental-care barriers, and availability of providers. The caregiver-specific variables included knowledge, attitudes toward oral health care, comfort in providing oral care, stress, caregiver burden, self-efficacy, and perception of the patient's oral health. Family impact variables included the quality of life of the family, caregiver difficulty, treatment burden, and emotional impact. Key findings pertinent to the review question were charted along with reported study limitations and research gaps. Whenever possible, precise statistical measures reported in the original article were obtained (including p-values, confidence intervals, odds ratios, regression coefficients, or correlation coefficients) and are provided. When not available in the published article, the results were described qualitatively as provided by the

authors.

2.10 Data Synthesis

Data were synthesized both descriptively and thematically. A meta-analysis was not performed. This mapping review intended to report on the available evidence rather than pool study results. Thematic synthesis was completed based on the main themes included in the review: home oral hygiene behaviors, caregiver assistance during tooth brushing, barriers to tooth brushing, child cooperation with tooth brushing, healthy diet practices, access to dental care, utilization of preventive dental care, caregiver knowledge and awareness, caregiver comfort levels, caregiver burden, family impact, oral health-related quality of life (OHRQoL), and gaps in caregiver-centered oral health interventions. Results are displayed using summary tables, descriptive mapping, and narrative summaries.

2.11 Quality Appraisal

A quality appraisal was performed to aid the interpretation of the mapped evidence. Appraisal tools were chosen a priori based on the study design. Cross-sectional and case-control studies were appraised using the Joanna Briggs Institute critical appraisal checklists. Qualitative studies were appraised using the Critical Appraisal Skills Programme checklist, and mixed-methods studies were appraised using the Mixed Methods Appraisal Tool. The results of the appraisal were synthesized descriptively and were not used to exclude studies. This scoping review aimed to map the breadth and nature of the available evidence rather than exclude studies based on methodological quality. Common methodological limitations were considered when discussing the strength of the findings.

2.12 Presentation of Results

Findings are presented using a PRISMA-ScR flow diagram, a study characteristics table, a thematic summary table, an evidence gap table, and a conceptual framework.

2.13 Ethical Considerations

This review was conducted using published literature; thus, no ethical approval was required. This study did not involve contact with humans, nor did we access individual patient data. References for all studies included in this review are cited. This review will be reported according to the principles of transparency and reproducibility.

3. Results

3.1 Study Selection

Database searches yielded 612 records. 28 additional records were retrieved through citation tracking, reference-list screening, grey literature searching, and manual searching strategies, and 640 records were retrieved before removing duplicates. After removing duplicates, 504 records

were screened based on their titles and abstracts. After title and abstract screening, 421 articles were excluded. A total of 83 full-text reports were retrieved for eligibility assessments. Following full-text review, 60 records were excluded because they did not include caregiver-mediated determinants for oral health outcomes (n=24), reported oral health-related outcomes but lacked an identifiable caregiver and family component to care or quality of life component (n=12), did not have ASD-specific child or adolescent data (n=12); only recruited adults for their study (n=5) ineligible publication types (reviews, commentary (n=3) or did not provide adequate methodological details to assess inclusion/exclusion criteria (n = 4)). Finally, 23 primary studies were included in this review. No review articles met the inclusion criteria of this study. The selection of studies is presented in a flow diagram below (Figure 1).

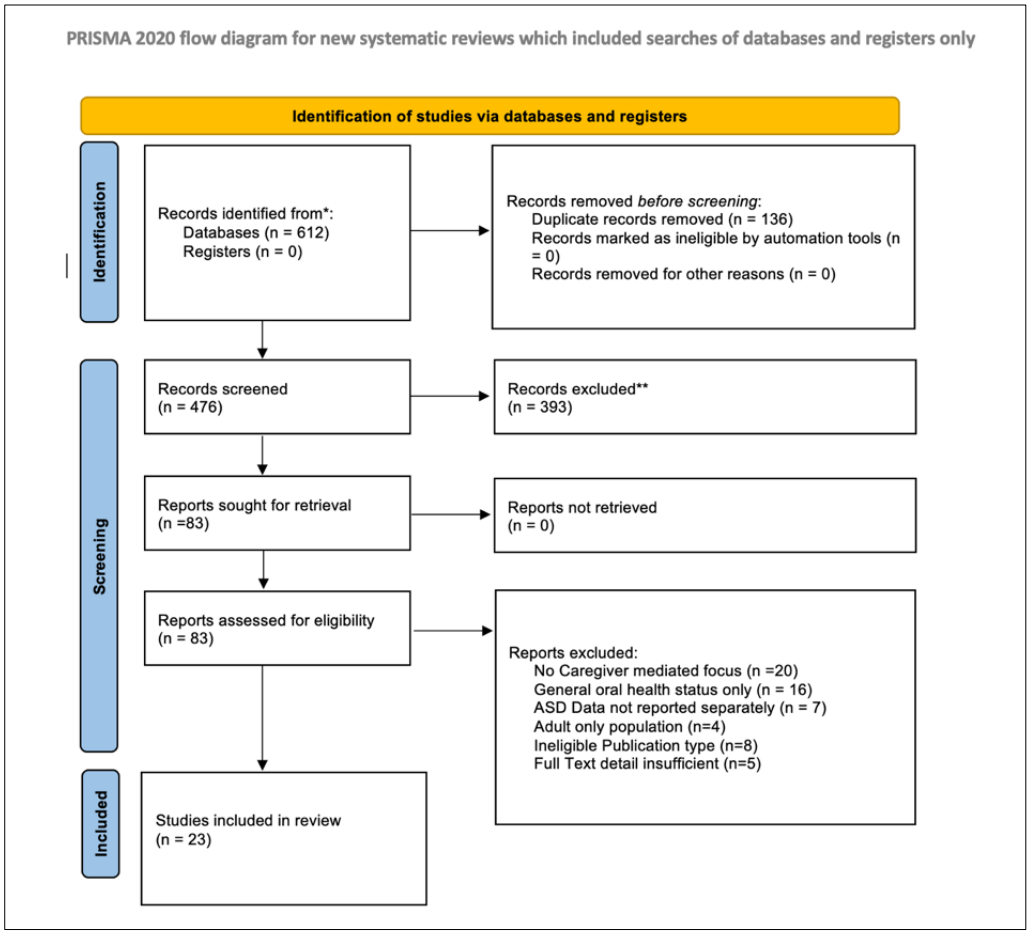

Figure 1. PRISMA 2020 Flow Diagram of Study Selection. PRISMA 2020 flow diagram showing the identification, screening, eligibility assessment, and inclusion of studies in the scoping review on caregiver-mediated determinants of oral health in children with Autism Spectrum. The diagram summarizes the number of records identified, duplicates removed, records screened, reports assessed for eligibility, reasons for exclusion, and final studies included in the review.

3.2 Characteristics of Included Studies

The included primary studies originated from Asia, the Middle East, Africa, Europe and Latin America. Many studies have employed cross-sectional designs. Few studies employed qualitative research designs, online caregiver surveys, case-control designs, or analytic modelling studies. Although most studies enrolled study populations with children and adolescents with ASD, some

studies used broader age ranges and mixed populations. Sources of data for study outcomes varied but were most frequently obtained using caregiver questionnaires, parental perception tools/completed by parents, clinical oral examinations, and oral health indices (DMFT/dmft, plaque index, gingival index, and/or oral hygiene indices). Measures of oral health-related quality of life, family impact, dietary exposure, dental attendance, and perceived barriers to dental attendance have been utilized in several studies. Additional information on the characteristics of the included primary studies is summarized in Table 2.

Table 2. Detailed Characteristics of Included Primary Studies.

Author/year	Country/ region	Study design	Sample and age group	Caregiver respondent/data source	ASD diagnosis/ severity	Oral-health assessment/ outcomes	Caregiver-mediated determinants assessed	How the study met the caregiver-mediated inclusion criterion	Key findings relevant to the review
AlHumaid et al., 2020	Saudi Arabia	Cross-sectional study	75 children with ASD attending special-needs schools	Parents completed the questionnaire	Children with ASD, severity not clearly central to analysis	Dental caries, gingival disease, plaque accumulation	Parental attitudes, comfort in providing oral care, brushing supervision, sugar consumption	The criterion was met through caregiver-reported parental attitudes, comfort, brushing supervision, and sugar consumption practices linked with child oral health indicators	Half of the parents supervised brushing. Brushing supervision was associated with plaque, gingival disease, and primary tooth caries. Positive parental attitudes were associated with lower sugar intakes. Greater parental comfort was inversely correlated with plaque and gingival scores
Piraneh et al., 2022	Iran	Cross-sectional study	217 students with ASD, aged 7-15 years	Parent questionnaire plus clinical examination	ASD severity assessed using DSM-5 by a psychologist	OHI-S, DMFT, cooperation level, caries experience	Parent-assisted brushing, brushing barriers, sweet-snack consumption, fluoride toothpaste use	The study met the criteria by reporting parent-assisted brushing, caregiver-reported brushing barriers, sweet snack consumption, and oral hygiene practices	Eighty percent brushed their teeth with parental help. Difficulty in brushing was the most common barrier to oral hygiene. Better oral hygiene was associated with a higher brushing frequency and lower sweet snack consumption
Badrov et al., 2025	Croatia/online	Online cross-sectional parental survey	121 parents of children with ASD	Parent-reported questionnaire	Parent-reported ASD, severity not the primary focus	Parent-perceived oral health, P-CPQ-16, FIS-8	Parental perception, oral-hygiene difficulty, child cooperation, dental access, family impact	The criterion was met through parent-reported oral hygiene difficulty, cooperation during brushing and dental visits, dental-access barriers, and family impact	Poorly perceived oral health was associated with lower child and family quality of life. The most common oral hygiene difficulty was child unwillingness to cooperate. Dental access challenges and poor cooperation were associated with a higher family impact
Slabšinskienė et al., 2026	Lithuania	Cross-sectional study using structural equation modeling	399 mothers of autistic children/adolescents aged 2-18 years	Mothers reported child dental health, ASD severity, diet, and brushing willingness	Parent-reported ASD severity	Parent-reported dental health status	Toothbrushing willingness, diet quality, ASD severity	The criterion was met by modelling caregiver-reported toothbrushing willingness and diet quality as mediating factors linking ASD severity and dental health	ASD severity directly and indirectly affected dental health through tooth brushing willingness and diet quality. Tooth brushing was a strong mediator, supporting the caregiver-mediated pathway
Ningrum & Bakar, 2023	Indonesia	Qualitative study	6 parents of children with ASD	Focus-group interviews with parents	Children with ASD from the autism care center	Parent-reported oral-health barriers and toothbrushing behavior	Parent perspectives, brushing barriers, oral-health knowledge gaps, expectations from dentists and policymakers	The criteria were met through parent interviews describing caregiver difficulties, knowledge gaps, brushing assistance, and expectations from dental providers	Parents reported barriers such as drooling, tongue thrusting, poor attention, and uncertainty about how long to assist with brushing. Parents wanted more education, patient dentists, and greater government attention to oral health for special needs
Khalifa et al., 2025	Tunisia	Descriptive cross-sectional study	48 children with ASD	Structured caregiver questionnaire plus clinical examination	Mild/moderate and severe ASD groups reported	Oral hygiene, untreated caries, gingival inflammation, parafunctional habits	Caregiver knowledge, attitudes, practices, brushing frequency, toothpaste use, dental attendance, diet	The criterion was met by assessing caregivers' knowledge, attitudes, and practices related to tooth brushing, toothpaste use, diet, and dental attendance	Poor oral hygiene, irregular brushing, untreated caries, and low dental attendance have been reported. The authors emphasized caregiver training and adapted dental protocols
Qiao et al., 2020	China	Parent-reported comparative study	144 children with ASD and 228 typically developing children, aged 3-16 years	Parent questionnaires	Children with ASD and typically developing controls	Oral symptoms, oral habits, hygiene practices, dental-care experience, OHRQoL	Parent-reported brushing independence, dental access, unpleasant dental experience, family impact	The criteria were met through parent-reported brushing independence, dental-access difficulty, unpleasant dental experiences, and child/family OHRQoL	Children with ASD had worse oral symptoms, less independent brushing, more difficulty accessing dental care, more unpleasant dental experiences, and reduced child/family quality of life
Richa et al., 2014	India	Cross-sectional comparative study	135 children with autism and 135 controls, aged 4-15 years	Parents completed the Parental-Caregiver Perception Questionnaire	Children with autism	OHI-S, DMFT/dmft, DMFS/dmfs, OHRQoL	Parental perception of oral-health-related quality of life	The criterion was met by using caregiver perception to assess the child's oral health-related quality of life and functional limitations	Children with autism had higher oral hygiene and caries scores than those in the control group. Functional limitations related to oral problems were more prevalent in children with autism

Table 2 cont. Detailed Characteristics of Included Primary Studies.

Author/year	Country/ region	Study design	Sample and age group	Caregiver respondent/data source	ASD diagnosis/ severity	Oral-health assessment/ outcomes	Caregiver-mediated determinants assessed	How the study met the caregiver-mediated inclusion criterion	Key findings relevant to review
George et al., 2024	India/Qatar/Saudi-linked authorship	Cross-sectional study	96 children with ASD and 96 typically developing children	Clinical examination and oral-care practice assessment	DSM-5 diagnosis; severity categories reported	WHO oral-health form, Nyvad criteria, dft, plaque, traumatic dental injuries, harmful oral habits	Toothbrushing difficulty, oral-care practices, caregiver-supported oral hygiene	Met the criterion by reporting oral care practices and caregiver-supported tooth brushing difficulties in children with ASD	Children with ASD had more tooth brushing difficulties, poorer plaque scores, more harmful oral behaviors, and more traumatic dental injuries, despite a lower caries prevalence than controls
Moorthy et al., 2022	India	Case-control study	136 children with ASD and 136 children without ASD, aged 5-12 years	Parent/caregiver-reported sociodemographic, oral-hygiene, behavior, diet, oral-habit, and trauma data; 24-hour dietary recall; clinical oral-health assessment	Children with clinically diagnosed ASD compared with non-ASD controls	Oral-health status and dietary sugar exposure; sugar exposure calculated using a Dental Diet Diary mobile application	Dietary sugar exposure, cariogenic diet, oral-hygiene practices, diet-related behavior	The study met this criterion because caregiver-reported diet and oral hygiene information were used to examine dietary sugar exposure and oral health status in children with ASD	This study directly addressed dietary sugar exposure as an oral health determinant in children with ASD and supported diet as a caregiver-mediated risk pathway
Fallea et al., 2024	Italy	Cross-sectional study	Individuals with ASD; includes broader ASD population	Standardized oral-health and quality-of-life instruments	ASD diagnosis	OHAT, EQ-5D-Y, oral-health status, quality of life	Functional ability/autonomy and oral-health-related quality of life	The criterion was met by linking oral health status with functional ability/autonomy and quality-of-life outcomes relevant to caregiver and family support	Better oral health was significantly associated with a higher quality of life. These findings support the inclusion of oral health assessment in broader ASD therapeutic protocols
Naidoo & Singh, 2018	South Africa	Cross-sectional study	149 children with ASD, aged 7-14 years	Clinical examination	Children with ASD from special-needs schools	DMFT/dmft, gingival index, plaque index, attrition, soft-tissue trauma	Oral-care context, unmet treatment needs, preventive-care need	The unmet preventive and treatment needs of a school-based ASD population were identified, with implications for caregiver-facilitated dental care and prevention	High levels of caries, plaque, mild gingival inflammation, attrition, and soft tissue trauma were reported. Restorative and preventive care appeared to be limited, indicating unmet needs
Jaber, 2010	UAE	Comparative clinical study	61 children with autism and 61 non-autistic controls, aged 6-16 years	Clinical examination	Children with autism	Caries, plaque, gingivitis, restorations, treatment needs	Oral hygiene practices and unmet treatment needs	The criterion was met through oral hygiene practices and unmet dental treatment needs that require caregiver recognition, support, and service use	Children with autism had higher caries prevalence, poorer oral hygiene, more gingivitis, and greater unmet dental treatment needs than controls
Bossù et al., 2020	Italy	Cross-sectional clinical study	229 autistic children, aged 5-14 years	Clinical examination and recorded background data	Children with ASD attending special-needs unit	DMFT/dmft, periodontal status, plaque, gingivitis, caries prevalence	Dietary habits, cooperation at first visit	The criterion was met by reporting dietary habits and cooperation at the first dental visit, both of which are relevant to caregiver-mediated diet and dental-access pathways	High prevalence of plaque, gingivitis, and caries was reported. Dietary habits and periodontal indices were significantly associated with the caries outcomes
Oda et al., 2021	Turkey	Cross-sectional study	83 children with ASD, aged 3-18 years	Parent form and clinical examination	DSM-5 diagnosis; Autism Behavior Checklist used	Dental caries, dental plaque, DMFT/dmft	ASD severity, caregiver-reported sociodemographic factors	The criterion was met by combining caregiver-reported sociodemographic information and ASD severity with clinical oral health outcomes	The prevalence of caries was high. Child age and ASD symptom severity were significantly associated with the DMFT score

Table 2 cont. Detailed Characteristics of Included Primary Studies.

Author/year	Country/ region	Study design	Sample and age group	Caregiver respondent/data source	ASD diagnosis/ severity	Oral-health assessment/ outcomes	Caregiver-mediated determinants assessed	How the study met the caregiver-mediated inclusion criterion	Key findings relevant to review
Rages et al., 2023	Libya	Cross-sectional study	51 children with ASD	Parent questionnaire	Children from specialized centers	Oral-care behavior, dental symptoms, dental attendance	Need for brushing help, dental access, parental perception of dental visits	The criterion was met through parent-reported need for brushing help, dental attendance, and parental perception of dental visits	Seventy-six-point six percent needed help with tooth brushing, approximately half visited the dentist only when needed, and many parents described dental visits as hard and unpleasant
Elamami & Alamami, 2022	Libya	Cross-sectional comparative study	60 autistic children and 60 matched non-autistic controls, aged 4-14 years	Clinical examination; caregiver-related brushing information	Children with ASD from a rehabilitation center	dmft/DMFT, gingival index, plaque index, bruxism/attrition, oral problems	Assistance during toothbrushing, need for preventive education	The study met the criteria for caregiver-related brushing assistance and the need for preventive oral health education	Most autistic children require some or complete assistance while brushing their teeth. The authors recommend preventive oral health education and dentist training
Narula et al., 2024	India	Cross-sectional comparative study	80 children with ASD and 80 controls, aged 5-14 years	Clinical examination and behavior assessment	Children with ASD	Dental caries, oral hygiene status, treatment needs, Frankl behavior rating	Child behavior during dental examination, home hygiene implications	The criterion was met by assessing dental behavior and home hygiene implications relevant to caregiver-supported oral care and dental attendance	Children with ASD exhibited more negative behavior during examinations but had lower caries and treatment needs than controls. The findings highlight the role of routine oral hygiene and dietary modifications
Sosa Seda et al., 2025	Puerto Rico/Hispanic population	Non-matched case-control study	22 ASD cases and 27 controls, aged 5-18 years	Parents/caregivers completed social-determinants questionnaire	Children diagnosed with ASD	Caries, gingivitis, oral-health indices	Dental-service access, rural residence, behavioral problems during visits	The study met the criteria through caregiver-reported social determinants, dental service access, rural residence, and behavioral problems during dental visits	Patients with ASD had better clinical oral health indices than controls, but barriers included difficulty in finding dental services, rural residence, and behavioral problems during dental visits
Ahmed et al., 2024	Iraq	Case-control observational study	31 ASD individuals and 31 controls, aged 4-15 years	Clinical examination	ASD group matched by age and gender	DMFT/dmft, gingival index, plaque index, calculus index, OHI-S	Parent/school/dentist role implied in oral-hygiene maintenance	The study met the criterion by emphasizing the role of parents, schools, and dentists in oral hygiene maintenance and awareness	Individuals with ASD had fair to poor oral health at higher rates, with significant differences in plaque and calculus. The authors emphasized the need for awareness among parents, schools, and dentists
Al-Zaidi, 2021	Iraq	Comparative cross-sectional study	30 children with autism and 30 controls, aged 3-14 years	Clinical examination	Children attending autism centers	dmfs/DMFS, plaque index, calculus index, gingival index	Oral-care education and prevention need	The study met the criterion by identifying oral-care education and prevention needs relevant to caregivers and dental teams supporting children with ASD	Children with ASD had higher permanent tooth caries severity and plaque than controls. The authors recommend preventive strategies and oral care educational programs
Du et al., 2014	Hong Kong	Case-control study	347 preschool children with ASD recruited; 257 completed full screening	Clinical oral-health screening	Preschool children with ASD	Caries, gingival health, tooth wear, malocclusion, trauma, oral mucosa	Early oral-care implications in preschool ASD	The study met the criterion by addressing early oral care implications in preschool children with ASD, where daily oral care is caregiver mediated	Preschool children with ASD had lower caries experience and better gingival health than did controls. Demonstrates variability in oral health outcomes across settings
Radzuan et al., 2024	Malaysia	Case-control study	28 children with ASD and 30 controls, aged 3-16 years	Clinical examination	Children with ASD attending pediatric dentistry clinic	MGI, sBPE, OHI-S, DMFT/dmft	Sensory processing and parental oral-hygiene challenges discussed	The study met the criterion by discussing sensory processing and parental oral hygiene challenges as caregiver-mediated barriers to oral care	Children with ASD showed numerically poorer oral hygiene and periodontal indicators, although the differences were not statistically significant. Early detection of this risk is recommended

Abbreviations: ASD, Autism Spectrum Disorder; DMFT/dmft, Decayed, Missing and Filled Teeth; OHI-S, Simplified Oral Hygiene Index; OHRQoL, oral health-related quality of life; P-CPQ-16, Parental-Caregiver Perceptions Questionnaire short form; FIS-8, Family Impact Scale short form; OHAT, Oral Health Assessment Tool; MGI, Modified Gingival Index; sBPE, simplified Basic Periodontal Examination.
Note. Table 2 includes only primary research studies. Relevant reviews and scoping reviews were used for background context and citation tracking but were not included in the primary study characteristics table. A dedicated column indicates how each included study met the caregiver-mediated eligibility criteria.

3.3 Methodological Quality Appraisal Summary

Our pooled data included mostly cross-sectional and case-control studies. There were fewer qualitative and mixed methods designs. Appraisal revealed that the studies had low to moderate-strength methodology. The reported limitations included parent-reported outcomes, cross-sectional designs without longitudinal follow-up, limited adjustment for confounders, inconsistent reporting of ASD severity, and lack of reporting of sampling procedures. Studies utilizing clinical oral examinations had stronger outcome measures than those using caregiver perception alone. Few studies presenting clinical oral health data have offered robust caregiver burden or parental stress burden measurements. Our evidence was sufficient to map caregiver-mediated determinants of oral health but inadequate to draw causal conclusions.

3.4 Thematic Mapping of Evidence

After coding, the evidence was grouped into the following six themes: caregiver-supported home oral hygiene and tooth brushing barriers; dietary practices, sugar exposure, and food selectivity; dental access and preventive dental care utilization; caregiver knowledge, attitudes, comfort, and self-efficacy; caregiver burden, family impact, and oral health-related quality of life; and system-level and provider-related factors. Table 3 shows the themes mapped to the caregiver-mediated determinants identified across the included primary studies.

Table 3. Thematic Mapping of Caregiver-Mediated Determinants of Oral Health in Children with ASD from Included Primary Studies.

Theme	Caregiver-mediated determinant	Reported variables	Oral-health outcomes/ effects	Representative primary studies	Interpretation
Caregiver-supported home oral hygiene and toothbrushing barriers	Caregiver assistance, supervision, prompting, and management of brushing barriers	Parent-assisted brushing, brushing frequency, supervision, toothpaste use, refusal, gagging, oral sensitivity, biting, drooling, tongue thrusting, poor attention, and resistance to routine change	Plaque accumulation, gingival inflammation, oral hygiene index scores, caries, irregular brushing, and caregiver difficulty during home care	AlHumaid et al.; Piraneh et al.; Badrov et al.; Ningrum and Bakar; Khalifa et al.; Qiao et al.; George et al.; Elamami and Alamami	Daily oral hygiene is a caregiver-child activity for many children with ASD. Cooperation and sensory tolerance influence the consistency and quality of brushing
Dietary practices, sugar exposure, and food selectivity	Caregiver influence on food choices, sugar intake, snacking, and selective eating	Sugar exposure, sweet snacks, soft or sweet food preference, food selectivity, restricted diet variety, diet quality, cariogenic food intake, and resistance to dietary change	Dental caries, plaque accumulation, gingival inflammation, poorer parent-reported dental health, and increased diet-related risk	Moorthy et al.; AlHumaid et al.; Slabsinskiene et al.; Bossu et al.; Piraneh et al.	Diet-related oral health risks may be partly caregiver-mediated, although sensory preference and behavioral rigidity can limit caregiver control
Dental access and preventive dental-care utilization	Caregivers' ability to obtain, maintain, and coordinate dental care and preventive services	Dental attendance, regular checkups, preventive visits, fluoride use, toothpaste use, prophylaxis, difficulty finding providers, rural access, unpleasant visits, dental anxiety, and behavioral problems during visits	Delayed care; unmet treatment needs; reduced preventive care; poor treatment completion; negative dental experiences; reduced child/family OHRQoL	Qiao et al.; Sosa Seda et al.; Rages et al.; Khalifa et al.; Naidoo and Singh; Elamami and Alamami; George et al.; Narula et al.	Dental access depends on caregiver motivation, provider availability, geography, cost, child cooperation, and ASD-adapted care pathways
Caregiver knowledge, attitudes, comfort, and self-efficacy	Caregiver awareness, beliefs, motivation, confidence, and comfort in supporting oral care	Knowledge of oral hygiene, fluoride awareness, caries recognition, attitudes toward brushing and prevention, comfort with brushing, ability to manage resistance, and confidence in routines	Brushing practices, sugar consumption, dental attendance, plaque scores, gingival health, and consistency and quality of home care	AlHumaid et al.; Khalifa et al.; Ningrum and Bakar; Badrov et al.; Ahmed et al.; Al-Zaidi.	Positive caregiver attitudes, knowledge, and comfort may promote healthier behaviors. Knowledge alone may not overcome the sensory and behavioral barriers related to ASD
Caregiver burden, family impact, and oral-health-related quality of life	Emotional, practical, time-related, and family level impacts of maintaining oral health and attending dental care	Caregiver difficulty, parental stress, treatment burden, frustration during brushing, difficult dental visits, Family Impact Scale, parental perception, child discomfort, eating difficulty, dental pain, and family disruption	Reduced child OHRQoL, poorer family QoL, delayed visits, irregular oral hygiene, caregiver concern, and family strain	Badrov et al.; Fallea et al.; Richa et al.; Qiao et al.; Ningrum and Bakar; Rages et al.	Direct burden measurement is limited, but several studies have shown that oral health problems and access barriers can affect child well-being and family functioning
System-level and provider-related factors	Dental team training, clinic adaptation, communication support, and healthcare system readiness	ASD-friendly clinics, provider knowledge, training, communication support, sensory-adapted appointments, flexible visits, referral pathways, and pre-visit preparation	Dental attendance, caregiver satisfaction, preventive utilization, treatment completion, and fewer unpleasant dental experiences	Ningrum and Bakar; Sosa Seda et al.; Qiao et al.; Rages et al.; Naidoo and Singh; Elamami and Alamami	Caregiver efforts may be insufficient when dental systems are not adapted to ASD-related needs. Provider training and ASD-friendly pathways remain a priority

Note: ASD, Autism Spectrum Disorder; OHRQoL, oral health-related quality of life. This table summarizes the recurring themes from the included primary studies. Review articles were used for background context and citation tracking but were not included as primary evidence in thematic mapping.

3.5 Home Oral-Hygiene Practices and Caregiver Assistance

Home oral hygiene practices are another commonly reported caregiver-mediated determinant. A few studies have mentioned that children with ASD require parental supervision or assistance with tooth brushing due to sensory issues, low cooperation, poor manual dexterity, behavioral inflexibility, or inability to follow directions. [1,2,8,9,11,18]

When assessing factors associated with home oral hygiene practices among students with ASD, Piraneh et al. conducted a study in Iran, where 80% brushed with parental assistance, and difficulty brushing was the factor reported by the highest percentage of participants. Increased brushing frequency and decreased sweet snack consumption were associated with better oral hygiene [2].

Elamami and Alamami conducted a study in Libya and reported similar results, where most autistic children needed some or total assistance while toothbrushing. Their findings support caregiver-mediated preventive protocols. [18]

A study from Tunisia reported irregular tooth brushing habits among children with ASD, with one-third brushing their teeth rarely. This study also found that almost half of participants had poor oral hygiene and stated caregiver involvement and oral-health education were vital.[8]

3.6 Toothbrushing Barriers and Child Cooperation

Caregivers' brushing barriers were often related to sensory sensitivities, refusal behaviors, difficulty sustaining attention, difficulties communicating, or resistance to change in routines. Caregivers endorsed similar barriers for Oral Care at Home and visiting the dentist.

Qualitative research from Indonesia revealed that parents reported barriers to accessing oral healthcare, including drooling, tongue thrusting, inability to sit still, and uncertainty regarding the duration of parental assistance with tooth brushing. Parents also suggested needing dentists who are more patient and have better oral-health-related communications from providers.[5]

Badrov et al. reported that difficulty accessing dental care was associated with higher child and family OHRQoL impact scores on both P-CPQ-16 and FIS-8 ($p \leq 0.001$). Poor child cooperation during dental visits was also associated with higher FIS-8 ($p \leq 0.001$) and P-CPQ-16 ($p = 0.017$) scores. Dental visit frequency was associated with both FIS-8 ($p = 0.021$) and P-CPQ-16 ($p = 0.027$), and unestablished dental care was associated with higher scores on both scales ($p = 0.002$). [3]

These data suggest that child cooperation may serve as an important mediator between caregiver exertion and oral health outcomes. Oral hygiene may continue to be challenging despite caregivers' willingness if children are noncompliant with tooth brushing or are unable to tolerate oral sensory input.

3.7 Dietary Practices, Sugra Exposure, and Food Selectivity

Dietary patterns were the third caregiver-mediated pathway identified in this study. Food selectivity, preference for soft or sweet foods, restrictive diets, and unwillingness to change dietary

habits are some feeding behaviors observed in children with ASD.

Feeding behaviors can affect the risk of caries, plaque deposition, gingival inflammation, and caregiver strain. Dietary sugar exposure was the focus of Moorthy et al.'s investigation of oral health in children with ASD, which speaks directly to the role of diet in this review.[12]

The study by Slabšinskienė et al. also informs our understanding of the mechanisms involved. Using structural equation modeling, they found that parent-reported ASD severity was associated with dental health outcomes through both direct pathways and indirect pathways involving willingness to toothbrush and diet quality.[4] Willingness to brush teeth fully mediated the relationship, while diet quality partially mediated the effect of ASD severity on dental health.

AlHumaid et al. found that positive parental attitude was correlated with reduced sugar intake among children with ASD. [1] Although this cross-sectional study cannot establish causality, the findings imply that caregiver attitudes may modify dietary risk behaviors in children with ASD.

Dietary intake is a skill set that is both child- and caregiver-dependent. Diet-related oral health risks in ASD may be affected by caregiver knowledge of diet, feeding management skills, feeding-related stress, and the ability to limit exposure to cariogenic foods.

3.8 Dental Access and Preventive Dental-Care Utilization

Difficulty in accessing dental care was identified several times. The topics included difficulty in finding appropriate dental providers, child behavior problems, difficulty communicating with the dentist, unpleasant dental experiences, lack of adapted dental settings, and professional training.

Children with ASD were noted to have greater difficulty accessing dental care and experiencing unpleasant dental experiences than their typically developing peers in a Chinese parent-reported study. Both difficulty accessing dental care and unpleasant dental experiences were associated with poorer child and family oral-health-related quality of life. [9]

Sosa Seda et al. reported significant barriers among children with ASD, including difficulty finding dental services ($p = 0.014$) and behavioral problems during dental visits ($p = 0.012$). Children with ASD had lower odds of caries than controls (OR = 0.121; 95% CI: 0.023–0.636).[22]

These articles show that preventive dental utilization is reliant on parental motivation, service availability, clinician training and expertise, availability of adapted care, cost, and caregiver confidence.

3.9 Parental Knowledge, Attitudes, Comfort, and Oral-Health Practices

In AlHumaid et al., parental brushing supervision was significantly associated with plaque accumulation ($p = 0.004$), gingival disease ($p < 0.0001$), and caries experience in primary teeth (def; $p = 0.02$). Positive parental attitude was associated with lower sugar consumption ($p = 0.043$), while parental comfort in providing oral care showed inverse correlations with gingival and plaque scores ($r = -0.18$ and $r = -0.23$, respectively).[1]

The Tunisian study relied on a questionnaire that asked caregivers about their knowledge,

attitude, and practices related to oral hygiene instructions, fluoride use, recognition of dental caries, regular dental checkups, toothbrushing frequency, toothpaste utilization, dental attendance, and dietary habits. [8] The authors concluded that caregivers need training and dentists need to have adapted approaches to provide better oral health care for children with ASD.

The Indonesian study did not directly assess KAP but showed that parents expressed a desire for more information. [5] Topics that parents wanted more information on included special oral healthcare, support for brushing, and communication with dentists.

In conclusion, some evidence showed that caregiver KAP affects their oral health-related practices, but many caregivers reported not receiving specific information regarding the behavioral and sensory challenges associated with ASD.

3.10 Caregiver Burden, Family Impact and Quality of Life

Evidence investigating caregiver burden as a directly measured outcome is lacking. Evidence assessing family impact, parental perception, caregiver difficulty, and child oral health-related quality of life was found.

Badrov et al. found poor perceived child oral health among those with ASD was significantly associated with lower child and family oral-health-related quality of life scores.[7] Family impact was related to access to dental care and child cooperation during dental visits.

Fallea et al. found a statistically significant positive association between oral health measured using the Oral Health Assessment Tool and quality of life measured using EQ-5D-Y total score ($\beta = 0.13045$, $p = 0.00271$). [13] They concluded that oral health assessment should be considered during therapeutic interventions for individuals with ASD.

Richa et al. reported significantly higher OHI-S, DMFT, and dmft scores among children with autism compared with controls (OHI-S: 2.07 ± 0.83 vs 0.46 ± 0.58; DMFT: 0.86 ± 1.22 vs 0.46 ± 1.06; dmft: 1.40 ± 2.48 vs 0.59 ± 1.28). The functional limitation domain of OHRQoL was also higher among children with autism than among controls (8.87 ± 5.65 vs. 6.66 ± 4.97), although the exact p values were not clearly reported in the accessible extracted text. [10] They found functional limitations due to dental problems were significantly higher among children with autism when compared to children without autism. [10]

The results indicate that the oral health of those with ASD can impact more than the clinical indicators of the disease. Outcomes such as difficulty with daily function, family routine, caregiver effort and expenditure, dental attendance, and perceived quality of life were affected by oral health indicators. Directly measured evidence reporting on caregiver burden, parental stressors, or caregiver strain related to child oral health outcomes needs to be developed.

3.11 Evidence Gaps

The included literature showed repeated evidence that caregivers influence oral hygiene, diet, access to care, and quality-of-life. However, several gaps remained. The key evidence gaps and future research directions are summarized in Table 4.

Table 4. Key Evidence Gaps and Future Research Directions.

Key evidence gap	Recommended future direction
Limited direct measurement of caregiver burden, parental stress, and caregiver self-efficacy	Validated caregiver burden, parental stress, and self-efficacy scales were used together with clinical oral health outcomes
Predominance of cross-sectional studies	Longitudinal studies should be conducted to clarify the links between ASD severity, caregiver factors, home hygiene, diet, dental access, and oral health outcomes
Few caregiver-centered intervention studies	Test caregiver training, brushing coaching, visual support, desensitization strategies, and family centered preventive programs
Underreporting of preventive dental-care utilization	The use of fluoride, fissure sealants, recall adherence, professional prophylaxis, first dental visit, and preventive counseling were reported
Inconsistent reporting of ASD severity and functional profile	ASD severity, sensory sensitivity, communication level, cooperation level, intellectual disability, and adaptive functioning were recorded
Limited evaluation of ASD-friendly dental-care pathways	Dental team training, sensory-adapted clinics, pre-visit preparation, social stories, and structured referral pathways were evaluated

Note: ASD: Autism Spectrum Disorder.
This table summarizes the most important evidence gaps and future research priorities for caregiver-mediated oral health determinants in children with Autism Spectrum.

4. Discussion

This review mapped evidence showing that oral health in children with ASD is shaped by interactions among child-related factors, caregiver factors, homecare routines, dietary behaviors, dental service access, and family impact. Across studies, caregiver involvement was central to tooth brushing, diet control, dental attendance, and management of oral health-related consequences.

To contextualize these findings, readers should consider their strengths and limitations based on the methodological profiles of the included studies. As numerous studies were cross-sectional and several used parent-reported outcomes, the identified associations between caregiver factors and child oral health outcomes should not be inferred as causal. Results supporting themes related to parental attitude, caregiver comfort, diet control, brushing cooperation, and dental access should be interpreted as indicative of possible caregiver-mediated pathways rather than established mechanisms. Readers can be most confident in repeated findings across studies where caregiver-reported data was confirmed by clinical oral health indices. Themes related to caregiver burden, parental stress, and self-efficacy should be regarded as preliminary owing to indirect reports of these constructs rather than validated scales.

The findings of this review may also demonstrate a paradigm shift from conceptualizing oral health risk among children with ASD using a strictly clinical model to family centered caregiver-mediated models. Previous reviews have focused on caries prevalence, plaque scores, gingival inflammation, bruxism, oral trauma, and the need for treatment, although these clinical outcomes do not address why oral health problems emerge or persist in pediatric populations with ASD.[25,26,28,32,35]

This review highlighted several potential caregiver-mediated pathways.[4] A child's sensory intolerance to toothpaste flavor, toothbrush texture, oral tactile sensations, and dental instruments may lead to increased resistance to oral hygiene. This resistance may contribute to increased caregiver burden and distress during brushing, leading to less frequent or lower-quality tooth brushing and increased plaque scores or gingival inflammation. Similarly, children with food selectivity may exert more control over their dietary choices in the hands of caregivers, leading to increased sugar consumption or poorer nutrition. Dental visits may be irregular if caregivers

suspect that their children will be uncooperative, distressed, or misunderstood by the providers.

Caregiver-mediated pathways were supported by a structural equation modeling study, which demonstrated that ASD severity had both a direct and indirect effect on dental health through toothbrushing willingness and diet. Tooth brushing was identified as the main mediator. This finding has important implications, as it suggests that interventions designed to modify brushing behavior and establish caregiver-supported routines may reduce oral health disparities among children with ASD, even in the presence of ASD symptoms.

A Saudi Arabian study provides additional support for this hypothesis. Parental monitoring of children's tooth brushing was positively associated with plaque scores, gingival disease index, and caries experience in primary teeth. Positive parental attitude was negatively associated with high-sugar diet, and higher parental comfort in giving oral care showed an inverse association with plaque score and gingival index. [1]

The findings show that brushing teeth among children with ASD at home was typically completed by another person and can be considered an externally regulated behavior rather than an independent self-care routine. Tooth brushing might be challenging for children with ASD because of sensory avoidance, low compliance, decreased manual dexterity, expressive/receptive language deficits, and lack of flexibility or change in routines. [2,5,8,11,18] Tooth brushing often requires assistance from caregivers, whether it be physical help, oversight, prompts, or behavioral management, at least once per day. Caregiver assistance does not always equal proper oral hygiene practices if ASD-specific recommendations are not provided to families. Traditional methods, such as brushing twice a day, might not be effective when children gag, bite, exhibit refusal behaviors, are intolerant to toothpaste flavors, and have short attention spans. Oral health promotion among children with ASD should involve caregiver-based interventions such as desensitization, visual schedules, modeling, positive reinforcement, toothbrush/toothpaste modifications, and routine development. [27,28,35] This study highlights the need for improved oral hygiene in children with ASD. Prevention strategies should focus on individualized recommendations that are behaviorally adapted and family centered. Intervention studies are needed to determine whether behavioral training among caregivers can help increase brushing frequency, reduce plaque accumulation and gingival inflammation, and boost caregiver self-assurance.

Mealtime behaviors represent a second caregiver-mediated exposure pathway that may place children with ASD at risk for oral diseases. Food selectivity, preference for soft or sweet foods, restrictive eating behaviors, and strong food neophobia may lead to greater exposure to cariogenic foods and poor dietary variety. [4,12,23] Mealtime issues may make dietary control challenging for caregivers when children exhibit strong preferences for certain foods that may be secondary to sensory sensitivity, behavioral rigidity, or the need for behavioral/emotional control. These data highlight the importance of not viewing dietary risk among children with ASD as purely sugar-focused; rather, they should be viewed within the broad context of feeding behaviors, sensory preferences, family routines, parental stressors, and child noncompliance with dietary changes. [4,12] Caregivers may benefit from tailored recommendations to limit their child's exposure to cariogenic foods and drinks while providing acceptable, nutritionally adequate alternatives. Incorporating dietary counselling into behavioral interventions should involve anticipatory guidance for

caregivers and referral to nutritionists, pediatricians, behaviorists, or occupational therapists as needed. Slow changes to diet using reinforcement-based techniques and individualized, family-centered feeding programs may prove more attainable than recommending caregivers to limit sugar-containing foods and drinks.

Dental access was identified as a primary caregiver-mediated and system-level barrier to child's oral health. [5,9,17,26,36] Caregiver willingness to obtain dental care may not result in attendance if the child's sensory sensitivity, communication ability, dental anxiety, behavioral dysregulation, and/or past negative dental experiences act as barriers to care. This can result in families waiting until a perceived emergency before seeking care. The results also highlight that access is dependent on the dental system's readiness to care for children with ASD. Provider training, clinic environmental adaptations for children with ASD, lengthy appointments, sensory challenges, communication accommodations, and availability of special-care appointment pathways may impact the utilization of preventive dental services. [25,28,35] Children with ASD may be less likely to receive preventive dental interventions and early prevention services, such as fluoride varnish, fissure sealants, professional prophylaxis, dietary counseling, and regular recall visits. Ensuring dental access for children with ASD will require caregiver support and system-level changes. Dental teams can improve access by providing flexible hours, pre-visit familiarization appointments, short appointments, visual support, sensory-adapted environments, caregiver participation in visits, and training dental staff in ASD-sensitive communication and behavior guidance techniques. [25,28,35] Future research should explore whether the establishment of ASD-friendly dental care pathways increases attendance to preventive visits, completion of treatment plans, caregiver satisfaction, and oral health outcomes.

The findings demonstrate that oral health problems in youth with ASD have the potential to negatively affect both the child and the family. Oral pain related to untreated gingival inflammation, bruxism/oral trauma, halitosis, inability to eat, or distress related to tooth brushing or dental visits may negatively affect daily functioning and increase parental distress. Negative oral health experiences may also evoke emotional reactions from caregivers after repeated failed attempts to establish good oral hygiene habits or find appropriate dental care for their children. Family impact can be viewed as an interpretable outcome for assessing oral health in ASD research. Although clinical markers of oral disease (that is, DMFT, plaque scores, and gingival indices) are important factors to assess when considering oral health, they may not be sensitive enough to detect the impact of oral health problems on daily functioning, parental effort, family routines, or quality of life. Instruments measuring oral-health-related quality of life, caregiver burden, parental stress, and treatment burden may allow researchers to gain further insight into the total impact of oral disease on youth with ASD and their families. [3,10,13,31,32,33,34] ASD oral health researchers are encouraged to include caregivers and family reported outcomes in addition to child-level outcomes in future studies. Doing so can help researchers determine which oral health problems are most burdensome for families and which caregiver-centered interventions are most likely to improve clinical outcomes. [3,31,32,33,34]

Previously published systematic reviews have synthesized oral health status, barriers to dental care, and general management strategies for children with ASD. [25,26,28,32,35] This review is unique in that it focuses on caregiver-mediated determinants of oral health specifically, rather than clinical outcomes at large. Of the evidence presented in the included studies, inconsistent caries prevalence in children with ASD across settings has been reported. In both developed and developing country settings, some studies found increased caries experience and treatment needs, while others showed decreased caries levels compared with control participants. [9,11,14,15,21-24,37] In contrast, poor plaque control, gingival inflammation, tooth brushing difficulty, deleterious oral habits, and dental access barriers have been more consistently reported. [1,2,8,9,11,14,15,18,23,24] Differences in diet, parental supervision and involvement with dental access, fluoride exposure, study setting, ASD severity and socioeconomic background, and study methodology may account for some inconsistencies among studies in caries experience. A caregiver-mediated framework may be useful in understanding these differences, as oral health outcomes are dependent not only on ASD diagnosis but also on day-to-day practices supported by caregivers and access to appropriate dental care.

These findings have multiple clinical implications that pediatric dentists, special care dentists, public health professionals, and caregivers should consider. First, caregiver-mediated factors should be assessed during the examination. How frequently are oral health habits evaluated by asking? Who brushes your child's teeth? How frequently are teeth brushed? Does your child refuse to brush? Which flavors does your child tolerate? Does your child need assistance with brushing their teeth? What strategies have you attempted? Second, oral health instructions should be tailored. Children with ASD may need recommendations for brushing modifications, sensory tools and aids, visual support, social stories, systematic desensitization, and positive reinforcement. Third, emphasis should be placed on prevention strategies. Children with ASD who have difficulty brushing should be recalled more frequently for cleaning and preventative services. [25,35] During recall visits, fluoride varnish, fissure sealants, dietary counseling, and caregiver instructions can be provided. Fourth, communication with caregivers is essential. [25,27,28,35] Dental teams should be mindful that parents may be overwhelmed by the numerous therapeutic, educational, behavioral, and medical demands of raising a child with ASD. Advice regarding oral health should be feasible, and families should not be stressed because of perceived poor dental habits. Finally, an ASD-friendly model of care should be adopted. Dental offices can create "special-needs-friendly" pathways of care by providing pre-appointment questionnaires, quiet waiting rooms, avoidance of sensory overload, consistent routines, and staff trained in behavioral management. This review identified several research gaps in the literature. Direct evidence linking caregiver burden or parental stress to oral health outcomes remains limited. [3,5,10,31-34] Many studies describe caregiver assistance, parental perception, or access barriers, but few use validated caregiver burden or parental stress instruments.

Future studies should examine the following:

1. The association between caregiver burden and child oral health outcomes.
2. The role of parental stress in tooth brushing frequency and quality.
3. Caregiver self-efficacy as a predictor of preventive dental behavior.
4. Longitudinal pathways between ASD severity, caregiver practices, diet, dental access, and oral health outcomes.

5. Intervention studies testing caregiver-centered oral health training.
6. Father-specific and family system perspectives.
7. Preventive dental utilization outcomes, such as fluoride varnish, sealants, recall adherence, and early dental visits.
8. Regional and health-system differences, especially in low- and middle-income countries, should be considered.

Informed by the mapped evidence, we developed the following caregiver-mediated conceptual framework for oral health in children with ASD. ASD-related characteristics related to ASD such as sensory sensitivity, difficulty communicating, behavioral rigidity, food selectivity, limited cooperation, and decreased manual dexterity, may impact caregiver-related factors such as knowledge, attitudes, comfort level, stress, burden, self-efficacy, time constraints, and dental need perception. [2,4,5,8,9,11,12,18] Caregiver-related factors may impact caregiver-mediated practices such as assisted tooth brushing, dietary consistency, scheduling of dental appointments, receipt of preventive care, and communication with the dental team. Health system factors, such as the training and education of providers, adaptation of the clinic environment, insurance coverage or cost concerns, availability of special care services, and rural versus urban locations, may also impact caregiver-mediated practices. [9,25-28,35,36] These factors ultimately impact oral health outcomes such as plaque scores, gingivitis, caries, oral trauma and injury, bruxism-related pathology, untreated treatment needs, and oral hygiene status, which may influence child and family outcomes, including pain, eating distress, poor oral health-related quality of life, caregiver burden, and family disruption. [1,2,8,11,14,15,21-24,37] The conceptual framework is displayed in Figure 2.

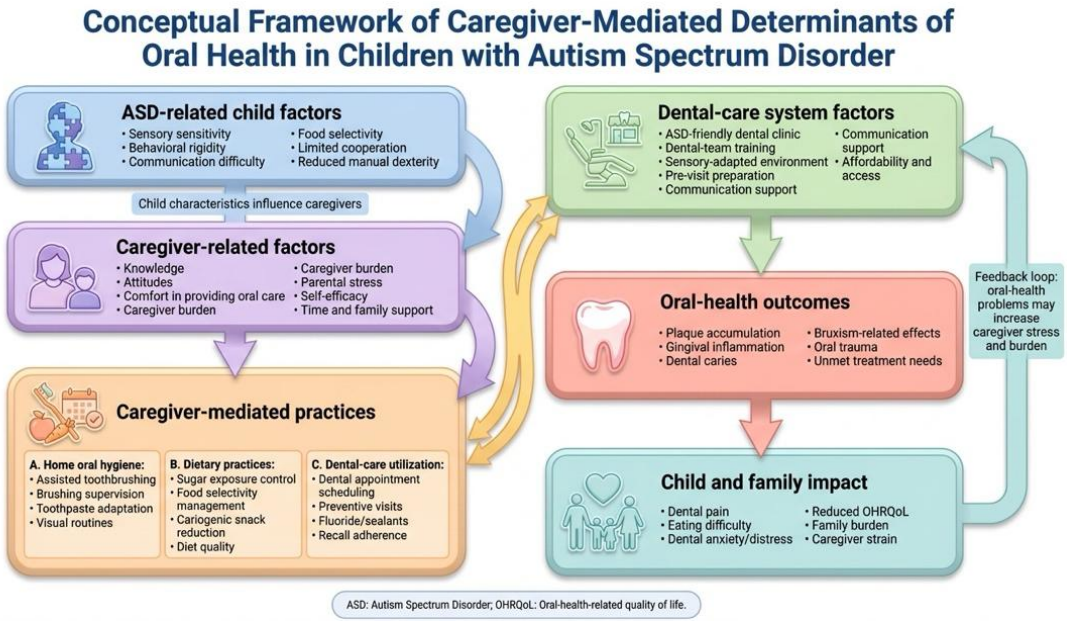

Figure 2. Conceptual Framework of Caregiver-Mediated Determinants of Oral Health in Children with Autism Spectrum Disorder. Conceptual framework illustrating the proposed pathways through which ASD-related child factors, caregiver-related factors, caregiver-mediated practices, and dental care system factors interact to influence oral health outcomes and child–family impact. The framework highlights how sensory sensitivity, behavioral rigidity, communication difficulty, food selectivity, and limited cooperation may affect the caregiver burden, parental stress, knowledge, comfort, and self-efficacy. These caregiver-related determinants may influence assisted tooth brushing, dietary control, dental attendance, preventive care utilization, and ultimately oral health outcomes and quality of life.

The strengths of this review include its narrow focus on the knowledge gap within ASD oral health, attention to caregiver-mediated pathways, and inclusion of evidence related to home hygiene and dietary habits, access to dental care/utilization, parental attitudes about ASD and oral

health, and family impact/caregiver burden. Additionally, this scoping review design allowed us to map heterogeneous evidence and identify research gaps. The limitations of this review include the following: the use of cross-sectional studies precludes causal interpretation; many articles used parent-reported measures, which could be biased due to recall or reporting bias; the heterogeneity of the included studies did not allow us to consistently report on ASD severity, sensory profile, intellectual disability, and level of functioning; the included studies varied in oral health indices and caregiver measures used, the ages of children studied, and the settings in which the studies took place; and few studies used direct measures of caregiver burden or parental stress in relation to oral health outcomes, limiting our ability to draw conclusions about this association. Because this review was designed as a scoping review, it aimed to map the breadth and nature of the evidence rather than determine intervention effectiveness, establish causality, or produce pooled estimates. Therefore, the proposed framework should be interpreted as an evidence-informed conceptual model rather than a causal pathway.

The literature review supports that caregiver-mediated factors influence the oral health of children with ASD. Dental brushing ability, dietary restriction, dental care access, parental attitude, caregiver discomfort, and family impact are all related to oral health outcomes. Clinical outcome measures, including caries, plaque, and gingivitis, may still be useful but should be contextualized within family centered and health-system outcomes. Directions for ASD-specific oral health care should shift from reporting disease prevalence to planning caregiver-centered behavioral modifications and prevention-based care.

5. Conclusion

This scoping review indicates that caregiver-mediated factors are frequently reported in relation to oral health in children with ASD, including assisted tooth brushing, dietary practices, dental access, parental attitudes, caregiver comfort, and family impact. These findings support the need for family-centered prevention-focused research and care models. However, because most evidence is descriptive or cross-sectional, future longitudinal and intervention-based studies are needed to clarify the causal pathways and evaluate caregiver-centered strategies.

Abbreviation	Full Form
ASD	Autism Spectrum Disorder
PCC	Population–Concept–Context
PRISMA - Scr	Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews
dmft	Decayed, Missing, and Filled Teeth index for primary dentition
GI	Gingival Index
PI	Plaque Index
EQ-5D-Y	EuroQol Five-Dimension Youth questionnaire
OHRQoL	Oral Health-Related Quality of Life
KAP	Knowledge, Attitudes, and Practices

Declarations:

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