

Unmet Dental Needs and Barriers to Dental Care Among Children with Autism Spectrum Disorders

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Abstract Mail-in pilot-tested questionnaires were sent to a stratified random sample of 1,500 families from the North Carolina Autism Registry. Multivariate logistic regression analysis was used to determine the significance of unmet dental needs and other predictors. Of 568 surveys returned (Response Rate = 38%), 555 were complete and usable. Sixty-five (12%) children had unmet dental needs. Of 516 children (93%) who had been to a dentist, 11% still reported unmet needs. The main barriers were child's behavior, cost, and lack of insurance. The significant predictor variables of unmet needs were child's behavior ($p = 0.01$), child's dental health ($p < 0.001$), and caregiver's last dental visit greater than 6 months ($p = 0.002$). Type of ASD did not have an effect on having unmet dental needs.

Keywords Unmet needs · Dental · Barriers · Autism · ASD

Autism spectrum disorders (ASD) is a group of disorders with a wide range of severity characterized by impairments

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in language, social interaction, and a markedly restricted repertoire of activities and interests. In the psychiatric nomenclature, the spectrum consists of Autistic Disorder, Asperger's Disorder, and Pervasive Developmental Disorder—Not Otherwise Specified (PDD-NOS; American Psychiatric Association 2000). The prevalence of ASD has been increasing over the past few decades, with current estimates from the Autism Development and Disability Monitoring (ADDM) Network (Autism and Developmental Disabilities Monitoring Network Surveillance Year 2006 Principal Investigators, and Centers for Disease Control and Prevention (2009)) showing a rate of approximately 1 in 110 US children. With this increasing rate of occurrence, undoubtedly there will be increased health care needs that will associated with ASD.

One area of need rests in dental care where the complexities associated with ASD likely will present challenges to not just oral health care over a life time, but also the access to adequate routine care for these children and their families. Clinical features such as sensorimotor deficits, impaired executive function, attention problems, anxiety and related affective regulation, difficulties in comprehension, and general language impairment could hinder their oral health care (Rapin and Tuchman 2008). These clinical features can make oral hygiene routines and associated behavior management for children with ASD a difficult set of tasks for caregivers, dentists, and hygienists.

Dental Health: An Unmet Health Care Need

Of all the unmet health care needs, unmet dental need is the most prevalent among children in United States (Newacheck et al. 2000; Yu et al. 2002). An estimated 50% of adolescents in the general population were reported to lack

the recommended number of dental visits (Yu et al. 2002). Although enrollment in other public health programs (other than Medicaid) has shown improvement in children's access and use of dental care, barriers to dental care remain apparent (Lee et al. 2004; Wang et al. 2007). The majority of studies that examined access to dental care in healthy children have focused on Medicaid-eligible children or children from low-income families. The identified barriers for these populations included low family income, limited parental educational, poor oral health literacy, little awareness about the importance of oral health, negative attitudes of dentist and office staff, ethnic and racial issues, insurance status, willingness of dentists to treat, and distribution or location of dentists within some states and local communities (Al Agili et al. 2005; Byck et al. 2002; Edelstein 2002; Mofidi et al. 2002; Seale and Casamassimo 2003; Smith et al. 2005; Yu et al. 2001).

Although fewer studies have been done on Children with Special Health Care Needs (CSHCN), the available studies reported that dental care remained the most prevalent unmet healthcare need (Lewis et al. 2005; Lewis 2009). It was reported that 78% of CSHCN required dental care in the prior 12 months, while 10.4% of CSHCN did not receive dental care when needed (Lewis et al. 2005). Factors associated with higher odds of unmet dental needs for CSHCN included household income, severity of the associated medical condition, lack of insurance, and insurance lapses (Lewis 2009). Recently, Nelson et al. (2011) targeted a more involved subsample of CSHCN and reported that 20% had unmet dental needs. Their findings suggested that poorer overall dental health and greater unmet needs were related to greater medical complexity (Nelson et al. 2011). This latter finding raises particular concerns for children and adolescents with ASD given the potential complexity of their condition.

Dental Health Care in Children and Adolescents with ASD

Few studies have explored the dental health status and dental needs of children with ASD (DeMattei et al. 2007; Kopycka-Kedzierawski and Auinger 2008; Lowe and Lindemann 1985; Marshall et al. 2010; Morinushi et al. 2001; Shapira et al. 1989). Although one study reported that children with ASD had better oral hygiene compared to those with other disabilities (Altun et al. 2010), there have been emergent concerns for the presence of caries susceptibility (DeMattei et al. 2007; Lowe and Lindemann 1985; Morinushi et al. 2001; Shapira et al. 1989). Most recently, Marshall et al. (2010) reported that ASD may be considered an indicator for high caries risk, with oral hygiene being the most influential risk indicator associated

with new caries in children with ASD. Specifically, in a sample of 99 children with ASD, 59% with poor oral hygiene had new caries compared to 28% with good or excellent oral hygiene (Marshall et al. 2010). While this may not be surprising in any population, issues related to oral health care and access to qualified and experienced oral health professionals comfortable and knowledgeable about ASD can create significant additional burdens for receiving preventive care.

To date, three studies have explored the issue unmet dental needs and associated barriers to treatment among children with ASD. Data extracted from the 2003 National Survey of Children's Health (NSCH) did not show a statistical difference for dental care access measures between children with and without ASD. This study, however, did not explore barriers to dental care for children with ASD (Kopycka-Kedzierawski and Auinger 2008). In a sample of 55 children with ASD, Brickhouse et al. (2009) identified difficult behaviors in the dental office and household income as the major barriers to dental care. In addition, it was reported that 24% of these children did not have scheduled periodic dental care. Recently, Nelson et al. (2011) explored the unmet dental needs of children and adolescents with ASD within the CSHCN population. These investigators found that 23% of the ASD group had unmet dental needs, although this rate was not significantly different when compared to CSHCN with other medical conditions (Nelson et al. 2011).

The Present Study

The primary aim of the present study was to describe the unmet dental needs and associated barriers to oral health care among children with ASD utilizing survey methodology to ascertain a large sample of caregivers from the autism registry. A second research question was to examine the association of having unmet dental needs with (1) the type of ASD, and (2) the child's perceived behavior in the dental office. Findings from this study should compliment the relative dearth of literature examining the oral health care needs of children and adolescents with ASD.

Methods

Participants

The sample was obtained from the Autism Registry of North Carolina, which is part of the core services of the UNC Neurodevelopmental Disorders Research Center at the Carolina Institute for Developmental Disabilities (CIDD). Although the sample was obtained from a single

state, North Carolina has a representative population of individuals with ASD due to its availability and diversity of autism-related services for children (Thomas et al. 2007). The registry data base is primarily populated through a collaboration with the TEACCH (Treatment and Education of Autistic and Related Communication Handicapped Children) Program, which is a state-funded program that provides diagnostic and treatment services for individuals with ASD in seven centers across North Carolina. The Autism Registry currently has enrolled more than 4,500 individuals diagnosed with ASD of which 3,441 are under 18 years old.

For this survey, 1,500 families with children with ASD were selected using a stratified random sampling scheme with weighted allocation. The inclusion criteria were families with children age 18 and under who were diagnosed with ASD. If there was more than one child diagnosed with ASD in the family, the oldest child with ASD was considered as the participant for the questionnaire. The sole exclusion criterion was children who were above age 18. This study was approved by the Institutional Review Board of the University of North Carolina at Chapel Hill.

Measures

The survey framework was adapted from the Behavioral Model of Health Services Use (Aday and Andersen 1974). The questionnaire included questions on basic demographics, predisposing factors, enabling factors, and need factors. Additional questions targeted to the ASD population inquired about the type and severity of ASD, the age at diagnosis, number of children diagnosed with ASD in the household, the association with autism-related organizations, and the use of educational programs/services. For those who have been to a dentist, dental visit related questions were asked with regards to their child's last dental visit, the main problems faced during the last dental visit, the type of dental office, and the frequency of the child's dental visits.

The initial questionnaire was pilot tested by caregivers with parents of children with ASD who presented as patients in the UNC Graduate Pediatric Dentistry Clinic. Feedback obtained led to modifications on the structure and wording of the questionnaire. The edited questionnaire and survey administration methods were further discussed and developed with experts from the UNC Odum Institute for the Research of Social Sciences to ensure adherence to contemporary survey methodology standards.

To address the study's primary question (i.e., To determine the presence of unmet dental needs in children with ASD), the following question was asked: "During the past 6 months was there a time when you wanted to get dental care for your child but could not get it at that time?"

For caregivers who answered "yes" to the above question, follow-up descriptive questions that addressed the main barriers to dental care were asked. Multiple answers were allowed for this descriptive section.

Procedures

The survey was conducted from March to May of 2010. All mailings were handled by two staff members from the Autism Registry in UNC Neurodevelopmental Disorders Research Center. The investigators did not have access to the mailing list due to confidentiality issues and all questionnaires were anonymous. An identification number was assigned to each questionnaire only for the purpose of tracking non-respondents. In accordance with contemporary survey methodology, a total of three separate mailing were sent (Burns et al. 2008). The first mailing, consisting of an information sheet, the questionnaire, and a return envelope, was sent to all selected participants. Two weeks later, a reminder card was sent to all non-respondents. A final mailing, consisting of the questionnaire, information sheet, and return envelope, was sent to all non-respondents 4 weeks after the initial mailing. For Hispanic families, both the English and Spanish questionnaires were mailed. Collection of questionnaires ended at 6 weeks after the initial mailing. All received questionnaires were scanned by an automatic reader.

Data Analyses

To address the research question pertaining to the rate of unmet dental needs, operationally defined in this study as the inability to get dental care when needed in the past 6 months, and associated barriers to treatment, descriptive analyses included calculation of frequencies and percentages for categorical variables, and means and standard deviations for continuous variables. The second research question related to the association of having unmet dental needs with the type of ASD and the child's perceived behavior in the dental office. The Fisher's exact test was used for bi-variate analyses to examine the relationships between the dependent and independent variables. A multivariate regression model was used to examine the relationships between the dependent and independent variables after controlling for potential confounding covariates. Odd ratios (ORs) and 95% confidence intervals (CIs) were used to present the logistic regression analyses. The final model for the outcome was derived by "child's behavior in dental office" and "type of ASD" as the primary explanatory variables, and employing forward selection to determine if any other covariates were significantly related to the outcome. The survey data were managed using Statistical Analysis Systems (SAS[®]) Version 9.1.3.

Results

From the 1,500 potential respondents, the response rate was 37% ($N = 568$) over three mailings. Of these, a total of 555 questionnaires were complete and used in data analysis. The difference between respondents and non-respondents using characteristics provided from the Autism Registry of North Carolina was analyzed using chi-square tests. Only the child's race ($p = 0.004$) was significantly associated. The association between child's race and having unmet dental needs, the targeted outcome variable, was not statistically significant ($p = 0.85$). Therefore, with the limited information available for comparison, the respondent sample appears to be representative of the larger random sample of 1,500 families. The demographic characteristics of children with ASD and caregiver factors are summarized in Tables 1 and 2.

Presence of Unmet Dental Needs

The proportion of children with unmet dental needs and dental visit characteristics was summarized in Table 3. Overall, only 11.7% of the caregivers reported an unmet dental need in the past 6 months. Although the majority of the children (94.2%) had been to a dentist, 11% of these children still reported unmet needs. Among the children who had been to a dentist, about 90% of them had their last dental visit within the past year and 75% visited their dentist every 3–6 months. The two most common problems at the child's last dental visit were reported to be the child's behavior (29.8%) and the clinic not accepting Medicaid (21.0%).

Barriers to Dental Care

Descriptive data on barriers to dental care is summarized in Table 4. For those who had an unmet dental need in the past 6 months, the most commonly reported barriers were the child's cooperation (60.0%), cost of care (38.5%), and lack of dental insurance (23.1%). When the relationship of the covariates and the outcome variable were assessed with bivariate analyses, the following variables were significantly associated with having unmet dental care needs: (1) average household income ($p = 0.02$); (2) dental insurance coverage ($p = 0.04$); (3) caregiver's education level ($p < 0.001$); (4) child's behavior in dental office ($p < 0.001$); (5) child's dental health status ($p < 0.001$); (6) caregiver's last dental visit ($p < 0.001$), and (7) the type of dental office ($p = 0.002$).

Table 5 shows factors related to having unmet dental needs after multivariate analysis. Improving behavior in the dental office had a protective effect on having unmet dental needs. Children with fair and good behavior had decreased odds of having unmet dental needs (OR = 0.41, 95% CI = 0.19–0.86, $p = 0.01$; OR = 0.37, 95% CI = 0.17–0.80,

$p = 0.01$) compared to those with poor behavior in the dental office. The diagnosis of either Asperger's syndrome or PDD-NOS was not significantly associated with having unmet dental needs compared to those with autistic disorder ($p = 0.89$).

Discussion

Dental care remains the most prevalent unmet health-care need for children with and without special needs (Newacheck 2000; Yu et al. 2001). This study reported 12% of children with ASD to have unmet dental needs in the past 6 months. The prevalence was higher compared to previous studies (Lewis et al., 2005; Newacheck et al. 2000). Data extracted from a 4 year National Health Interview Survey (NHIS) (1993–1996) revealed that 5.3% of all children had unmet dental needs in the past year (Newacheck et al. 2000), while 10.4% of families with children with special health care needs reported unmet needs (Lewis et al. 2005). Our study is one of the few studies that has focused on unmet dental needs in children with ASD. Brickhouse (2009) reported 19% of children with ASD as having unmet dental needs in the past 12 months, which was higher than the 12% rate in our study. The difference could be due to sampling from a different population and having a larger sample size in our study. Nelson (2011) subdivided their sample of CSHCNs into those with and without ASD and reported that 23% of children with ASD had unmet dental needs; however, this rate was not found to be statistically significantly different from CSHCNs with other conditions. The higher prevalence of unmet dental needs in their study could be due to a more involved, specifically targeted population of CSHCNs, who presented with greater medical complexity. Further, our findings revealed that although the majority of children with ASD (94%) had been to a dentist, 11% still reported unmet dental needs.

The main cited barriers to dental care were the child's behavior, cost of dental care, and lack of dental insurance. These were consistent with other national studies reporting on the general child population and CSHCN. Limitations attributed to disability and difficult behaviors hindered children from getting dental care when needed in addition to the commonly reported barriers (Brickhouse et al. 2009; Lewis et al. 2005) In our study, the child's behavior in the dental office was the major barrier to dental care and the most frequently cited problem during the child's last dental visit. Additionally, children with perceived poor behavior in the dental office had higher odds of having unmet dental needs after controlling for the effects of other key variables. Our findings were not surprising in that children with ASD were described as demonstrating many behavioral and clinical features, such as sensorimotor deficits,

Table 1 Demographic characteristics for children with ASD ($N = 555$)

	<i>N</i>	<i>%</i>		<i>N</i>	<i>%</i>
<i>Sex</i>					
Male	464	83.6	<i>Type of dental insurance</i>		
Female	91	16.4	Private only	301	54.4
			Medicaid only	159	28.8
			Medicaid and private	18	3.3
			None	75	13.6
			Missing	2	–
<i>Race</i>					
Black	43	7.8	<i>Type of community</i>		
White	466	84.9	Rural	182	33.6
Other	40	7.3	Suburban	274	50.7
Missing	6	–	Urban/city	85	15.7
			Missing	14	–
<i>Ethnicity</i>					
Hispanic or Latino	22	4.0	<i>Last dental visit for caregiver</i>		
Not Hispanic or Latino	529	96.0	≤6 months	367	66.1
Missing	4	–	6 months–1 year	51	9.2
			>1–3 years	81	14.6
			>3 years/never been/do not know or remember	56	10.1
<i>Average household income</i>					
<\$35,000	144	26.6	<i>School attendance</i>		
\$35,000–74,999	199	36.7	Yes	529	96.5
≥\$75,000	199	36.7	No	19	3.5
Missing	13	–	Missing	7	–
<i>Caregiver's education</i>					
Did not complete HS	18	3.3	<i>Child's perceived cooperation in dental office</i>		
HS graduate	221	40.1	Poor	150	27.1
College graduate	312	56.6	Fair	137	24.7
Missing	4	–	Good	142	25.6
			<i>Child's perceived dental health status</i>		
			Poor	21	3.8
			Fair	83	15.0
			Good	450	81.2
			Missing	1	–
			<i>Age of child (years)</i>		
			<i>Mean (SD)</i>	<i>Median (Range)</i>	
			9.9 (3.9)	10.0 (2.0–18.0)	
			Missing = 2		

impaired executive function, attention problems, aggression, irritability, difficulties in comprehension, and language disabilities, that likely complicated oral health care at home and in the dental office.

Although a previous study (Brickhouse et al. 2009) had reported on unmet dental needs among children with ASD, our study was the first to examine the relationship between unmet dental needs and the type of ASD. Children with different types of ASD present with unique clinical features and the severity of the condition within each type of ASD also differs among individuals. In

contrast to our hypothesis that a different degree of dental needs may exist among children with different types of ASD, our findings did not detect any differences in having unmet dental needs. The effect of ASD on unmet dental needs may be diluted by the variability of severity within each type of ASD.

Study Limitations

We acknowledge several limitations when conducting this research study. One of the limitations of this study was the

Table 2 Autism-related factors and medical condition (*N* = 555)

	<i>N</i>	%
<i>Type of ASD</i>		
Autism Disorder	216	38.9
Asperger's syndrome	210	37.8
PDD-NOS	129	23.3
<i>No. of children in household with ASD</i>		
1	513	92.4
More than 1	42	7.6
<i>Other medical conditions</i>		
Yes	230	41.5
No	324	58.5
Missing	1	
<i>Type of medical conditions*</i>		
ADHD	89	39.0
Behavioral/psychiatric conditions	47	20.6
Cerebral palsy/seizure disorders	15	6.6
Other	77	33.8
<i>Medical care by family physicians</i>		
Yes	535	97.0
No	16	3.0
Missing	4	
<i>Reasons for seeing family physicians</i>		
Regular check-ups only	82	15.6
Illness only	27	5.2
Both	416	79.2
Missing	30	
<i>Child registered with organization[†]</i>		
Autism society of NC	333	60.0
TEACCH	495	89.2
CDL	18	3.2
<i>Age of diagnosis</i>		
Missing = 4	Mean (<i>SD</i>)	Median (<i>Range</i>)
	5.2 (3.1)	4.4 (1.0–16.0)

* Only those who answered “yes” to the question “Does your child have any other medical conditions?” responded

[†] Multiple answers were allowed for the question

response rate. The average reported mail-in response rate of the Autism Registry of North Carolina was 30%. Although we tried to increase the response rate through three separate mailings, in accordance with contemporary survey methods, the current study had a response rate of 38%. Although our respondents appeared to be similar in their sociodemographic make-up to the non-respondents, we only had access to several key variables for comparison, and additional variables may would have been preferable for a more thorough examination of the representative nature of our sample.

Perhaps of more concern was the potential for selection bias. Families who have registered with the autism registry may have better access and utilization to health care

Table 3 Unmet dental needs and dental visit characteristics (*N* = 555)

	<i>N</i>	%
<i>Child needed dental care but did not get it in the past 6 months</i>		
Yes	65	11.7
No	490	88.3
<i>Child ever been to a dentist</i>		
Yes	523	94.2
No	32	5.8
<i>Child's frequency of dental visit*</i>		
Every 3–6 months	391	75.2
Once a year	72	13.8
Only when pain occurs/other	57	11.0
Missing	35	
<i>Child's last dental visit*</i>		
≤6 months	390	74.6
6 months to 1 year	56	10.7
1–3 years	54	10.3
>3 years/do not know or remember	23	4.4
Missing	32	
<i>Type of dental office*</i>		
General practice	195	37.6
Pediatric dentistry	298	57.5
Other	25	4.8
Missing	37	
<i>Main problems at last dental visit*[†]</i>		
Dentist/assistant was not able to handle my child	50	9.6
Dentist/assistant did not treat me or my child with respect	22	4.2
Dentist did not treat young children	5	1.0
Dentist did not treat special needs children	43	8.2
My child could not cooperate	156	29.8
Clinic did not accept Medicaid	11	21.0
Clinic was not “special-needs” friendly	39	7.5
Child's anxiety	19	3.6
None	180	34.4

* Only those who answered “yes” to the question “Have your child been to a dentist?” responded

[†] Percentage calculated out of those who had been to a dentist (*N* = 523); multiple answers were allowed for the question

resources. Because the questionnaires were mailed through the autism registry, institutionalized children and those who were not part of the registry were omitted in the study. In addition, those who were illiterate or did not understand English or Spanish would not be able to complete the survey. These individuals may be the ones who truly have difficulties in accessing health care and have unmet needs. As such, caution should be exercised in generalizing our findings to the larger population of children and adolescents with ASD. In this regard, the overall prevalence of

Table 4 Caregiver-reported barriers to dental care ($N = 65$)

	Main reasons why child could not get care when he/she needed dental care during the past 6 months*	
	<i>N</i>	%
Could not afford it	25	38.5
No insurance	15	23.1
Dentist did not accept medicaid/insurance	6	9.2
No dentist available	11	16.9
Transportation problem	6	9.2
Health of another family member	5	7.7
Other things in the family to be taken care of	7	10.8
Hours not convenient due to work	8	12.3
Wait too long in clinic/office	9	13.8
Difficulty in getting appointment	12	18.5
Did not know where to go	7	10.8
Didn't like/trust/believe in dentists	5	7.7
Patient's medical condition	1	3.1
Language barrier	1	1.5
Child was uncooperative	39	60.0
Child was too young	3	4.6
Baby teeth will "fall out" by themselves soon	–	–
Child's oral condition was very good and did not need to see a dentist	–	–
Child's dental condition was not serious enough to see a dentist	–	–

* Multiple answers were allowed for the question

Table 5 Factors associated with the odds of having unmet dental need in children with ASD ($N = 555$)

	OR	95.0% CI	<i>P</i> -value
<i>Perceived behavior in dental office</i>			0.01*
Poor	Reference	–	
Fair	0.41	0.19–0.86*	
Good	0.37	0.17–0.80*	
<i>Type of ASD</i>			0.89
Autistic disorder	Reference	–	
Asperger's syndrome	1.16	0.58–2.31	
PDD-NOS	1.17	0.54–2.51	
<i>Caregiver's last dental visit</i>			<0.001*
≤6 months	Reference	–	
>6 months to 1 year	2.58	1.07–6.26*	
>1–3 years	3.26	1.65–6.47*	
>3 years/do not remember	0.79	0.28–2.27	
<i>Dental health status of child</i>			0.002*
Poor	Reference	–	
Fair	0.66	0.33–1.30	
Good	0.17	0.07–0.39*	

Parameters are odd ratio (OR) and 95% confidence interval (CI)

* Statistically significant level at 0.05

unmet dental needs in children with ASD may be underestimated, and might explain why rates are lower than the 23% rate reported by Nelson (2011).

Finally, as with other self-reported cross-sectional studies, we acknowledge the reporting bias with regards to

the reliance on caregivers' reports. The caregiver's assessment of behavior may or may not represent the actual behavior of the child, especially when each child differs in behavior under different situations and interaction with other individuals, and associated family dynamics. In

addition, the caregiver's assessment may not be accurate for those children who had not been to the dentist. We also did not specify the dental procedures performed. It is suspected that there would be a difference in response to dental treatment, depending on the type of dental procedures performed. Without clinical oral examinations and assessments in the dental office, caregivers' reports may not accurately reflect the true dental needs, dental health status, and behavior of the child in the dental office. In addition, there are many different dental needs relating to oral hygiene, caries, trauma or orthodontics. We did not identify the type of dental needs that were needed in this study.

Clinical Implications

Despite these limitations, the findings from this study continue to shed light on the oral health care needs of children and adolescents with ASD. In this regard, the findings begin to point to a number of clinical implications for working with children with ASD in the oral health care setting. First, the child's behavior was found to be the major barrier to care in this study, and this was consistent with findings in previous studies (Brickhouse et al. 2009; Lewis 2009). Our study reinforces the importance of behavior management of children with ASD in the dental office for all oral health care providers. Successful management of children with ASD in the dental environment involves preparation of the parents and the child outside the dental office, scheduling the child at appropriate times of the day, systematic desensitization to the environment, modification and flexibility in common techniques such as positive reinforcement, tell-show-do, and negative reinforcement when necessary (Hernandez 2007; Lowe and Lindemann 1985). Above all, it is important for oral health care providers to have some knowledge and awareness of ASD and its associated features so as to facilitate the oral health care of this population. Future studies investigating behavior management interventions for children with ASD before and during dental visits may provide insights into helping these children to cope better with needed dental procedures.

Second, the influence of the child's age on behavior may be different among children with and without ASD. For example, behavior management of younger children with ASD may be relatively easier in the dental office (e.g., employing positive reinforcement) than with older children with ASD where additional concerns related to anxiety and repetitive behaviors may be further complicating the behavior in the dental office. This remains a critical area for further empirical investigation.

Third, caregiver's perception of behavior may underestimate or overestimate the child's actual behaviors, especially for those who have never been to the dentist. In addition, the child may respond differently to different dental procedures. Future studies should examine the association between the caregiver's perceptions of child's behavior in the dental office in comparison to the perceptions of the dental care provider in an effort to determine how best to provide a specific dental procedure with a particular child at a specific developmental epoch.

Fourth, from a training perspective, it is important for all dental health care providers to be familiar with ASD and its associated clinical manifestation so that they can tailor specific procedures to their patients' individual needs and use the appropriate strategies to garner maximum cooperation. Unfortunately, at present, training in the dental care of patients with special needs is inadequate. A survey of dental school programs revealed that only 64% offered a separate course about special needs patients (Vainio et al. 2011). Further, Wolff et al. (2004) reported 50.8% of dental students had no clinical experience in caring for patient with ASD or related intellectual/developmental disabilities, and 60% reported having little or no confidence in providing care to this population. Weil and Inglehart (2010) noted that both pediatric and general dentists reported that they received little or no training in their predoctoral dental education in treating patient with ASD. The study also found that the quality of pediatric dentists' educational experiences correlated with the frequency of appropriate behavior management strategy used when treating patients with ASD.

Finally, it is important to note that the majority of the children (95%) in this study had regular medical care by their family physicians, while 75% had regular dental visit at least every 6 months. Although this study did not investigate unmet medical needs among children with ASD, the findings seemed to suggest that this sample of children with ASD had more encounters with physicians than dental professionals. An interdisciplinary team approach with the child's physician may help to overcome or manage the behavior of the child with ASD in the dental office, which was reported to be the major barrier to dental care and most frequently cited problem at the child's last dental visit. An oral health screening could be incorporated into the visit with the primary care provider, and a follow-up connection could be established for dental care.

To conclude, this study examined the prevalence of unmet dental needs and the associated major barrier to dental care in a sample of children and adolescents with ASD. Despite oral health care needs being the number one unmet health care need for all children, this is one of the few studies to examine these issues in a sample of individuals with ASD. Findings showed that although the

majority of children with ASD had been to a dentist, 12% reported unmet dental needs in the past 6 months. Further, the child's behavior appeared to be the most prominent barrier to treatment; however, the type of ASD was not associated with unmet dental needs. Strategies to minimize unmet dental needs should focus on increasing patient cooperation in the dental office, perhaps by utilizing an interdisciplinary team approach with as part of the dental health care plan for children and adolescents with ASD. Future research should examine the specific aspects of dental care by exploring how best to provide a specific dental procedure with a particular child with ASD at a specific developmental epoch along with the associated ASD-related training needs for all oral health providers.

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