

## Study Type: Cross Sectional

### Significant Factors Related to Failed Pediatric Dental General Anesthesia Appointments at a Hospital-based Residency Program

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**Abstract: Purpose:** *The purposes of this study were to: (1) evaluate the relationship between appointment failure and the factors of age, gender, race, insurance type, day of week, scheduled time of surgery, distance traveled, and weather; (2) investigate reasons for failure; and (3) explore the relationships between the factors and reasons for failure. **Methods:** Electronic*

*medical records were accessed to obtain data for patients scheduled for dental care under general anesthesia from May 2012 to May 2015. Factors were analyzed for relation to appointment failure. **Results:** Data from 3,513 appointments for 2,874 children were analyzed. Bivariate associations showed statistically significant ( $P<0.05$ ) relationships between failed appointment and race, insurance type, scheduled time of surgery, distance traveled, snowfall, and temperature. Multinomial regression analysis showed the following associations between factors and the reason for failure ( $P<0.05$ ): (1) decreased temperature and increased snowfall were associated with weather as reason for failure; (2) the African American population showed an association with family barriers; (3) Hispanic families were less likely to give advanced notice; and (4) the “additional races” category showed an association with fasting violation. **Conclusion:** Patients who have treatment under general anesthesia face specific barriers to care.*

**KEYWORDS:** DENTAL, INSURANCE, COMPLIANCE, MEDICAID, GENERAL ANESTHESIA

Failure to keep a patient’s scheduled dental appointment under general anesthesia is a common problem faced by hospitals and ambulatory surgery centers. Failed appointments harm the child by delaying treatment and are costly to the health care system by not using committed resources.<sup>1,2</sup>

Several studies have established a relationship between appointment failure and insurance type. Two studies completed in a pediatric dentistry clinic and a pediatric medicine clinic revealed a direct association between the number of missed appointments and the number of publicly insured patients.<sup>3,4</sup> Fazio showed that patients with public insurance are more likely to fail dental appointments than self-paying patients, and Lamberth established that public insurance patients were three times more likely to fail medical appointments than patients with private insurance in a pediatric medicine clinic.<sup>5,6</sup> This trend has also been demonstrated in a general adolescent dental clinic as well as an orthodontic practice.<sup>7,8</sup> However, in 2014, Mathu-Muju found a different relationship showing that self-paying patients were more likely to fail dental appointments than patients with public or private insurance.<sup>1</sup>

Additional factors other than insurance status can be related to patients failing dental appointments. Cassaverde et al. suggested that patients are less likely to keep a dental appointment if they have a high caries score, exhibit poor behavior, have long wait times between scheduled appointments, have multiple missed appointments, or lack a serviceable telephone.<sup>2</sup> Lindauer et al. showed that patients with delinquent accounts were three times more likely to miss an orthodontic appointment than patients with nondelinquent accounts.<sup>9</sup> Mathu-Muju found that patients were more likely to fail dental appointments if the patient was seen by a resident rather than a faculty member, was older in age, or traveled from a rural area.<sup>1</sup> Other suggested factors associated with failure include the patient being male, the appointment unconfirmed, the patient older in age, and lower education and socioeconomic status of the parent or guardian.<sup>2,9,10,11</sup>

Several studies have explored factors associated with appointment failure in settings such as hospital-based pediatric dental clinics, private practice pediatric dental clinics, pediatric medicine clinics, and orthodontics clinics.<sup>1,3-7,9</sup> However, there are currently no studies that explore the characteristics of dental patients who fail dental appointments for treatment to be completed utilizing general anesthesia. Comprehensive dental care under general anesthesia requires both a facility and resources qualified to safely provide general anesthesia. These resources are expensive, and the patient population is unique. The decision to treat patients under general anesthesia is multifactorial and includes reasons such as the extent of the patient's decay as well as their behavior, medical status, and psychological status.

The purpose of this study was to determine if insurance type, age, gender, race, distance traveled, time of year, time of surgery, and weather are related to failure to maintain scheduled appointments for dental care under general anesthesia. Identification of any association between these factors and reason for failure may lead to a better understanding of the barriers to access care and improve overall scheduling predictability and efficiency.

## **Methods**

The Institutional Review Board of Indiana University, Indianapolis, Ind., USA, approved the study protocol (study no. 1601634691A002). Data from patients scheduled for pediatric dental care under general anesthesia, including the number of visits were retrieved from Cerner (Kansas City, Mo., USA) and Dentrix Enterprise (American Fork, Utah, USA). These are electronic

medical record management systems used at Riley Hospital for Children at Indiana University Health, Indianapolis, and were used to access records and appointment histories. All cases scheduled for pediatric dental care under general anesthesia in the Riley Outpatient Surgery Center were identified from the surgery schedules from the 36-month period between May 1, 2012 and April 30, 2015. The rate of failed appointments was calculated by dividing the number of failed appointments by the number of total appointments in the 36-month period. All personal identifiers were removed from the data file prior to analysis to protect patients' confidentiality. The following demographic and clinical variables were collected from the patient's Cerner electronic chart: insurance type; age; gender; race; day of week; and time of scheduled surgery. Zip code data were extracted from the patient's Dentrax electronic chart. The zip code was entered into Melissadata.com to calculate the distance from the surgery center. The date of surgery was used to obtain weather data from accuweather.com. Average temperature and amount and type of precipitation were recorded.

Each factor was first examined individually for an association with appointment failure using logistic regression. A multiple-variable logistic regression model was then developed using model-selection techniques to create a parsimonious model for prediction of failure. All variables that were individually significant, with *P*-values less than 0.3, were included; then, nonsignificant variables were removed one at a time until only variables with *P*-values less than 0.05 remained in the model. Generalized estimating equation (**GEE**) methods were used for the logistic regression models to account for multiple appointments by some patients. Associations of the factors, with reason for failure, were analyzed using multinomial logistic regression.

## **Results**

Data from 3,513 scheduled visits from 2,874 children were analyzed. The average age was 65.93 months (5.5 years). Fifty-eight percent of the children were male, and 42 percent were female. Eighty-two percent of the children had only a single visit scheduled, 14.3 percent had two, 2.7 percent had three, 0.6 percent had four, and 0.2 percent had five. The overall failure rate was 24 percent. In children with only one visit scheduled, the failure rate was 10 percent. In children with two visits scheduled, 12 percent attended two visits, 77 percent attended one visit, and 11 percent failed both visits. In children with three visits scheduled, four percent attended three visits, 16 percent attended two visits, 61 percent attended one visit, and 19 percent failed all three

visits. In children with four visits scheduled, six percent attended four visits, 24 percent attended two visits, 59 percent attended one visit, and 12 percent failed all four visits. In children with five visits scheduled, 33 percent attended two visits, 50 percent attended one visit, and 17 percent failed all five visits. Characteristics of the visits can be seen in Table 1.

Bivariate associations with failure are illustrated in Table 2. Hispanic patients had a lower risk of failure than African American, Caucasian, and all other additional patient ethnic groups. Within the “additional races” category are the electronic medical records race categories of Asian, Native Hawaiian or other Pacific Island, biracial, American Indian or Alaska Native, Arabic, unknown, and refused to identify. Self-pay patients had a higher risk of failure. Patients scheduled as the fifth or sixth case (the end of the daily schedule) had a higher risk of failure. Distances traveled greater than 60 miles had higher risk of failure. Snowfall greater than 0.5 inches was associated with a higher risk of failure than if there was no snowfall. Risk of failure increased as temperature decreased. Age, sex, day of week, and precipitation other than greater than 0.5 inches of snowfall did not appear to affect failure.

The multivariate model to predict failure is shown in Table 3. The c-statistic for the multivariable model was 0.65, indicating that, while the model is statistically significant, it is probably not useful to predict the failure of individual patients.

Reasons for failure are defined in Table 4. Several factors were associated with specific reasons for failure ( $P < 0.05$ ): the African American population was associated with family barriers; the “additional race” category was associated with fasting violation; and patients of Hispanic ethnicity were associated with less likelihood of giving advanced notice. Temperature and snowfall were the weather conditions most often associated with failure. No other significant associations were found.

## **Discussion**

This study aimed to understand the barriers encountered by patients scheduled for dental care under general anesthesia. By evaluating the factors that increase the likelihood of failed dental appointments under general anesthesia, we can improve our methods of making appropriate decisions for resource commitment as well as gain a greater understanding of the barriers to the population who require this type of treatment.

Although previous studies had revealed a relationship between public insurance and failed appointments, Mathu-Muju established that self-paying patients are more likely to fail their appointments than patients with public or private insurance.<sup>1,3-8</sup> Consistent with the Mathu-Muju study, our results showed that a much greater percentage of self-pay patients fail to appear than patients with public or private insurance.<sup>1</sup> Moreover, our results reveal only minimal differences in the failure rates between privately insured and publicly insured patients. Hence, our results question any refusal to care for patients with public insurance on the basis of a historical propensity for this population to fail to show up for care in this setting.

Previous studies have suggested that a low socioeconomic status is linked to high appointment failure rates.<sup>7,9-12</sup> Moreover, children with public insurance tend to come from socioeconomically challenged families while children without insurance are less likely to use health care services.<sup>13</sup> Our results suggest that children who qualify for public insurance are not at a significant increased risk to fail an appointment when compared to patients with private insurance. Furthermore, our results showed that self-pay patients were more likely to fail. Therefore, our study further supports the expansion of public insurance programs to include more children.

Unlike previous studies, our findings did not suggest that the patient's risk of failing an appointment increases with age.<sup>1,11,14</sup> This is likely due to the unique population seen for dental treatment under general anesthesia. Mathu-Muju suggests that the relationship between age and failed chairside dental appointments is potentially attributable to the growing autonomy of older children.<sup>1</sup> However, autonomy granted to older patients may not play a role when the patient requires general anesthesia. Parents must make the legally binding decision to allow for treatment to be completed in the operating room. The patient's health status or behavior associated with the indication for general anesthesia are fundamentally different when dental appointments occur in ambulatory settings.

Previous studies have revealed that travel distance is directly related to failure rate. While several studies refute this relationship, our results agree with others that indicate this positive correlation.<sup>1,15-18</sup> Our study established a statistically significant difference in failure rates between patients who traveled less than 60 miles and patients who traveled more than 60 miles. This suggests potential transportation and financial barriers associated with traveling longer distances. Further studies are required to evaluate this area more thoroughly.

Some studies have shown that males were more likely to fail appointments.<sup>9,13</sup> However, our study is consistent with Mathu-Muju in showing that there is not a significant relationship between gender and appointment failure.<sup>1</sup> Interestingly, 58 percent of the appointments studied were male patients, while 42 percent were female patients. It is well-known that there is a greater susceptibility of the male gender to be affected by neurodevelopmental disorders, which may explain the trend seen in this population.<sup>19</sup>

This study revealed a relationship between start time and failure. Cases scheduled after 1:30 pm showed a higher likelihood of failure; later start times require a family to follow a less convenient set of fasting guidelines. The analysis did not show an association between start time and fasting violation; however, this may be a limitation of our sample size. A likely explanation for the higher failure rate for the later appointments could be a result of our common scheduling practices. Scheduling administrators typically schedule the patients who they feel are most likely to fail for the end of the scheduled list. This is commonly due to difficulties contacting the patient.

This study aimed to determine if weather influenced failure rate. Interestingly, the bivariate analysis suggested that snowfall and temperature influenced the failure rate; however, the multivariate analysis suggests that it was the temperature that truly influenced the failure rate. Neither the bivariate nor multivariate analysis suggested that precipitation other than snowfall affects failure rate. This relationship has not been previously reported in this setting.

Another goal of this study was to evaluate the reasons a family or a patient may fail a dental appointment scheduled to be performed under general anesthesia (Table 4). The most common event given as the reason for failure evaluation was “no show with advanced notice” (N equals 463). This type of failure occurred when advanced notice of 12 hours or more was obtained prior to appointment failure. The second most common event was “no show without advanced notice” (N equals 152). This occurred when advanced notice and reason for failure were not obtained. It should be noted that this method of reporting no show with advanced notice as failure may have inflated our reported 24 percent failure rate, as the advanced notice often allowed the clinic enough time to schedule another appointment in the time block.

Other reasons for failure, recorded in descending frequency, were: patient sickness (N equals 80); fasting violation (N equals 45); transportation (N equals 25); family reason (N equals 19); insurance/finances (N equals 12); consent (N equals five); weather (N equals five); and other

(N equals seven). Within the “other” category were cancellations due to facility issues such as “power outages” (N equals five); additionally, two families decided not to pursue the surgery, because they sought a second opinion. These reasons for failure help us identify and evaluate specific barriers to care.

Not only were there relationships between the factors with failure, there were also relationships between the factors and the reason for failure. The Hispanic population showed less likelihood of giving advanced notice prior to failure, the African American population revealed an association with citing family barriers (Table 4) as reason for failure, the “additional races” population displayed a relationship to fasting violation, and, predictably, temperature and snowfall were associated with the weather reason for failure.

It is also interesting to note that there were many patients who required multiple appointments within the studied time period. Some of these duplicate events were due to the patient missing or rescheduling multiple times; however, and perhaps more interesting, there were some patients who required multiple surgeries during this time period. Two potential reasons for patients requiring multiple surgeries may be that the patient’s behavior was extremely poor, or the patient’s decay rate was very aggressive. Further investigation into the reason for multiple surgeries is needed.

Not only was the amount of multiple surgeries unexpected, but another limitation to the study may be found in the way these duplicate events were evaluated. We accounted for multiple events for a patient in our analyses; however, there were many different patterns in how a patient failed or maintained an appointment. For example, some patients showed up three consecutive times within the time period, and others failed a single appointment. The number of patients with multiple scheduled appointments was not large enough to explore this further.

Interestingly, a confounding variable within many of these relationships is a communication barrier. The Hispanic population may be less likely to give advanced notice due to difficulty in obtaining translation services. Furthermore, the “additional races” population included the Asian and Burmese populations, which showed a relationship to violating fasting guidelines. When completing care under general anesthesia, it is critical that the patients follow the fasting guidelines; perhaps these directions are difficult to communicate accurately. It should also be noted that, midway through the time period studied, in-person translation services were replaced by telephone translation services. A limited comparison showed that the failure rate of



the second half of the time period was higher than the failure rate of the first half of the time period, and studying the translation service type should be an area for future investigation.

An original goal of this study was to examine the relationship between primary language and failure rate. Although the electronic medical record allowed for the tracking of whether interpretation services were requested prospectively, the tracking was not uniform and consistent. For example, one of the parents in a Spanish-speaking family often was able to communicate in English and may continue to choose to communicate in English, even though the other parent had previously requested translation services. In the current system, the need for translation services is often recorded prospectively and does not necessarily correlate to whether or not a translator was used. Future studies should explore specific relationships between primary language and failure rate.

Although the present study provided an accurate characterization of the profiles of patients who may be more likely to have failed appointments, it was not without limitations. One such limitation was the retrospective collection of the data. For example, the chart review to determine the reason for failure data was limited by the coding practices of the staff and administration. Although documentation was excellent for those patients who showed up at the hospital, sometimes a reason for failure was not obtained by the staff if the patient did not physically appear. Future prospective studies could improve data collection. Similarly, the coding also played a role investigating a possible relationship to a patient's American Society of Anesthesiologists (ASA) physical status classification. We had hoped to evaluate the relationship between ASA class and failure rate; however, patients who did not show up did not receive an ASA classification. A prospective study could be designed to address this issue.

This study identified areas for improved preoperative patient education and aimed to help understand and potentially address specific barriers to access to care as well as lead to more efficient scheduling techniques. In the long-term, this study may serve as a baseline for contrasts, with future interventional strategies aimed at decreasing failure rate. This may not only be useful in evaluating our own dental service; it may also help provide insight into patient behavior by comparing our service to other services, such as cardiology, neurology, ophthalmology, and gastroenterology.

## **Conclusion**

Based on this study's results, the following conclusions can be made:

1. There was a relationship between appointment failure and the factors of race, insurance type, scheduled time of surgery, distance traveled, and temperature.
2. Multiple reasons accounted for a patient not showing up for a dental appointment scheduled under general anesthesia; a better understanding of these reasons may lead to more efficient access to care.
3. There were unique associations between appointment failure and reason for failure that highlight potential cultural and communication barriers, weather barriers, and family barriers.

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Table 1. FREQUENCY DISTRIBUTION OF SOCIODEMOGRAPHIC, ENVIRONMENTAL, AND CLINICAL CHARACTERISTICS OF THE PATIENTS ACROSS ALL APPOINTMENTS, AND APPOINTMENTS KEPT AND FAILED\*

	<b>All visits</b> (N=3,513) N (%)	<b>Failed visits</b> (N=859) N (%)	<b>Kept visits</b> (N=2,654) N (%)
Age (months)†	65.93 (41.76)	65.69 (40.88)	66.01 (42.04)
Race: Caucasian	1,716 (49)	421 (25)	1,295 (75)
African American	755 (21)	197 (26)	558 (74)
Hispanic	512 (15)	91 (18)	421 (82)
Additional races	530 (15)	150 (28)	380 (72)
Sex: Male	2,024 (58)	512 (25)	1,512 (75)
Female	1,489 (42)	347 (23)	1,142 (77)
Insurance: Public	2,915 (83)	674 (23)	2,241 (77)
Private	497 (14)	110 (22)	387 (78)
Self-payers	101 (3)	75 (74)	26 (26)
Start time: 7:30-8:59 a.m.	853 (24)	188 (22)	665 (78)
9:00-10:29 a.m.	866 (25)	187 (22)	679 (78)
10:30-11:59 a.m.	824 (23)	166 (20)	658 (80)
12:00-1:29 p.m.	708 (20)	194 (27)	514 (73)
1:30-5:00 p.m.	262 (7)	124 (47)	138 (53)
Day of week: Monday	702 (20)	185 (26)	517 (74)
Tuesday	40 (1)	9 (23)	31 (78)
Wednesday	577 (16)	152 (26)	425 (74)
Thursday	1,224 (35)	292 (24)	932 (76)
Friday	970 (28)	221 (23)	749 (77)
Distance (miles)	20.67 (28.18)	22.89 (30.40)	19.95 (27.39)
Distance ≥60 miles: No	3,112 (89)	729 (23)	2,383 (77)
Yes	401 (11)	130 (32)	271 (68)
Temperature (°F)†	51.02 (21.36)	47.45 (21.82)	52.18 (21.08)
Precipitation (inches)†	0.11 (0.30)	0.10 (0.28)	0.11 (0.30)

	<b>All visits</b> <b>(N=3,513)</b> <b>N (%)</b>	<b>Failed visits</b> <b>(N=859)</b> <b>N (%)</b>	<b>Kept visits</b> <b>(N=2,654)</b> <b>N (%)</b>
Any precipitation: No	2,308 (66)	555 (24)	1,753 (76)
Yes	1,205 (34)	304 (25)	901 (75)
Snowfall (inches)†	0.10 (0.59)	0.15 (0.71)	0.09 (0.55)
Snowfall: No	3,221 (92)	761 (24)	2,460 (76)
Yes, <0.5”	122 (3)	36 (30)	86 (70)

*\*Percent values for “all visits” are calculated as the % of the total from each category; percent values for “failed visits” and “kept visits” are the % of visits failed or kept within each category.*

*†Mean±(SD)*

Table 2. BIVARIATE LOGISTIC REGRESSION EXAMINING ASSOCIATION OF APPOINTMENT FAILURES WITH SELECTED SOCIODEMOGRAPHIC, ENVIRONMENTAL, AND CLINICAL CHARACTERISTICS OF THE PATIENTS

<b>Factor</b>	<b>P-value</b>	<b>Odds ratio (95% confidence interval)</b>
Age	0.8746	
Race	0.0011	1.62 (1.21, 2.18) Caucasian vs. Hispanic 1.62 (1.18, 2.23) African American vs. Hispanic 1.95 (1.40, 2.70) Additional Races vs Hispanic
Sex	0.1406	
Insurance	<.0001	11.66 (7.02, 19.38)for Self-pay vs. Public 11.79 (6.75, 20.58) Self-pay vs. Private
Start time	<.0001	3.29 (2.35, 4.60) for 1:30-5 p.m. vs. 7:30-8:59 a.m. 3.29 (2.35, 4.60) for 1:30-5 p.m. vs. 9-10:29 a.m. 3.72 (2.63, 5.27) for 1:30-5 p.m. vs. 10:30-11:59 a.m. 2.50 (1.79, 3.48) for 1:30-5 p.m. vs. 12-1:29 p.m. 1.49 (1.11, 2.01) for 12-1:29 p.m. vs. 10:30-11:59 a.m.
Day of week	0.2863	
Distance	<.0001	1.66 (1.31, 2.11) for $\geq 60$ miles vs. <60 miles
Temperature	<.0001	0.81 (0.74, 0.88) per 20°F
Precipitation	0.6033	
Any precipitation	0.5676	
Snowfall	0.0059	1.82 (1.26, 2.63) for $\geq 0.5''$ vs. no snowfall

Table 3. MULTIVARIABLE LOGISTIC REGRESSION (GEE) MODEL OF THE LIKELIHOOD OF AN APPOINTMENT FAILING, WITH SELECTED SOCIODEMOGRAPHIC, ENVIRONMENTAL, AND CLINICAL CHARACTERISTICS OF THE PATIENTS

<b>Factor</b>	<b><i>P</i>-value</b>	<b>Odds ratio (95% confidence interval)</b>
Race	0.0023	1.40 (1.03, 1.91) for Caucasian vs. Hispanic 1.52 (1.10, 2.09) for African American vs. Hispanic, 1.87 (1.34, 2.62) for Additional Races vs. Hispanic 1.34 (1.05, 1.71) for Additional Races vs. Caucasian
Insurance	<.0001	10.72 (6.41, 17.93) for Self-pay vs. Public 11.41 (6.48, 20.10) for Self-pay vs. Private/Additional Races
Start time	<.0001	3.14 (2.21, 4.46) for 1:30p-5:00p vs. 7:30a-8:59a 3.23 (2.27, 4.58) for 1:30p-5:00p vs. 9:00a-10:29a 3.38 (2.37, 4.83) for 1:30p-5:00p vs. 10:30a-11:59a 2.58 (1.82, 3.65) for 1:30p-5:00p vs. 12:00a-1:29p
Distance	0.0003	1.61 (1.25, 2.09) for $\geq 60$ miles vs. < 60 miles
Temperature	<.0001	0.81 (0.74, 0.89) per 20°F

Table 4. OPERATIONAL DEFINITIONS OF THE REASONS RECORDED THAT LED TO A PATIENT FAILING TO ATTEND A SCHEDULED APPOINTMENT

No show without advanced notice	Patient did not show up for appointment on the day of the case; reason was unknown and/or undocumented
No show with advanced notice	Case was rescheduled with prior notice; notice was obtained 12 or more hours prior to case; reason was unknown and/or undocumented
NPO violation	Patient violates fasting guidelines
Patient sick	Patient was sick (asthma, URI, fever, recent emergency room visit); sickness was determined by anesthesia, dental or family
Medical	Rescheduled case due to medical reason (recent seizure, concussion, physician order for echocardiogram or labs, physician's judgement to move case to main operating room)
Family	Family barriers led to case failure or reschedule (patient late, family unaware of appointment date, parent sickness, overslept, parent could not leave work, family emergency)
Insurance/finances	Case not maintained due to insurance or financial reasons
Consent	Case not maintained due to consent reasons
Transportation	Case not maintained due to transportation reasons
Weather	Case not maintained due to weather reasons
Other	Case not completed due to miscellaneous reasons (facility power outage, procedure completed elsewhere, family refused procedure)