

# Characteristics and Associated Comorbidities of Pediatric Dental Patients Treated under General Anesthesia

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**Objective:** To describe characteristics and identify common comorbidities of children receiving dental treatment under general anesthesia at Children's Hospital of New York-Presbyterian. **Study design:** Electronic medical records of all children that received dental treatment under general anesthesia through the Division of Pediatric Dentistry from 2012-2014 were reviewed. Data describing patient characteristics (age, sex, race/ethnicity, insurance carrier, and American Society of Anesthesiologists physical status classification system), medical history, and justification for treatment were collected. Descriptive statistics, including frequencies, percentages and t-tests, were calculated. **Results:** A total of 298 electronic medical records were reviewed, of which 50 records were excluded due to missing information. Of the 248 electronic medical records included, the average age was 5-years-old and 58% were male. The most common reason for dental treatment under general anesthesia was extent and severity of dental disease (53%), followed by significant medical history (47%) and behavior/pre-cooperative age (39%). Those who were ASA III or IV were older (6.6-years) ( $p < .001$ ). Common medical comorbidities appear evenly distributed: autism (12%), cardiac anomalies (14%), developmental delay (14%), genetic syndromes/chromosomal disorders (13%), and neurological disorders (12%). Younger age groups (1 to 2 years and 3 to 5 years) had a high percentage of hospitalizations due to the extent and severity of the dental disease (83%) and behavior (77%) ( $p < 0.001$ ). **Conclusions:** No single comorbidity was seen more often than others in this patient population. The range of medical conditions in this population may be a reflection of the range of pediatric specialty services at Children's Hospital of New York-Presbyterian.

*Key words:* dental, general anesthesia, comorbidity.

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## INTRODUCTION

Children affected by early childhood caries (ECC) are often quite young and unable to cope with the necessary procedures to effectively treat the damage to their teeth.<sup>1</sup> As a result, many children treated via conventional methods lack "cooperative ability" and therefore require the use of deep sedation or general anesthesia (GA).<sup>1, 2, 3</sup> Despite concerns about anesthesia-related morbidity and postoperative pain<sup>4</sup>, a study of parents' experience with ECC treatment under GA for their preschool children found that this type of dental care is well-received by parents.<sup>5</sup> Restorative treatment for severe-ECC is quite often treated in this manner and is the primary justification for hospitalization for treatment under GA.<sup>5</sup>

In a comparison of medical diagnoses of pediatric dental patients treated under GA from 1990-99 with those treated from 2000-08, Roberts et al found no significant change in medical diagnoses over the 19-year period.<sup>6</sup> The most common diagnoses after acute stress reaction in an outpatient setting were asthma/respiratory issues, neurological disorders (e.g., cerebral palsy, seizure disorders), genetic syndromes/chromosomal disorders, and developmental delay.

The Division of Pediatric Dentistry at the College of Dental Medicine of Columbia University provides dental treatment under GA at the Children's Hospital of New York-Presbyterian, a regional

referral center for tertiary care, located in the Washington Heights/Inwood neighborhoods of Northern Manhattan. The purpose of this study is to explore and describe the characteristics and associated comorbidities of children receiving dental treatment under GA with the intent of better understanding this patient population.

**MATERIALS AND METHOD**

After institutional approval (protocol number AAAP7901), electronic medical records of children that received dental treatment in the operating room through the Division of Pediatric Dentistry from 2012 to 2014 were reviewed. Data describing patient characteristics (including age, sex, ethnicity, and insurance status), medical history (international classification of diseases version 9 code and American Society of Anesthesiologists (ASA) physical status classification system), and justification for treatment under GA (extent and severity, behavior/pre-cooperative age, and complexity of the medical condition) were collected and coded. The patients' comorbid conditions were classified into the following categories: well-child/acute stress reaction, developmental/behavioral disorder, cardiac anomalies, genetic syndrome/chromosomal disorder, neurological disorder, pulmonary disorder, renal disorder, endocrine disorder, gastrointestinal disorder, and other. Descriptive statistical analysis using Stata 13.0 version (TX StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP), including frequencies, percentages, and t-tests, was calculated for demographic information, ASA classification, justification for GA, and for common comorbidities. A  $p < .001$  was considered statistically significant.

**RESULTS**

A total of 298 electronic medical records were reviewed, of which 50 (17%) were excluded due to incomplete information. Table 1 shows the characteristics of the 248 included patients who had dental treatment under GA. The average age was about 5-years-old with more than half (56.5%) of all patients grouped as 3 to 5 years of age. More than half (57.7%) of all patients were male. Approximately 37 percent were Hispanic. Approximately 75% were on Medicaid or Medicaid managed care. About one-half (49.6%) of all patients were ASA physical status classification II, III, or IV. The primary justification for dental treatment under GA was the extent and severity of the disease (53.2%), then a significant medical history (47.2%), and then a pre-cooperative behavior or acute stress reaction in an outpatient setting (39.1%). With respect to the distribution of comorbidities, common comorbid conditions were autism (12%), cardiac anomalies (14%), developmental delay (14%), genetic syndrome/chromosomal disorders (13%), and neurologic disorders (12%).

There was a statistically significant difference in demographics (age, insurance, and race/ethnicity) by ASA physical status classification as shown in Table 2. Those who were ASA III or IV were older (6.6-years) in age in comparison to those who were ASA I or II (4.8-years) and those who were ASA III or IV had more equally distributed insurance carriers and race/ethnicities ( $p < .001$ ). There was no statistically significant correlation between sex and ASA classification.

Figure 1 shows the justification for dental treatment under GA by age group and reveals that younger age groups (1 to 2 years and 3 to 5 years) had a high percentage of hospitalizations due to the

**Table 1. Characteristics of Patients having Dental Treatment under General Anesthesia**

Demographics	n	(%)	ASA Classification	n	(%)
Age (mean, SD)	248	5.4 (2.9)	ASA I	125	(50.4)
			ASA II	40	(16.1)
			ASA III	75	(30.3)
			ASA IV	8	(3.2)
Age groups			1 to 2 years	17	(6.9)
			3 to 5 years	140	(56.5)
			6 to 9 years	73	(29.4)
			10 to 14 years	11	(4.4)
			15 to 17 years	7	(2.8)
Sex			<b>Justification</b>	n	(%)
			Significant Medical History	117	(47.2)
			Behavior	97	(39.1)
Female	105	(42.3)	Severity and Extent of Disease	132	(53.2)
			Male	143	(57.7)
Race and Ethnicity			<b>Comorbidities</b>	n	(%)
Non-Hispanic White	28	(11.3)	Well-child/Acute Stress Reaction	106	(42.7)
Non-Hispanic Black	17	(6.9)	Developmental/Behavioral Disorder	65	(26.2)
Hispanic	91	(36.7)	Cardiac Condition	34	(13.7)
Other	52	(21.0)	Neurological	29	(11.7)
Unknown	60	(24.1)	Genetic	32	(12.9)
Insurance Status			Pulmonary	34	(13.7)
			Renal	3	(1.2)
			Endocrine	9	(3.6)
			Gastrointestinal	2	(0.8)
			Other	35	(14.1)
Private	61	(24.6)			
Medicaid	40	(16.1)			
Medicaid Managed Care	147	(59.3)			

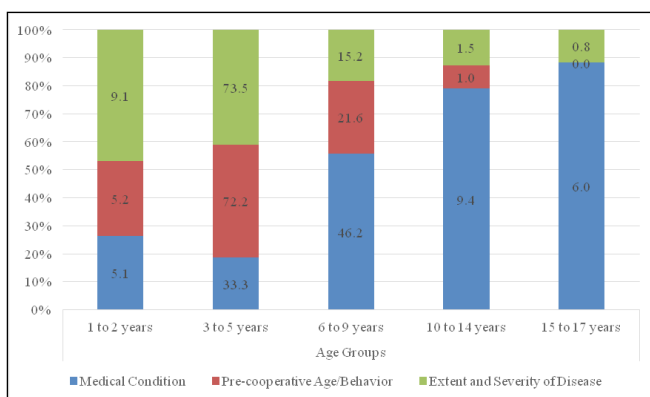
extent and severity of the dental disease (83%) and behavior (77%) in comparison to the older age groups (6 to 9 years, 10 to 14 years, and 15 to 17 years) who had a high percentage (62%) of hospitalizations due to the complexity of the case due to an underlying medical condition ( $p < .001$ ).

Figure 2 shows common comorbidities by age group and reveals that the younger age groups (1 to 2 years and 3 to 5 years) had a high percentage of well-children and those with acute stress reaction to dental treatment in an outpatient setting in comparison to the older age groups (6 to 9 years, 10 to 14 years, and 15 to 17 years). The older age groups had a higher percentage of comorbid conditions ( $p < .001$ ).

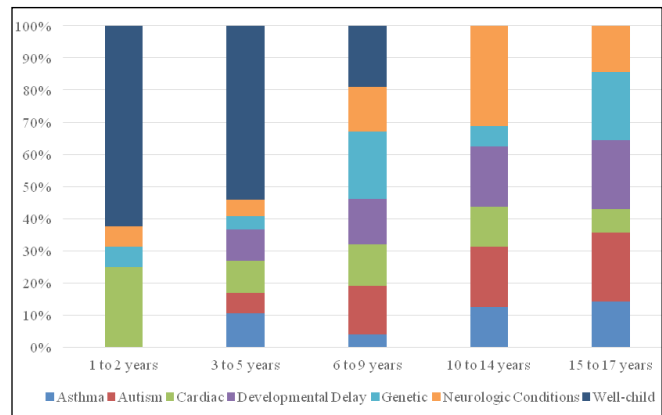
**Table 2. Demographics by ASA Classification**

	I and II			III and IV			p-value
	n	mean	(SD)	n	mean	(SD)	
Age	164	4.8	(2.3)	82	6.6	(3.5)	<.001
	n	(%)		n	(%)		
Age groups							
1 to 2 years	11	(6.7)		6	(7.2)		
3 to 5 years	113	(68.5)		27	(32.5)		
6 to 9 years	36	(21.8)		37	(44.6)	<.001	
10 to 14 years	2	(1.2)		9	(10.8)		
15 to 17 years	3	(1.8)		4	(4.8)		
Sex							
Female	68	(41.2)		37	(44.6)		.61
Male	97	(58.8)		46	(55.4)		
Race and Ethnicity							
Non-Hispanic White	9	(5.5)		19	(22.9)		
Non-Hispanic Black	7	(4.2)		10	(12.1)	<.001	
Hispanic	67	(40.6)		24	(28.9)		
Other	33	(20.0)		19	(23.9)		
Unknown	49	(29.7)		11	(13.3)		
Insurance Status							
Private	31	(18.2)		30	(36.2)	<.001	
Medicaid	15	(9.1)		25	(30.1)		
Medicaid Managed Care	119	(72.1)		28	(33.7)		

**Figure 1. Justification for dental treatment under GA by age group showing increasing significant medical conditions with increasing age (p<.001).**



**Figure 2. Common comorbidities by age group demonstrating increased complexity of medical condition with increasing age (p<.001).**



**DISCUSSION**

In contrast to previous studies that have described the clinical characteristics, risk and benefits, parent satisfaction, costs, clinical outcomes and relapse rates, and behavior of healthy and medically complex pediatric patients requiring dental treatment under GA<sup>2, 4, 7-16</sup>, this study provides insight into patient characteristics and describes common comorbidities.

In a study of 300 pediatric patients treated under GA, Legault *et al* (1972) found that rampant dental caries was the most common indication for treatment under GA followed by behavior management problems.<sup>17</sup> These findings were duplicated by Vermeulen *et al* (1991) in a report with three times the sample size of the previous study.<sup>18</sup> However, in the current study, it is interesting to note that extent and severity of the dental disease, although most frequently cited, was only slightly more common than the complexity of the medical condition, followed by the inability to cooperate or cope due to acute stress reaction in an outpatient setting.

Acs *et al* (2001) reported that 39% of patients requiring dental treatment under GA had a compromising medical or developmental condition.<sup>9</sup> In the current study, approximately 57% of all patients had a compromising medical or developmental condition which may be a reflection of the extent and severity of the patients underlying medical condition and the hospital’s status as a tertiary referral center.

Baens-Ferrer *et al* found the most common primary healthcare diagnoses among patients were primarily autism, cerebral palsy, and genetic disorders.<sup>19</sup> In a cohort of special patient care alone, Stapleton *et al* reported that the most common diagnoses were developmental delay, craniofacial anomalies, seizure disorders, cerebral palsy, and cardiac anomalies.<sup>20</sup> In this study, no single comorbidity was seen more often than others in this patient population. The most common medical comorbidities—autism, cardiac anomalies, developmental delay, genetic syndromes and chromosomal disorders, and neurological disorders—were all seen at a relatively similar rate. This is comparable to findings by Robert *et al* where common diagnoses were asthma/respiratory issues, neurological disorders (e.g., cerebral palsy, seizure disorders), genetic syndromes/ chromosomal disorders, and developmental delay.<sup>6</sup> The range and distribution of medical conditions in our patient population may be a reflection of the diversity of pediatric specialties at Children’s Hospital with an interdisciplinary approach to healthcare.

Patients from the local Washington Heights/Inwood neighborhoods of Northern Manhattan and patients referred from the pediatric specialists and pediatric dentists to the hospital have distinct demographic characteristics. The local community is primarily Hispanic and insured by Medicaid managed care. The patients referred by the medical specialists for dental treatment under GA often come from different regions to receive subspecialty medical care and have complex medical conditions.

As seen in Table 2, the average age of the ASA III/IV group was higher when compared to their healthier counterparts and had a more equal distribution of insurance carriers. The higher ASA groups also had a more equal distribution between races/ethnicities as patients come from various regions to find very specific pediatric care.

While some studies show no sex predilection, this study showed a male predilection. This is similar to results found by Anderson *et al* and Vermeulen *et al*.<sup>8,18</sup> The male predilection may reflect the fact that boys mature psychologically at a slower rate than girls and have not acquired the ability to cope with the stress of dental treatment in an outpatient setting.

A strength of this study is that this topic has been previously unexplored in this patient population and serves as baseline information for future studies. This study was subject to the inherent limitations of retrospective chart reviews, specifically, missing documentation in the electronic health record. Further there was a lack of diversity in our patient population, which is predominately Hispanic, and the sample size was limited.

## CONCLUSIONS

The most frequent indication for dental treatment under GA was extent and severity of the dental disease; although, the majority of patients had complicating medical conditions for GA.

The range of medical comorbidities in this patient population likely reflects the diversity of medical specialty services at Children's Hospital.

Those who were ASA III or IV were older in age compared to those who were ASA I or II and those who were ASA III or IV had more equally distributed insurance carriers and race/ethnicities.

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