WHAT FACTORS CONTRIBUTE TO POOR ORAL HEALTH OUTCOMES FOR INDIVIDUALS WITH THE DEVELOPMENTAL DISABILITIES AUTISM SPECTRUM DISORDER, CEREBRAL PALSY, AND DOWN SYNDROME IN THE UNITED STATES: A LITERATURE REVIEW

University of Georgia

Dr. Proctor

Emma Nodine

22 April 2025

TABLE OF CONTENTS

RESEARCH QUESTION

What factors contribute to elevated rates of poor oral health outcomes for individuals with the developmental disabilities Cerebral Palsy, Autism Spectrum Disorder, and Down Syndrome in the United States?

INTRODUCTION

Oral health is a fundamental component of overall health and well-being. Good oral hygiene and regular dental care are essential for preventing common oral health problems such as dental caries (cavities), gum disease (periodontal disease), and halitosis (bad breath), which can lead to more serious complications such as infections that spread to other parts of the body. Poor oral health impacts a variety of health issues, including cardiovascular disease, diabetes, respiratory conditions, and overall quality of life contributing to pain, discomfort, and difficulties with social interactions (NIDCR, 2023). Poor oral health is associated with varied risk factors such as poor diet, lack of access to dental care, and inadequate oral hygiene practices. In the general U.S. population, nearly 26% of adults have untreated dental caries, and 46% of adults over 30 show signs of gum disease (CDC, 2024c). Among individuals with developmental disabilities, the prevalence is significantly higher. For instance, studies show that children with Autism Spectrum Disorder (ASD) are twice as likely to have unmet dental needs compared to neurotypical peers, and individuals with CP and DS have a higher incidence of caries, gingivitis, and plaque accumulation due to motor and developmental impairments (Sami et al., 2024).

Proper dental care and hygiene are essential for maintaining good health; however, individuals with developmental disabilities often encounter significant challenges in this area. Developmental disabilities are a group of conditions caused by a variety of factors, resulting in impairments in physical, learning, language, or behavioral abilities (CDC, 2024b). These

disabilities can arise in individuals of any racial, ethnic, or socioeconomic group from genetic factors, complications during pregnancy, birth-related issues, or early-life exposures, and they typically manifest before or during early childhood development (CDC, 2024b).

Among the most common developmental disabilities in the United States are Cerebral Palsy, Autism Spectrum Disorder, and Down Syndrome. Autism Spectrum Disorder (ASD) is a developmental disorder that affects individuals' communication, behavior, and social interaction due to the wide range of symptoms and severities (CDC, 2024a). Cerebral Palsy (CP) is a group of neurological disorders that affect movement, muscle coordination, and posture, often resulting from brain injury or abnormal brain development, and it can range in severity from mild motor impairments to severe physical disabilities (CDC, 2024b). Down syndrome (DS) is a genetic disorder caused by the presence of an extra copy of chromosome 21, leading to developmental and speech delays, characteristic physical features, varying degrees of intellectual disability, and other symptomatic health issues (CDC, 2023). Approximately 1 in 6 children in the U.S. has a developmental disability, with ADHD affecting about 1 in 10 children, ASD affecting 1 in 36 children, CP affecting 1 in 345 children, and DS affecting 1 in 1,484 individuals (CDC, 2024a; Johnson et al., 2007). Trends in the prevalence of developmental disabilities have shifted over time, due to increasing recognition of the conditions thus increased rates of diagnosis, although the causes of the increases in conditions are complex (CDC, 2024b). Despite advancements in healthcare, individuals with developmental disabilities face persistent disparities in oral health outcomes compared to individuals without the conditions.

A primary concern regarding the overall health of individuals with developmental disabilities is the common prevalence of elevated rates of poor oral health outcomes, which can negatively impact systemic health (Sami et al., 2024). Individuals with ASD, CP, and DS face

unique challenges that complicate or inhibit their ability to maintain proper oral hygiene and access dental care, and they have significantly higher rates of dental caries, periodontal disease, and other oral health complications compared to individuals without developmental disabilities (Sami et al., 2024). Research indicates that dental caries affect approximately 89.4% to 95.5% of individuals with CP (Fernández et al., 2021). Over 90% of individuals with Down syndrome experience periodontitis, often with early onset and rapid progression (Pecci-Lloret et al., 2022). Additionally, children with ASD are more likely to experience unmet dental needs and have a caries prevalence of 60%, compared to 35% in typically developing children (Sami et al., 2024). Poor oral hygiene and dental implications can lead to systemic conditions, such as heart disease, diabetes, and respiratory infections, as bacteria from the mouth can enter the bloodstream and affect other parts of the body (ADA, 2024). In instances of extreme poor oral health, cases such as untreated periodontal disease can allow bacteria to enter the bloodstream, contributing to serious issues such as heart disease, stroke, or infections in other organs. Additionally, severe oral infections, such as abscesses, can become systemic and lead to sepsis, a life-threatening response to infection (ADA, 2024).

The elevated rates of poor oral health outcomes for individuals with the developmental disabilities ASD, CP, and DS are driven by a complex combination of physical, developmental, and behavioral factors. Although existing research has explored these factors individually, there remains a gap in comprehensive, comparative studies examining how these unique challenges manifest across different developmental disabilities (Sami et al., 2024). This literature review aims to fill these gaps by examining current research on the oral health disparities faced by individuals of all ages, races, and sexes in the United States who are living with developmental disabilities such as Cerebral Palsy, Autism Spectrum Disorder, and Down Syndrome. By evaluating the

variety of physical, developmental, behavioral, and systemic disparities of individuals with ASD, DS, or CP, this review seeks to provide a deeper understanding of the factors contributing to the elevated rates of poor oral health outcomes to improve future dental care for individuals with developmental disabilities.

METHODS

For this literature review, a comprehensive search was conducted across the databases PubMed and UGA Libraries. The first database used, PubMed, is a comprehensive online resource focused on medical sciences and healthcare information. It exclusively includes peer-reviewed sources, ensuring that the journal articles retrieved are reliable and trustworthy, making PubMed a valuable tool for researchers seeking credible medical literature. The second database used was The University of Georgia (UGA) Libraries. The UGA Libraries is a comprehensive academic resource for UGA students, providing access to a wide range of scholarly materials including peer-reviewed journal articles, books, and online resources. Through the database's multi-search tool, UGA Libraries searches through approximately 733 GALILEO databases. GALILEO, Georgia Library Learning Online, is a virtual library service to provide access to a variety of resources, including peer-reviewed journals, ensuring that the provided resources are credible. These databases were selected for their broad access to peer-reviewed, academic, and relevant sources including research within the field of dental health and developmental disabilities.

The first database utilized was PubMed, a large health database with a focus on medical sciences and peer-reviewed articles. The first search was very broad, using the search terms "Oral health barriers disabilities" with a search filter of peer-review and publication within the past ten years. This search yielded 195 results, and most of the results were not relevant, as they were either conducted in countries other than the United States or were systematic reviews. The search

approach was then changed to be more comprehensive of the topics of interest, including the terms (((((Autis*) OR (Cerebral Palsy) OR (Down* Syndrome)) AND ((Dental) OR (Oral))) AND ((Challenge) OR (Difficult*))) AND (United States)) NOT (Review). An asterisk was used to assist in the cohesive search of interchangeable terms, as "Autis*" was used to account for Autism and Autistic, "Down*" was used to account for Down Syndrome and Down's Syndrome, and "Difficult*" was used to account for difficulties and difficulty. This search was also conducted with a filter of the past ten years, and it yielded 56 results. Out of these results, 11 articles were selected for further analysis through their relevance to the research question. Articles were selected for inclusion in the study if they met the geographical constraints and provided further insight into the challenges faced by individuals with ASD, DS, and CP in receiving and maintaining oral care. The titles and abstracts of the 56 resulting articles were first analyzed for relevance to the research question. Articles that did not meet the inclusion criteria yet were not excluded by the search terms, such as those conducted outside the U.S. or lacking a specific focus on ASD, DS, or CP but had similar terms that aligned with the search criteria, were excluded. From this initial selection process, 24 articles were selected for further review of the full article. The methodology and findings of each article were then analyzed for relevancy to the research topic, and 11 were ultimately chosen based on their direct relevance to the research question and their representation of the three developmental conditions, with an effort made to include a balanced mix of studies across ASD, DS, and CP populations. There was also an intention to include an approximately equal distribution of each of the three conditions in the article selection process.

A similar search was then conducted in UGA Libraries, which offers a broad range of academic resources, including journals and peer-reviewed articles, across a wider variety of disciplines. The search terms were aligned with those used in PubMed, using the search terms

(((((Autis*) OR (Cerebral Palsy) OR (Down* Syndrome)) AND ((Dental) OR (Oral))) AND ((Challenge) OR (Difficult*))) AND (United States)) NOT (Review). This search was filtered to only produce peer-reviewed articles published within the past ten years, which produced 185 results. Many of the articles provided were conducted in regions beyond the geographical scope of the study despite the use of the term "United States", so the search terms "NOT ((Asia) OR (Europe) OR (South America) OR (Africa))" were added to filter out these articles. The final search terms included (((((Autis*) OR (Cerebral Palsy) OR (Down* Syndrome)) AND ((Dental) OR (Oral))) AND ((Challenge) OR (Difficult*))) AND (United States)) NOT (Review) NOT ((Asia) OR (Europe) OR (South America) OR (Africa)). This search produced 55 results, from which nine were selected. These articles were evaluated for their relevance to the research topic, focusing on studies related to dental care management and unique challenges faced by individuals with the developmental disabilities ASD, DS, or CP. UGA Libraries draws from a variety of sources, such as EBSCO, PubMed, and other specialized databases, enhancing the comprehensiveness of the search results which required more sorting and evaluation of each article produced as a result. Out of these 55 results produced by the search terms and criteria, nine articles were selected for further analysis based on their relevance to the research question. The titles and abstracts of the 55 resulting articles were initially reviewed to assess whether they addressed oral health challenges specific to individuals with ASD, DS, or CP in the United States. Articles that did not meet the inclusion criteria, such as those conducted in excluded geographical regions or those focusing on general disability populations without specific mention of the target oral health conditions, were removed. From this initial screening, 21 articles were selected for further full-text review. Each article was then evaluated in greater detail by analyzing the methodology, results, and the extent to which the findings addressed the research question. Ultimately, nine articles were

selected that provided insight into the oral health disparities experienced by individuals with ASD, DS, and CP. A similar process to the PubMed selection was used to include balanced studies across all three developmental disabilities.

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria were carefully defined to ensure that only the most relevant and applicable studies were produced as results and considered for the study. Inclusion criteria required that articles focus on individuals in the United States with ASD, CP, or DS and address topics related to oral health care or treatment. The articles had to be published within the last 10 years, peer-reviewed, and provide free full-text access. Exclusion criteria eliminated review articles, non-peer-reviewed sources, and studies published outside the designated time frame or geographical scope of the United States. Furthermore, articles not directly addressing the oral health challenges or treatments for individuals with ASD, CP, or DS were excluded. Through this careful selection process, a final set of 20 articles was selected from PubMed and UGA Libraries, providing a comprehensive overview of the barriers, challenges, and treatment options for improving oral health outcomes in individuals with ASD, CP, and DS.

RESULTS

The elevated rates of poor oral health outcomes in individuals with developmental disabilities such as Cerebral Palsy (CP), Autism Spectrum Disorder (ASD), and Down Syndrome (DS) have a complexity of causes, involving a combination of physical, developmental, behavioral, and systemic factors. This literature review aims to explore the various disparities these individuals face in receiving proper dental care, focusing on how these challenges contribute to the increased prevalence of oral health issues. Through examining current research across a broad

spectrum of factors including mobility limitations, communication barriers, sensory sensitivities, and the impact of socioeconomic and systemic health disparities, this review aims to provide a deeper understanding of the unique needs to be addressed of individuals with CP, ASD, and DS.

Developmental Challenges

Individuals with developmental disabilities experience common oral health issues such as halitosis, bruxism, malocclusion, and periodontal disease, increasing their risk for severe dental complications. Bruxism, or involuntary teeth grinding, affects approximately 58% of children with DS, leading to enamel wear and temporomandibular joint (TMJ) dysfunction (Duker et al., 2020). Malocclusion is also a significant concern for individuals with DS and CP with 95% of individuals with CP exhibiting some form of misalignment, contributing to difficulty chewing, swallowing, and maintaining oral hygiene (Martínez-Mihi et al., 2022). These conditions contribute to heightened vulnerability to periodontal disease in aging individuals with DS and CP, who exhibit significantly higher Calculus Index, Plaque Index, and Gingival Index scores compared to younger individuals of the same conditions (Goud et al., 2021).

Other developmental challenges in individuals with ASD, DS, and CP include orofacial dysfunctions, such as open mouth posture and visceral swallowing, which complicate oral hygiene maintenance and increase susceptibility to dental caries and infections (Wriedt et al., 2024; Yusuf et al., 2020). Additionally, dysphagia, or difficulty swallowing, exacerbates oral health issues by impeding proper food clearance, leading to food impaction and plaque buildup, further increasing the risk of caries and periodontal disease (Majstorovic et al., 2023; Ronis et al., 2023). Malocclusions, including frontal open bite and frontal crossbite, are also common in this population, significantly impairing chewing, speech, and oral hygiene (Wriedt et al., 2024). Damaging oral habits, such as teeth grinding, clenching, food pouching, mouth breathing, and

tongue thrusting, are common in individuals with developmental disabilities and contribute to the increased prevalence of oral health issues. These disabilities often result in oral malformations, including enamel defects and variations in the number, size, and shape of teeth. These developmental factors, in addition to food selectivity and oral defensiveness, complicate the maintenance of proper oral hygiene for individuals with ASD, DS, and CP, contributing to poor overall oral health outcomes (Frank et al., 2019). Furthermore, gingival bleeding and periodontal disease are more frequent in older individuals with DS, emphasizing the need for lifelong preventative dental care (Wriedt et al., 2024).

Physical and Lifestyle Challenges

Mobility limitations significantly impact the ability of children with ASD, CP, and DS to maintain proper oral hygiene and receive professional dental care. For example, children with CP often struggle with poor motor control, limiting their ability to effectively use a toothbrush, leading to plaque accumulation and periodontal disease (Nelson et al., 2021). Additionally, approximately 48% of children with DS experience temporomandibular joint dysfunction (TMJ), limiting their ability to fully open their mouths during cleanings and treatments (Duker et al., 2020). Similarly, individuals with CP also experience jaw misalignment and muscle dysfunction, worsening their dental complications and restricting their ability to maintain adequate oral care (Martínez-Mihi et al., 2022). These challenges are worsened by difficulties in reclining in dental chairs and tolerating dental instruments, particularly among individuals with sensory over-responsivity (SOR) (Duker et al., 2021).

Communication difficulties further present significant barriers to receiving proper dental care for individuals with ASD, DS, and CP. Many children with DS face challenges with verbal expression in dental care, with only 32% using full sentences and 14% relying on nonverbal

gestures (Duker et al., 2020). Similarly, children with ASD frequently exhibit communication impairments, making it difficult for them to express pain or discomfort (Nagda et al., 2024). These limitations make it difficult for patients with ASD and DS to convey pain or discomfort, leading to delayed or improper treatment. Caregivers often rely on behavioral cues rather than direct verbal communication to assess dental issues, increasing the risk of undiagnosed and untreated conditions (Como et al., 2022).

Behavioral Challenges

Sensory sensitivities and dental anxiety are also major challenges for children with ASD, CP, and DS in maintaining oral hygiene and receiving oral health care. Many individuals with ASD and DS experience heightened sensory aversions, or sensory over-responsivity (SOR), to lights, sounds, and oral stimuli, increasing stress and complications in routine dental care (Duker et al., 2023; Duker et al., 2021). Many parents reported in studies that their children with ASD could not tolerate traditional toothbrushing due to oral aversion and sensory sensitivities, leading to inconsistent or avoided at-home hygiene. For example, one parent stated that they were completely unable to get into their child's mouth for the first several years of her life, demonstrating how extreme oral sensitivity and communication difficulties can severely limit basic oral care and contribute to increased caries risk (Lewis et al., 2015).

Behavioral resistance is another significant factor leading to poor oral health outcomes in these populations. Approximately 47% of individuals with ASD refused to allow parents to brush their teeth, compared to only 7% of peers without ASD (Nagda et al., 2024). Additionally, extreme dental anxiety frequently results in incomplete or avoided treatments, with some caregivers resorting to physical restraint or sedation to complete routine dental care (Lee & Chang, 2021). Dental professionals also report high rates of treatment refusal among patients with CP and ASD

due to behavioral resistance and difficulty maintaining oral positioning during procedures (Michelogiannakis et al., 2018). Sensory issues also impact at-home oral hygiene routines, with autistic children displaying aversions to toothpaste flavors, bristle textures, and the sensation of brushing, leading to inadequate daily care. As a result, 70% of autistic children were classified as high risk for dental caries, compared to only 40% of their non-autistic peers (Floríndez et al., 2022; Stein Duker et al., 2019).

Systemic Disparities and Barriers to Dental Care

Significant systemic disparities hinder access to adequate dental care for individuals with ASD, CP, and DS. Financial barriers, insurance limitations, and a lack of trained providers contribute to worsening oral health outcomes. Low-income status, lack of private insurance, and lower parental education levels are key risk factors, with children from households at 0–99% of the federal poverty level experiencing the highest risk of oral health problems (Yusuf et al., 2020). Many families struggle to afford specialized dental care, even with insurance coverage, due to the high cost of sedation, behavioral accommodations, and travel expenses (Como et al., 2022). For example, 47% of ASD families report traveling over 20 miles for dental care, compared to only 13% of typically developing peers, with 23.3% traveling over 50 miles (Nagda et al., 2024).

Oral health disparities within the population of individuals with ASD, CP, and DS in the United States are further compounded by racial and cultural factors in receiving care. African American caregivers of children with ASD frequently report mistrust and dissatisfaction in their interactions with dental professionals, leading to further reduction in access to care (Como et al., 2022). Latinx families face additional challenges, including language barriers, financial difficulties, limited oral health knowledge, and limited access to culturally appropriate oral health education (Floríndez et al., 2021). Additionally, Latinx caregivers exhibited knowledge gaps

regarding the role of cariogenic foods — foods that contribute to tooth decay— and oral bacteria in tooth decay, emphasizing a need for culturally responsive oral health education programs throughout the target population (Floríndez et al., 2022).

A shortage of trained dental professionals and limited access to dental providers trained to work with patients with developmental disabilities further exacerbates access issues. For example, only 11% of pediatric dentists in California accept Medicaid, significantly limiting options for lower-income families (Nagda et al., 2024). Parents of children with ASD, CP, and DS additionally often report discrimination based on insurance status, with those on state-sponsored Medicaid receiving lower-quality care or outright provider refusals (Como et al., 2022). Approximately 80% of parents of children with DS report difficulty finding a dentist willing to treat their child and 61% state that their child had been refused care due to behavioral difficulties or the provider's lack of training (Duker et al., 2020). Additionally, many families traveled over 20 miles to access a qualified dental provider, placing additional financial and logistical burdens on caregivers (Nagda et al., 2024). The lack of a medical home model for dental care and limited interdisciplinary collaboration between dentists, physicians, and behavioral specialists are other common disparities in finding and receiving adequate preventive treatment (Fenning et al., 2020).

These findings highlight the disproportionate barriers individuals with ASD, DS, and CP face in maintaining oral hygiene and receiving proper dental care. Physical limitations, sensory sensitivities, communication difficulties, and behavioral resistance contribute to increased caries risk and periodontal disease. Additionally, systemic disparities, including financial barriers, insurance limitations, and a shortage of trained providers, further worsen poor oral health outcomes.

DISCUSSION

This review aims to provide a comprehensive understanding of the factors contributing to elevated rates of poor oral health outcomes in individuals with Cerebral Palsy (CP), Autism Spectrum Disorder (ASD), and Down Syndrome (DS) in the United States. A combination of developmental, physical, behavioral, and systemic disparities prevents individuals with these disabilities from receiving adequate dental care, resulting in a higher prevalence of dental caries, periodontal disease, and other oral health complications. Barriers such as impaired motor control, communication challenges, sensory sensitivities, and financial limitations significantly impact the ability of individuals with CP, ASD, and DS to maintain proper oral hygiene and access professional dental services.

The findings of this study indicate that targeted interventions, including sensory-adapted dental environments, specialized oral hygiene tools, and enhanced training programs for dental professionals, could be developed to improve treatment outcomes and accessibility for these populations. These findings align with existing literature, concluding that individuals with CP benefit from adaptive dental equipment and assisted oral hygiene techniques, while those with ASD and DS respond well to behavioral interventions, visual supports, and anxiety-reducing strategies (Lansdown et al., 2022; Martínez Pérez et al., 2023). For example, sensory-adapted dental environments (SADEs) have been associated with reduced physiological distress, including lower heart rate and cortisol levels, and improved behavioral cooperation in children with ASD and DS (Martínez Pérez et al., 2023). Adaptive dental tools such as modified toothbrushes and stabilization devices improve at-home hygiene for individuals with CP who have limited motor function (Lansdown et al., 2022). Behavioral interventions such as visual diagrams and desensitization protocols have resulted in increased treatment compliance and reduced anxiety in

dental settings for individuals with ASD (Martínez Pérez et al., 2023). Similarly, Social Story interventions, which use visual narratives to teach and reinforce oral hygiene routines, have also been shown to significantly improve toothbrushing skills and compliance in children with ASD and other special-care needs (Zhou et al., 2020). These interventions not only enhance the immediate dental experience but also promote long-term oral health maintenance by increasing comfort and reducing avoidance behaviors to improve long-term patient compliance.

Additionally, expanding Medicaid coverage, increasing provider competency in treating special-needs patients, and addressing racial and socioeconomic disparities in dental care access are critical to mitigating oral health inequities (Patrick et al., 2006). This study further aligns with previous research highlighting the importance of multidisciplinary approaches in addressing oral health disparities among individuals with developmental disabilities (Seirawan et al., 2008). By implementing evidence-based solutions and policy reforms from existing literature, dental professionals and healthcare providers can significantly enhance oral health outcomes and overall well-being for individuals with CP, ASD, and DS.

Limitations

This literature review synthesized findings from twenty articles examining factors contributing to poor oral health outcomes among individuals with Autism Spectrum Disorder (ASD), Cerebral Palsy (CP), and Down Syndrome (DS). While the studies were recent, the selection process limited possible articles to those published in the past ten years, which may have excluded current research awaiting publication and relevant modern research just beyond the window of focus, potentially limiting the breadth of available evidence. Additionally, multiple studies had small sample sizes and specific demographic characteristics, such as a predominance of certain age or ethnic groups, which could hinder the generalizability of the findings to the greater

population of individuals with ASD, CP, and DS throughout the United States. Several articles utilized cross-sectional methods, which do not allow for the conclusion of causal inferences regarding the effectiveness of interventions. The reliance of some studies on self-reported data could also raise concerns about potential biases, impacting the validity of the results. This study is further limited by its geographic scope, as it only includes research from the United States within the past ten years, potentially excluding relevant global studies on oral health in individuals with developmental disabilities. Furthermore, the lack of racial and ethnic diversity in some study samples may not accurately reflect disparities experienced by minority populations, further limiting generalizability.

Future Research

Future studies should prioritize longitudinal research to assess the long-term effectiveness of sensory-adapted environments and other anxiety management methods in dental care. Additional research is also needed on culturally competent care to address racial disparities in access to dental care for individuals with developmental disabilities, particularly ASD, CP, and DS. Interventions to improve the accessibility of dental care and oral health knowledge could be studied through investigating the role of telehealth and virtual dental consultations. Additionally, research should focus on developing and testing training programs for dental professionals to enhance communication strategies and behavioral management techniques to improve patient care for individuals with ASD, CP, and DS. Evaluating the outcomes of community-based oral health initiatives may also offer insight into practical solutions that promote accessible and inclusive care.

Future Practice

In the future of the practice of oral health care, dental professionals should receive specialized training in treating patients with developmental disabilities, including behavioral management techniques and communication strategies. General and specialty care dental clinics should implement sensory-friendly adaptation options, such as dim lighting and noise reduction, to improve patient experiences for individuals with ASD, DS, and CP to ensure their ability to receive comfortable and effective dental care.

Future Policy

Policy changes should address racial disparities, increase provider training, and expand Medicaid reimbursement for specialized dental care. Mandating disability competency training in dental education, increasing funding for special-needs dental clinics, and implementing culturally competent programs can reduce access to care barriers and improve overall oral health outcomes for individuals with developmental disabilities, including those with ASD, CP, and DS.

CONCLUSION

Individuals with Cerebral Palsy (CP), Autism Spectrum Disorder (ASD), and Down Syndrome (DS) face unique oral health challenges due to impaired motor function, sensory sensitivities, and communication barriers. These conditions contribute to higher rates of dental caries and periodontal disease, compounded by financial and systemic obstacles that limit access to specialized care.

Sensory-adapted environments, behavioral interventions, and adaptive dental equipment can improve oral health outcomes for individuals with ASD, CP, and DS. Expanding Medicaid

coverage, increasing disability competency training for dental professionals, and integrating telehealth options could further enhance accessibility and treatment efficacy.

Addressing these disparities through specialized care and policy reforms is essential to ensuring equitable dental treatment for individuals with developmental disabilities. By implementing tailored solutions, healthcare providers and policymakers can significantly improve the oral health and overall well-being of individuals with ASD, CP, and DS in the United States.

REFERENCES

ADA. (2024). *Oral-Systemic Health*. Retrieved 15 September from https://www.ada.org/resources/ada-library/oral-health-topics/oral-systemic-health

CDC. (2023). *Living With Down Syndrome* Centers for Disease Control and Prevention.

CDC. (2024a, May 15, 2024). *Autism data and statistics*. https://www.cdc.gov/autism/data-research/index.html

CDC. (2024b, May 15, 2024). *Developmental disability basics*. Centers for Disease Control and Prevention. https://www.cdc.gov/child-development/about/developmental-disability-basics.html

CDC. (2024c, September 24, 2024). *Oral and Dental Health*. Retrieved December 1, 2024 from https://www.cdc.gov/nchs/fastats/dental.htm

Como, D. H., Floríndez-Cox, L. I., Stein Duker, L. I., & Cermak, S. A. (2022). Oral Health Barriers for African American Caregivers of Autistic Children. *International Journal of Environmental Research and Public Health, 19(24), 17067*. https://www.mdpi.com/1660-4601/19/24/17067

Duker, L. I. S., Como, D. H., Jolette, C., Vigen, C., Gong, C. L., Williams, M. E., Polido, J. C., Floríndez-Cox, L. I., & Cermak, S. A. (2023). Sensory Adaptations to Improve Physiological and Behavioral Distress During Dental Visits in Autistic Children: A Randomized Crossover Trial. *AMA Network Open, 6(6), e2316346*. https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2805763

Duker, L. I. S., Martinez, M., Lane, C. J., Polido, J. C., & Cermak, S. A. (2021). Association between oral care challenges and sensory over-responsivity in children with Down syndrome. *International Journal of Paediatric Dentistry, 32(4), 546–557.* https://doi.org/10.1111/ipd.12933

Duker, L. I. S., Richter, M., Lane, C. J., Polido, J. C., & Cermak, S. A. (2020). Oral Care Experiences and Challenges for Children with Down Syndrome: Reports From Caregivers. *Pediatric Dentistry, 42(6), 430–435*. https://pubmed.ncbi.nlm.nih.gov/33369553/

Fenning, R. M., Steinberg-Epstein, R., Butter, E. M., Chan, J., McKinnon-Bermingham, K., Hammersmith, K. J., Moftt, J., Shui, A. M., Parker, R. A., Coury, D. L., Wang, P. P., & Kuhlthau, K. A. (2020). Access to dental visits and correlates of preventive dental care in children with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 50(12), 3739–3747*. https://pubmed.ncbi.nlm.nih.gov/32112232/

Fernández, M., de Coo, A., Quintela, I., García, E., Diniz-Freitas, M., Limeres, J., Diz, P., Blanco, J., Carracedo, Á., & Cruz, R. (2021). Genetic Susceptibility to Periodontal Disease in Down Syndrome: A Case-Control Study. *Int J Mol Sci*, *22*(12). https://doi.org/10.3390/ijms22126274

Floríndez, L. I., Como, D. H., Floríndez, D. C., Floríndez, F. M., Law, E., Polido, J. C., & Cermak, S. A. (2022). Toothbrushing and Oral Care Activities of Autistic and Non-Autistic Latino Children. *Children (Basel)*, *9*(5). https://doi.org/10.3390/children9050741

Floríndez, L. I., Como, D. H., Floríndez, D. C., Vigen, C., Floríndez, F. M., & Cermak, S. A. (2021). Identifying Gaps in Oral Care Knowledge, Attitudes, and Practices of Latinx Parents/Caregivers of Children With and Without Autism Spectrum Disorders. *Health Equity*, *5*(1), 185-193. https://doi.org/10.1089/heq.2020.0078

Frank, M., Keels, M. A., Quiñonez, R., Roberts, M., & Divaris, K. (2019). Dental Caries Risk Varies Among Subgroups of Children with Special Health Care Needs. *Pediatr Dent*, *41*(5), 378-384.

Goud, E. V. S. S., Gulati, S., Agrawal, A., Pani, P., Nishant, K., Pattnaik, S. J., & Gupta, S. (2021). Implications of Down's syndrome on oral health status in patients: A prevalence-based study. *Journal of Family Medicine and Primary Care, 10(11), 4247–4252*. https://pubmed.ncbi.nlm.nih.gov/35136797/

Johnson, C. P., Myers, S. M., & and the Council on Children With, D. (2007). Identification and Evaluation of Children With Autism Spectrum Disorders. *Pediatrics*, *120*(5), 1183-1215. https://doi.org/10.1542/peds.2007-2361

Lansdown, K., Irving, M., Mathieu Coulton, K., & Smithers-Sheedy, H. (2022). A scoping review of oral health outcomes for people with cerebral palsy. *Special Care in Dentistry*, *42*(3), 232-243. https://doi.org/https://doi.org/10.1111/scd.12671

Lee, J., & Chang, J. (2021). Oral health issues of young adults with severe intellectual and developmental disabilities and caregiver burdens: a qualitative study. *BMC Oral Health*, *21*(1), 538. https://doi.org/10.1186/s12903-021-01896-3

Lewis, C., Vigo, L., Novak, L., & Klein, E. J. (2015). Listening to parents: A qualitative look at the dental and oral care experiences of children with autism spectrum disorder. . *Pediatric Dentistry, 37(7), E98–E104.* https://docserver.ingentaconnect.com/deliver/connect/aapd/01641263/v37n7/s14.pdf?expires=1744691310&id=0000&titleid=75004753&checksum=16F81185C7068C35D93E0510FB281794&host=https://www.ingentaconnect.com

Majstorovic, M., Nandi, S. S., Canares, G., Chinn, C., Szirovicza, L., Best, E., & Moursi, A. M. (2023). Oral Health in the Down Syndrome Population: Parental Perceptions on Dental Care in the United States. *Pediatr Dent*, *45*(4), 316-319.

Martínez Pérez, E., Adanero Velasco, A., Gómez Clemente, V., Miegimolle Herrero, M., & Planells Del Pozo, P. (2023). Importance of Desensitization for Autistic Children in Dental Practice. *Children (Basel)*, *10*(5). https://doi.org/10.3390/children10050796

Martínez-Mihi, V., P.-G., V., S., F. J., , & Silvestre-Rangil, J. (2022). Comparison of Malocclusion Prevalence, Type and Severity between Cerebral Palsy and Healthy Subjects: A Prospective Case-Control Study. *Journal of Clinical Medicine, 11(13), 3711*. https://doi.org/10.3390/jcm11133711

Michelogiannakis, D., Vorrasi, J. S., Kotsailidi, E. A., & Rossouw, P. E. (2018). Interdisciplinary Management of a Class III Anterior Open Bite Malocclusion in a Patient With Cerebral Palsy. *Journal of Oral and Maxillofacial Surgery*, *76*(12), 2648.e2641-2648.e2615. https://doi.org/10.1016/j.joms.2018.07.033

Nagda, R., Le, T., Lin, B., & Tanbonliong, T. (2024). Oral hygiene practice and home-care challenges in children with autism spectrum disorder in San Francisco: Cross-sectional study. *Special Care in Dentistry*, *44*(3), 837-844. https://doi.org/https://doi.org/10.1111/scd.12922

Nelson, L. P., Getzin, A., Graham, D., Zhou, J., Wagle, E. M., McQuiston, J., McLaughlin, S., Govind, A., Sadof, M., & Huntington, N. L. (2021). Unmet dental needs and barriers to care for children with significant special health care needs. *Pediatr Dent*, *33*(1), 29-36.

NIDCR. (2023, 2023). *Developmental disabilities and oral health.* National Institutes of Health. https://www.nidcr.nih.gov/health-info/developmental-disabilities

Patrick, D. L., Lee, R. S. Y., Nucci, M., Grembowski, D., Jolles, C. Z., & Milgrom, P. (2006). Reducing Oral Health Disparities: A Focus on Social and Cultural Determinants. *BMC Oral Health*, *6*(1), S4. https://doi.org/10.1186/1472-6831-6-S1-S4

Pecci-Lloret, M. R., Pecci-Lloret, M. P., & Rodríguez-Lozano, F. J. (2022). Special Care Patients and Caries Prevalence in Permanent Dentition: A Systematic Review. *Int J Environ Res Public Health*, *19*(22). https://doi.org/10.3390/ijerph192215194

Ronis, S. D., Selvaraj, D., Albert, J. M., Koroukian, S. M., & Nelson, S. (2023). Dental Caries in Medicaid-Insured Preschool Children With or Without Special Health Care Needs in Northeast Ohio. *JAMA Network Open*, *6*(2), e230999-e230999. https://doi.org/10.1001/jamanetworkopen.2023.0999

Sami, W., Ahmad, M. S., Shaik, R. A., Miraj, M., Ahmad, S., & Molla, M. H. (2024). Oral health statuses of children and young adults with autism spectrum disorder: An umbrella review. *Journal of Clinical Medicine, 13(1), 59*. https://doi.org/10.3390/jcm13010059

Seirawan, H., Schneiderman, J., Greene, V., & Mulligan, R. (2008). Interdisciplinary approach to oral health for persons with developmental disabilities. *Special Care in Dentistry, 28(2), 43–52*. https://doi.org/10.1111/j.1754-4505.2008.00010.x

Stein Duker, L. I., Floríndez, L. I., Como, D. H., Tran, C. F., Henwood, B. F., Polido, J. C., & Cermak, S. A. (2019). Strategies for Success: A Qualitative Study of Caregiver and Dentist Approaches to Improving Oral Care for Children with Autism. *Pediatr Dent*, *41*(1), 4e-12e.

Wriedt, S., Service, F., Schmidtmann, I., & Erbe, C. (2024). Orthodontic findings in adults with Trisomy 21. *Clinical Oral Investigations*, *28*(8), 456. https://doi.org/10.1007/s00784-024-05846-5

Yusuf, Z. I., Dongarwar, D., Yusuf, R. A., & Salihu, H. M. (2020). Oral Health Problems among Children with Neurodevelopmental Disorders in the United States. *Int J MCH AIDS*, *9*(1), 157-160. https://doi.org/10.21106/ijma.342

Zhou, N., Wong, H. M., & McGrath, C. (2020). Efficacy of Social Story Intervention in Training Toothbrushing Skills Among Special-Care Children With and Without Autism. *Autism Res*, *13*(4), 666-674. https://doi.org/10.1002/aur.2256