

Utilization of Dental Services by Pregnant Women with NC Pregnancy Medicaid at MAHEC

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Abstract

Analyzed data from 98 patients who visited the Dental Clinic at **MAHEC** (Mountain Area Health and Education Center) in Asheville, North Carolina show that women presenting with increased risk factors and transmissible diseases, such as caries, late into their second trimester will continue to be limited to treatment completion and options due to the restrictions set forth by the North Carolina Medicaid dental program if they are not revised by NC policy makers. A significant correlation was found between the number of caries in these pregnant patients and the number of times they visited the dental clinic. Policy expansion should not only be considered imperative to the oral health and well-being of mothers, but rather take into consideration the well-being and preventative services that it should be providing to their unborn children as well.

1. Introduction

Periodontitis, or gum disease, is one of the increased risk factors for pregnant women if left untreated². When ignored, periodontitis can lead to preterm birth, which makes up an estimated 11% of all pregnancies². The Centers for Disease Control and Prevention states that those who are at an increased risk of developing periodontitis include people with poor oral hygiene and females experiencing hormonal changes such as with pregnancy or those who utilize oral contraceptive³.

As of 2019, the North Carolina Medicaid list of high risk indicators that could have an effect on delivery or the child itself does not include dental diseases such as periodontitis. This list of high risk indicators displays the exceptions to the pregnancy-related extensions of Medicaid services to pregnant women. The term “oral health” refers to the well-being and physical state of someone’s mouth, or oral cavity, and can oftentimes be an indicator of health for the rest of the body⁴. Along with periodontitis, dental caries, or more commonly known as cavities, are also considered to be one of the largest threats to a person’s oral health⁴. Dental caries have been identified as the leading chronic disease amongst children as well as one of the most common chronic diseases overall in the United States, showing to be five times more common than asthma and seven times more common than hay fever⁴. When left untreated in pregnant women, dental caries have the potential of being transmitted to the fetus which should ultimately make the treatment of caries in pregnant women a preventative health care service for children⁵.

The North Carolina Medicaid dental program provides coverage for pregnant enrollees up until the day of delivery. However, these pregnant women will remain covered for up to 60 days post delivery, including any days left in the month of which the 60th day falls, for any pregnancy-related or postpartum medical assistance. In a study conducted by the Prenatal Oral Health Program, or pOHP, at UNC Chapel Hill’s dental clinic, Medicaid status of pregnant women was shown to have a positive association with appointment attendance¹. With many women presenting progressed dental diseases late into their second trimester, comprehensive care for these patients is limited to roughly 14 weeks¹. In UNC’s study, 58% of pregnant women were unable to complete their treatment prior to giving birth¹.

Through the service of providing comprehensive dental care and education to pregnant women and new mothers, risks such as dental disease, preterm labor, low birth weight, and transmission of poor dental habits and oral health to their children are reduced⁶. This study will assist in highlighting the importance and urgency of extending the North Carolina Medicaid dental services coverage for pregnant women and will provide further evidence as to how extending coverage will increase the utilization of dental services by pregnant women.

2. Methodology

This is a retrospective cohort study of the utilization of the Mountain Area Health and Education Center, or MAHEC, dental services by pregnant women with NC Pregnancy Medicaid from 2014-2019. Descriptive statistics were utilized to characterize the study population and their treatment patterns using data gathered from medical charts. This study took place at the MAHEC Biltmore Campus. The data collected were stored and protected in a secure database application, REDCap, that is HIPAA compliant to reduce the already minimal risk of loss of patient confidentiality. Patient identifiers were flagged as such to ensure that any data exportation, as applicable, will protect confidentiality. To comply with these stipulations, data management and quantitative analysis was carried out by the research team at the MAHEC Biltmore Campus.

Frequency counts were charted for the location by city and zip code of the patient, age of patient at first visit, periodontitis diagnosis, treatment type at each visit, total number of visits, patient return rate, number of missing teeth, and number of fractured teeth. Distribution of data was collected and graphed for number of available treatment days, age at first visit, total payment in dollars, average payment in dollars, payment at initial visit in dollars, payment at first, second, and third treatment visit in dollars, number of caries, number of missing teeth, and number of fractured teeth.

Periodontitis diagnosis was categorized by three types based on probing depths recorded by dentists at the MAHEC dental clinic during comprehensive exams or periodontal cleanings. The number of fractured and missing teeth was recorded by dentists at the MAHEC dental clinic during most comprehensive exams and treatments. The total payment for each visit was either covered by North Carolina Pregnancy Medicaid or paid for out-of-pocket by the patient depending on the specific treatments coverage.

3. Data

Roughly 35 out of 98 patients were found to only have demographic data and no treatment or visit data; therefore, the available sample size varied based on the variable that was measured.

3.1. Mean, Median, and Standard Deviation by Variable

Simple statistics were calculated for distance traveled based on zip code (zip_distance), age at first visit (age_first_visit), total number of visits (visit_count), available treatment days (avl_tx_days), number of caries (caries), number of fractured teeth (fx_teeth), number of missing teeth (mx_teeth), total payment (total_pay), average payment (avg_pay), payment for the initial visit (pay_first), and payment for first (pay_first), second (tx_two_pay), and third (tx_three_pay) treatment visits (Table 1).

Table 1. Simple Statistics by Variable

Variable	N	Mean	Std Dev	Median	# Missing	Minimum	Maximum
zip_distance	98	10.24	9.77	5.40	0	0	54.30
age_first_vst	98	27.75	4.74	27.00	0	19.00	39.00
visit_count	98	2.56	1.49	2.00	0	1.00	7.00
avl_tx_days	98	104.06	56.99	105.00	0	16.00	231.00
caries	94	7.18	5.34	7.00	4	0	22.00
fx_teeth	89	0.57	1.23	0	9	0	8.00
mx_teeth	89	1.11	2.43	0	9	0	13.00
total_pay	76	259.08	274.02	161.70	22	34.94	1220.80
avg_pay	76	82.77	79.28	71.21	22	17.47	610.40
pay_first	98	126.92	140.22	119.31	0	0	1318.20
tx_one_pay	76	90.88	147.43	39.83	22	0	1220.80
tx_two_pay	39	150.26	88.16	111.18	59	0	365.00
tx_three_pay	21	145.89	87.25	114.21	77	55.59	400.32

3.2 Frequency Counts & Data Distribution

3.2.1 *location of patients*

Table 2. Frequency Count for Miles Traveled Based on Zip Code of the Patients

Miles Traveled Based on Zip Code	# of Patients	Percent	Cumulative Frequency	Cumulative Percent
10 or Less	64	65.31	64	65.31
10-20	20	20.41	84	85.71
More than 20	14	14.29	98	100.00

Table 3. Number of Patients by City of Residence

Patient City				
City (in North Carolina)	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Alexander	1	1.02	1	1.02
Arden	6	6.12	7	7.14
Asheville	47	47.96	54	55.10
Black Mountain	3	3.06	57	58.16
Brevard	1	1.02	58	59.18
Bryson City	1	1.02	59	60.20
Burnsville	3	3.06	62	63.27
Candler	6	6.12	68	69.39
Canton	3	3.06	71	72.45
Clyde	2	2.04	73	74.49
East Flat Rock	1	1.02	74	75.51

Fairview	1	1.02	75	76.53
Flat Rock	1	1.02	76	77.55
Hendersonville	4	4.08	80	81.63
Hot Springs	2	2.04	82	83.67
Lake Toxaway	1	1.02	83	84.69
Leicester	2	2.04	85	86.73
Mars Hill	1	1.02	86	87.76
Marshall	1	1.02	87	88.78
Mills River	1	1.02	88	89.80
Pisgah Forest	1	1.02	89	90.82
Swannanoa	4	4.08	93	94.90
Weaverville	4	4.08	97	98.98
Whittier	1	1.02	98	100.00

The distance in miles traveled was calculated by measuring the distance from the centroid of each zip code to the centroid of MAHEC's zip code. The vast majority, approximately 65%, of pregnant patients with North Carolina Pregnancy Medicaid coming to the dental clinic live within 10 miles of MAHEC's zip code (Table 2). Roughly 15% of patients live more than 20 miles away.

Roughly 48% of pregnant patients with North Carolina Pregnancy Medicaid visiting the dental clinic at MAHEC reside within Asheville city limits (Table 3). It can also be noted that the majority of patients who did not reside within Asheville city limits were located in neighboring cities including Arden (6.12%), Candler (6.12%), Hendersonville (4.08%), Swannanoa (4.08%), and Weaverville (4.08%).

3.2.2 age of patient at first visit

Table 4. Number of Patients by Age at First Visit

Age of Patient at First Visit	Frequency	Percent	Cumulative Frequency	Cumulative Percent
19	2	2.04	2	2.04
20	3	3.06	5	5.10
21	4	4.08	9	9.18
22	3	3.06	12	12.24
23	11	11.22	23	23.47
24	1	1.02	24	24.49
25	4	4.08	28	28.57
26	14	14.29	42	42.86
27	8	8.16	50	51.02
28	9	9.18	59	60.20
29	5	5.10	64	65.31
30	10	10.20	74	75.51
31	7	7.14	81	82.65
32	4	4.08	85	86.73
33	1	1.02	86	87.76
34	2	2.04	88	89.80
35	2	2.04	90	91.84
36	1	1.02	91	92.86

37	3	3.06	94	95.92
38	1	1.02	95	96.94
39	3	3.06	98	100.00

The age at first visit for the majority of North Carolina Pregnancy Medicaid patients that were seen at the MAHEC dental clinic ranged from 23 years to 31 years (Table 4). Roughly 11% of these patients were 24 years old, 14 % were 26 years old, and 10% were 30 years old. There was a mean age of 27 years with a standard deviation of 4 years (Table 1).

3.2.3 periodontitis diagnosis

Table 5. Number of patients by Periodontitis Diagnosis

Periodontitis Diagnosis				
Periodontitis Diagnosis	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Type 1	62	83.78	62	83.78
Type 2	10	13.51	72	97.30
Type 3	2	2.70	74	100.00
Frequency Missing = 24				

Since not every patient had a comprehensive exam or periodontal cleaning, we lack data for 24 patients who did not have any periodontal diagnosis data.

Approximately 84% of the North Carolina Pregnancy Medicaid patients seen at the MAHEC dental clinic presented with a Type 1 periodontitis diagnosis and only 2.7% of patients presented with a more serious, Type 3 diagnosis (Table 5).

3.2.4 distribution of caries

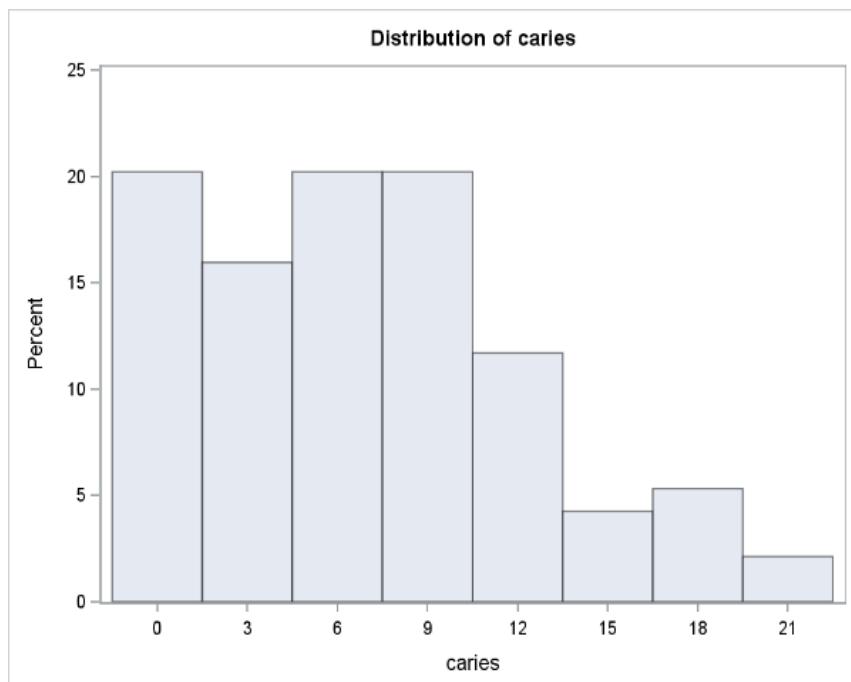


Figure 1. Data Distribution for the Number of Caries

The distribution of caries is slightly skewed to the right with major outliers at 21 and 22 caries (Figure 1). The average and median number of caries was about 7 with a standard deviation of 5 (Table 1).

3.2.5 number of fractured teeth

Table 6. Frequency Count for Number of Fractured Teeth

Fractured Teeth				
Number of Fractured Teeth	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	60	67.42	60	67.42
1	21	23.60	81	91.01
2	3	3.37	84	94.38
3	1	1.12	85	95.51
4	2	2.25	87	97.75
5	1	1.12	88	98.88
8	1	1.12	89	100.00
Frequency Missing = 9				

Exceptions to this data being recorded can include emergency visits or other areas of concern being primarily addressed by the patient leading to missing data points.

67.42% of the North Carolina Pregnancy Medicaid patients presented with no fractured teeth, 23.6% presented with one fractured tooth, and 8.98% presented with multiple fractured teeth (Table 6). Figure 3 shows that the data is heavily skewed to the right with one major outlier of a single patient with eight missing teeth. There was a mean of 0.57 with a standard deviation of 1.23 fractured teeth (Table 1).

3.2.6 number of missing teeth

Table 7. Frequency Count for Number of Missing Teeth

Missing Teeth				
Number of Missing Teeth	Frequency	Percent	Cumulative Frequency	Cumulative Percent
0	52	58.43	52	58.43
1	18	20.22	70	78.65
2	11	12.36	81	91.01
3	1	1.12	82	92.13
4	3	3.37	85	95.51
5	1	1.12	86	96.63
12	1	1.12	87	97.75
13	2	2.25	89	100.00
Frequency Missing = 9				

Patients who had an extraction performed during a treatment visit would have their number of teeth extracted count towards their number of missing teeth. Third molars #1, #16, #17, and #32 were not counted as missing if they had previously been extracted or were to be extracted during a treatment visit.

58.43% of the North Carolina Pregnancy Medicaid patients presented with no missing teeth, 20.22% presented with one missing tooth, and 21.35% presented with multiple missing teeth (Table 7). There was a mean of 1.11 and a standard deviation of 2.42 missing teeth (Table 1).

3.2.7 treatments at each visit

Table 8. Frequency Count for Treatment at Initial Visit

Treatment at Initial Visit				
Treatment at Initial Visit	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Cleaning	1	1.03	1	1.03
Composites	1	1.03	2	2.06
Limited Comprehensive Exam	37	38.14	39	40.21
New Patient Visit	48	49.48	87	89.69
Periodic Exam	9	9.28	96	98.97
Periodontal Cleaning	1	1.03	97	100.00
Frequency Missing = 1				

Table 9. Frequency Count for Treatment Received at First Treatment Visit

First Treatment Visit				
Treatment Received:	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Cleaning	41	54.67	41	54.67
Composites	9	12.00	50	66.67
Extraction	16	21.33	66	88.00
Periodontal Cleaning	8	10.67	74	98.67
Root Canal	1	1.33	75	100.00
Frequency Missing = 23				

Table 10. Frequency Count for Treatment Received at Second Treatment Visit

Second Treatment Visit				
Treatment Received:	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Cleaning	6	15.38	6	15.38
Composites	26	66.67	32	82.05
Extraction	3	7.69	35	89.74
Periodontal Cleaning	4	10.26	39	100.00
Frequency Missing = 59				

Table 11. Frequency Count for Treatment Received at Third Treatment Visit

Third Treatment Visit				
Treatment Received:	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Cleaning	2	9.52	2	9.52
Composites	14	66.67	16	76.19
Extraction	3	14.29	19	90.48
Periodontal Cleaning	2	9.52	21	100.00
Frequency Missing = 77				

Data was taken for treatment received for one initial visit and up to seven treatment visits. It can be inferred with a missing frequency of 77, that the majority of patients either did not return for or did not need any further treatment past a third treatment visit. The treatment at initial visit constitutes the reason for a patient coming to the dental clinic for the first time.

The majority of North Carolina Pregnancy Medicaid patients were seen for the first time at the dental clinic to either establish a dental home with a New Patient Visit (49.48%) or for a Limited Comprehensive Exam (38.14%) which is a general label used for most emergency visits (Table 8). Roughly 55% percent of patients who returned for treatment after their initial visit had a cleaning performed and 21.33% of those who returned had an extraction (Table 9). 66.67% of patients who returned for a second and third treatment received composites (Tables 10 and 11).

3.2.8 number of available treatment days

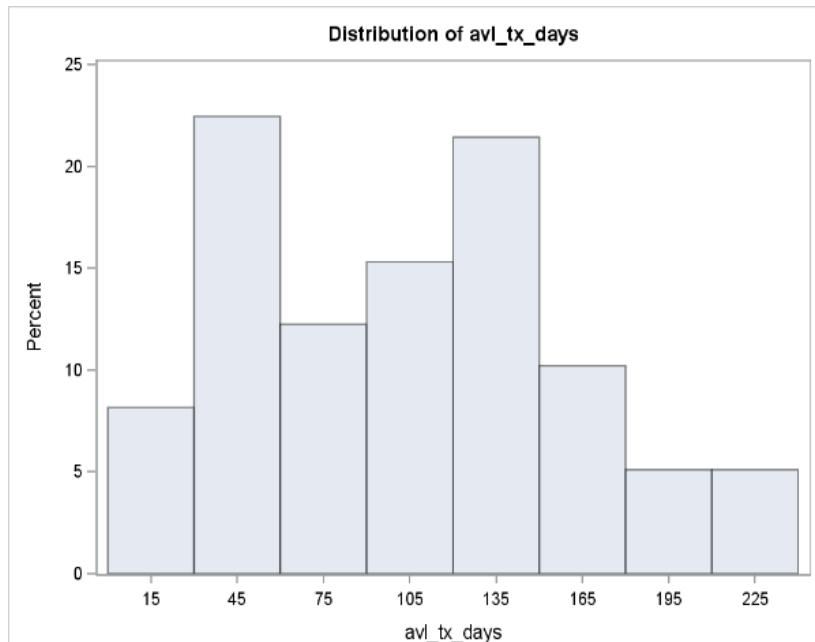


Figure 2. Data Distribution for the Number of Available Treatment Days

There is a bimodal distribution of the data with no real outliers (Figure 2). The data shows a mean of 104, a standard deviation of 57, and a median of 105 available treatment days (Table 1). These numbers were calculated by subtracting the date of first visit from the patients estimated due date.

3.2.9 total number of visits

Table 12. Frequency Count for the Total Number of Visits

Total Number of Visits				
Total Number of Visits	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	25	25.51	25	25.51
2	33	33.67	58	59.18
3	21	21.43	79	80.61
4	6	6.12	85	86.73
5	7	7.14	92	93.88
6	4	4.08	96	97.96
7	2	2.04	98	100.00

Roughly 80.61% of the North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic have between one and three visits (Table 12). There was a mean of 2.5 visits and a standard deviation of 1.5, respectively (Table 1).

3.2.10 distribution of payments by visit

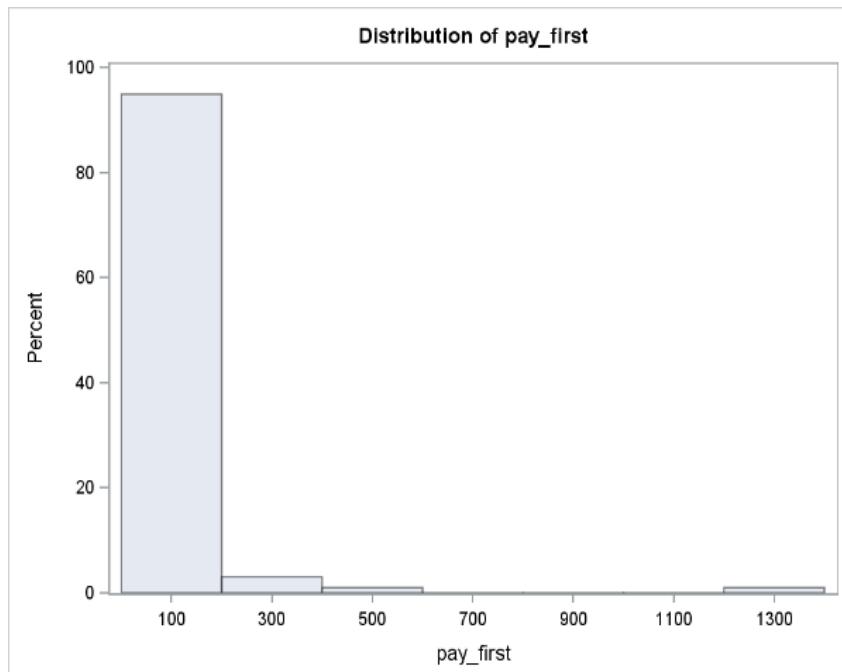


Figure 3. Data Distribution for Payment at Initial Visit

The distribution of data is heavily skewed to the right with an outlier at approximately \$1300 (Figure 3). This outlier could potentially be owed to the occurrence of an emergency department case or an out-of-pocket payment for a root canal or other miscellaneous treatment. There was a mean of about \$127 and a median of \$119 for the initial visit of North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic (Table 1).

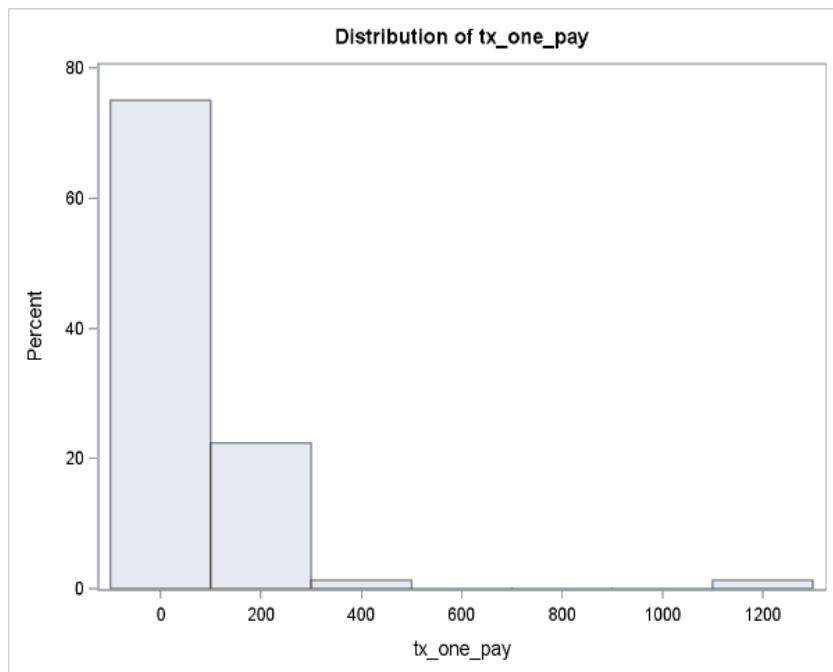


Figure 4. Data Distribution for Payment at First Treatment Visit

The distribution of data is heavily skewed to the right with an outlier at approximately \$1200 (Figure 4). This outlier could potentially be owed to the occurrence of an emergency department case or an out-of-pocket payment for a root canal or other miscellaneous treatment. There was a mean of about \$91 and a median of \$40 for the first treatment visit of North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic (Table 1).

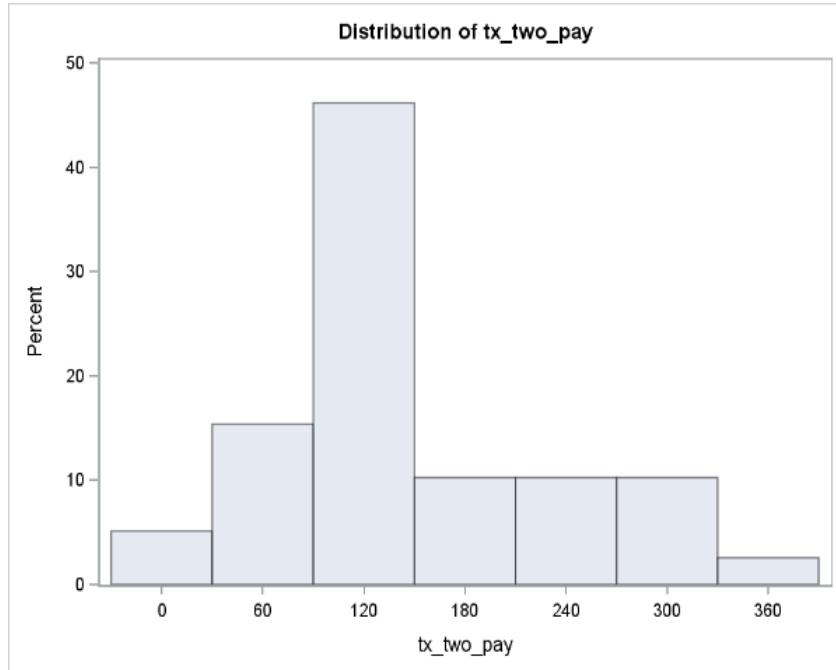


Figure 5. Data Distribution for Payment at Second Treatment Visit

There is a unimodal distribution of data that is slightly skewed to the right with no real outliers (Figure 5). There was a mean of about \$150 and a median of \$111 for the second treatment visit of North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic (Table 1).

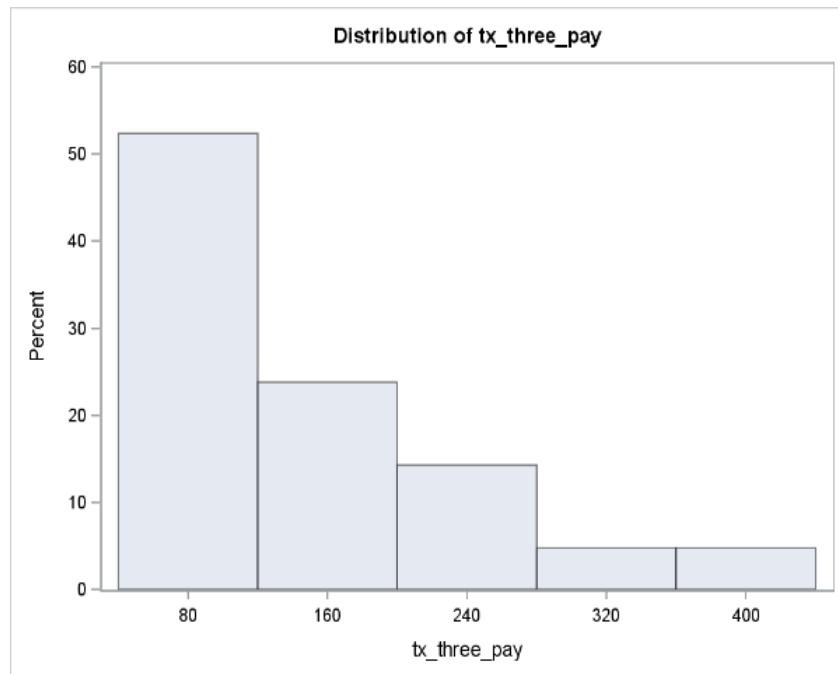


Figure 6. Data Distribution for Payment at Third Treatment Visit

There is a unimodal distribution of data that is skewed to the right with no real outliers (Figure 67). There was a mean of about \$145 and a median of \$114 for the third treatment visit of North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic (Table 1).

3.2.11 distribution of average pay and total pay

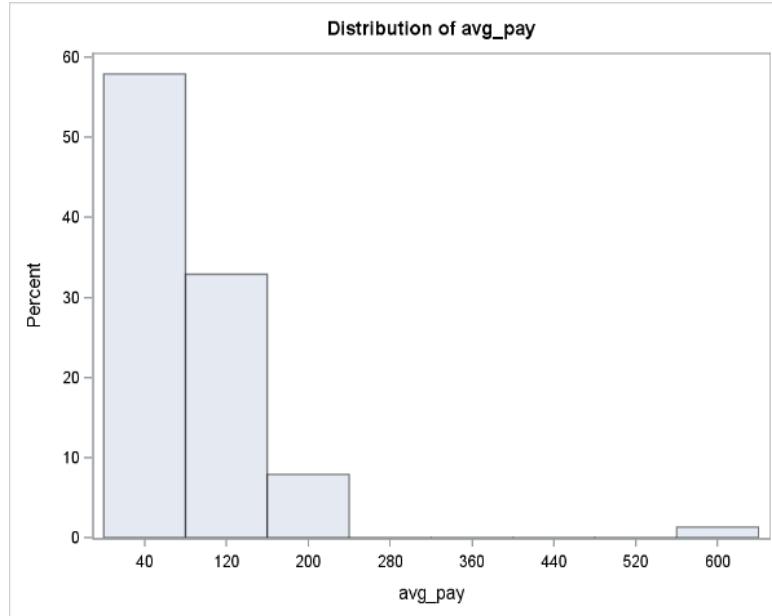


Figure 7. Data Distribution for Average Payment

The distribution of data is heavily skewed to the right causing the average payment per treatment visit to fall largely between \$20 and \$40 (Figure 7). This figure also shows an outlier at approximately \$600, which could potentially be

owed to the occurrence of an emergency department case or an out-of-pocket payment for a root canal or other miscellaneous treatment. There was a mean of \$82.77 paid per visit for the North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic (Table 1).

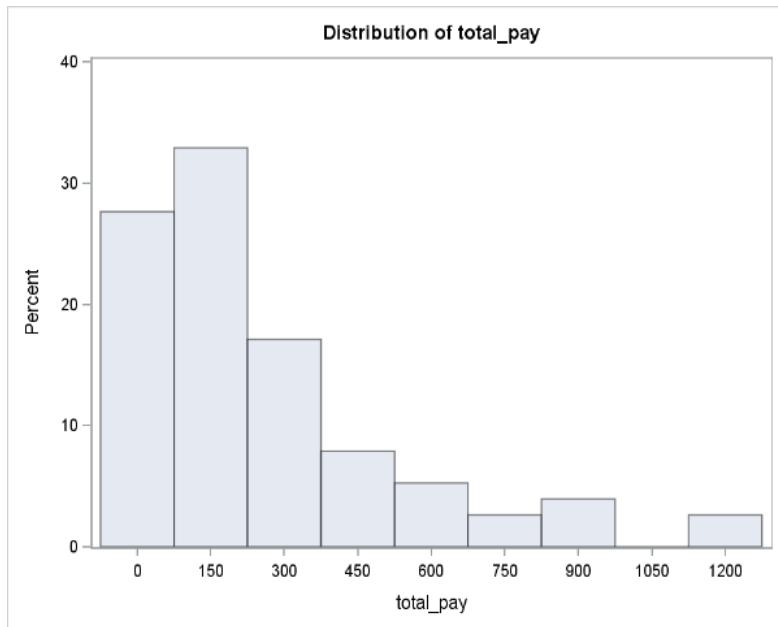


Figure 8. Data Distribution for Total Payment

The distribution of data is heavily skewed to the right with an outlier at approximately \$1200 (Figure 8). This outlier could potentially be owed to the occurrence of an emergency department case or an out-of-pocket payment for a root canal or other miscellaneous treatment. There was a median of \$161.70 for the total payment of North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic (Table 1). The total payment for each patient was largely between \$0 and \$300 (Figure 8).

3.2.12 patient return rates

Table 13. Frequency Count for Patient Return Rates

Patient Return Rates				
Did the Patient Return Within a Year?	Frequency	Percent	Cumulative Frequency	Cumulative Percent
No	46	46.94	46	46.94
Unknown	39	39.80	85	86.73
Yes	13	13.27	98	100.00

This data was determined by checking to see if the patient had returned (Yes) or failed to return (No) within a year of their last visit during their pregnancy. If a patient's data was collected before a year had passed since their last visit, they were marked as "Unknown".

Table 13 shows that 46.94% of the North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic did not return within a year. These patients either never returned or returned after the one year mark had passed. 39.80% of patients still fall within the one year mark, and 13.27% returned at least once within a year after their last visit during pregnancy.

3.3 Correlation Analysis

Correlation analysis was performed for age at first visit, number of visits, number of caries, and distance by zip code.

Table 14. Correlation Analysis of Variables

		Pearson Correlation Coefficients			
		Prob > r under H0: Rho=0			
		Number of Observations			
		age_first_vst	visit_count	caries	zip_distance
age_first_vst		1.00	-0.02	-0.02	0.03
		98	98	94	98
visit_count	visit_count	-0.02	1.00	0.33	0.06
		0.86		0.0013	0.56
		98	98	94	98
caries	caries	-0.02	0.33	1.00	0.16
		0.85	0.0013		0.12
		94	94	94	94
zip_distance		0.03	0.06	0.16	1.00
		0.76	0.56	0.12	
		98	98	94	98

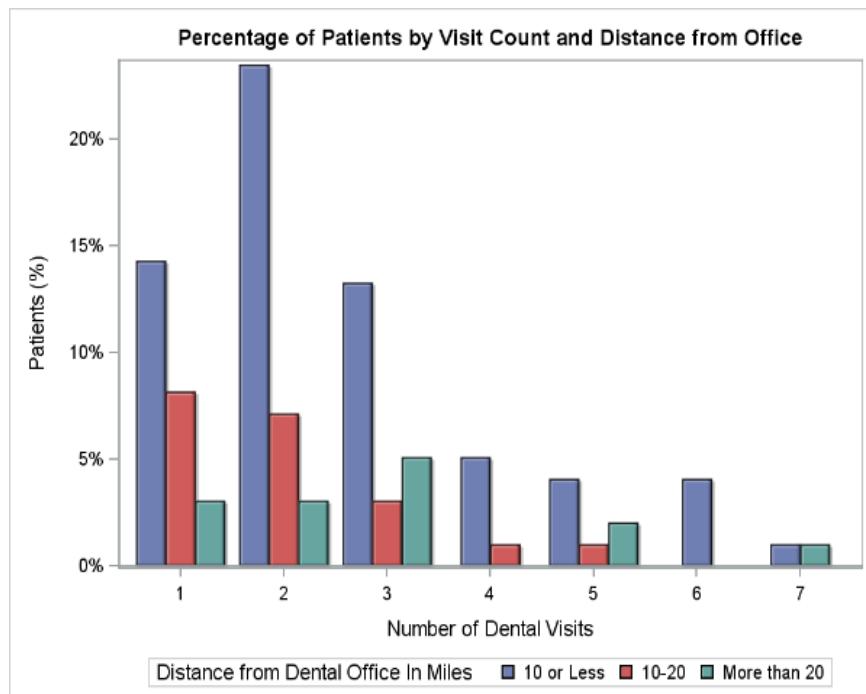


Figure 9. Percentage of Patients by Visit Count and Distance from MAHEC Office

The patients age at the first visit was not significantly correlated to the total number of visits ($p = 0.86$), the number of caries ($p = 0.85$), or the distance traveled ($p = 0.76$) (Table 14). The distance traveled was not significantly correlated

with the total number of visits ($p = 0.56$) or the number of caries ($p = 0.12$) (Table 14; Figure 9). However, there was a significant correlation between the number of caries and the total number of visits ($p = 0.0013$) (Table 14).

4. Conclusion

The location of patients help reiterate the urgency and need for establishing more Medicaid providers in rural areas of North Carolina (Tables 2 and 3). Being one of two providers who accept Medicaid in the Asheville, North Carolina region, the vast majority of the North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic reside within 10 miles of the office. Periodontitis diagnoses were shown to have a relatively normal distribution with few severe cases amongst our patient population in this sample, though some patients did not have any data points for this variable.

The average number of caries for the North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic was 7. This means that out of the 32 adult teeth that a patient has, the average patient from our sample presented with roughly 22% of their teeth being classified as carious. Composites, used to treat caries, were shown to be the leading treatment that patients returned for after their first treatment visit (Tables 10 and 11). There was a significant correlation ($p = 0.0013$) between the number of caries a patient has and their total number of visits (Table 14). Therefore, the more caries a patient has, the more treatment visits they will likely attend. This correlation is crucial to expansion of the North Carolina Pregnancy Medicaid policy because it recapitulates the need for mothers to have their caries treated so as they won't be transmitted to their baby. This correlation also goes to show that mothers who have caries and need to have them treated are more likely to attend and commit to treatment visits. The results from this research also show that most women are coming to the MAHEC Dental Clinic with the North Carolina Pregnancy Medicaid at least halfway through their pregnancy. Expanding and extending these policies will extend the number of available treatment days, allowing the mother to finish the treatment she had already committed herself to without fear of losing coverage. Women presenting with increased risk late into their second trimester will continue to be limited to treatment completion due to the restrictions set forth by the North Carolina Medicaid dental program¹.

The initial treatment visits were shown predominantly as being either a new patient visit, which is the first step in establishing a dental home, or as a limited comprehensive exam which generally refers to an emergency service visit (Table 8). The North Carolina Pregnancy Medicaid patients coming to the MAHEC Dental Clinic for a limited comprehensive exam are likely coming in to quickly address issues such as pain or discomfort related to one or multiple teeth. Treatments for patients coming in for a limited exam can include invasive, such as extractions, or non-invasive, such as medications, options. Root canals are a common treatment not covered by North Carolina Pregnancy Medicaid that could potentially be utilized during a limited comprehensive exam to save teeth and treat pain and discomfort as opposed to extractions⁷.

The return rate of North Carolina Pregnancy Medicaid patients seen at the MAHEC Dental Clinic was substantially lower than it ideally should be since the American Dental Association recommends dental visits at least once a year⁸. Though the cause for such a small return rate is unknown, it is not arbitrary to suggest that the loss of dental healthcare coverage and the unaffordable cost of services could be a factor for some of these patients⁹. The expansion and extension of North Carolina Pregnancy Medicaid coverage could be a crucial proponent in reversing these unfortunate rates¹⁰. Medicaid providers play an important role in making changes to these policies that will allow future generations to have dental homes, be well-educated enough on how to practice good oral health habits, and have an overall better quality of life for it¹¹. Providing expecting mothers with healthcare services should be held to the same policy standards and expectations as providing preventative healthcare services to their children¹².

5. Acknowledgements

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6. References

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