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Common Factors in Unplanned Cesarean Section

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By

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Introduction

Obstetrical delivery by cesarean section is a prevalent form of delivery. Whether clinically indicated or by maternal request, cesarean delivery rates in the United States have risen to account for over a third of all deliveries. Cesarean section procedures are often clinically indicated and occur because of fetal factors, but they can also be elected by maternal request. A clinically indicated cesarean section has many contributing factors. Some of these factors are modifiable while some factors are not. What factors contribute to this unplanned cesarean section? Is there a way to prevent or monitor patients with these factors so a safer, more controlled procedure can take place?

Literature Review

Cesarean section childbirth, an alternative to vaginal delivery, presently accounts for approximately 30% of all deliveries in the United States (11). It also has become the most common surgical procedure in the country. According to previous studies, the most common indications for all cesarean procedures (scheduled, unplanned, or emergent) include both fetal factors and maternal factors such as previous cesareans and elective request (1,3,4,10,13,16). Indications that lead to emergent or unplanned cesarean sections are often fetal factors such as fetal distress, non-reassuring heart tones, and malpresentation (1,3,4,10,13,16). Other emergent cesarean sections can occur as a result of maternal complications at the onset of labor, such as preeclampsia-ecclampsia, gestational diabetes mellitus, placenta previa, and placental abruption (15). One study stated that statistically, nulliparous woman were at increased risk for unplanned cesarean sections when compared to women who had previous deliveries (7). The cause for the correlation between nulliparous women and cesarean rates is unknown, and more research should be done in this area. Other contributing factors to unplanned cesarean sections include time of day, gestational age, type of augmentation, and race (2,5,6,8,9,12,13,17). Furthermore, a fetus at an early gestational age delivered via cesarean section has a higher risk for morbidity and mortality, related to immature development (5,6,9). This hinders the infant's ability to transition to extra uterine life, leading to more complications post-delivery for that infant. According to one study, the time of the procedure greatly affects the maternal outcome, associating a night time procedure with higher maternal morbidity rates and longer operative times which can also lead to further complications (12). More unplanned and emergent cesarean sections occur during the night, while most planned procedures occur during the day. This finding contributes to the suggestion that more complications arise at night simply because the procedures are more urgent and night shift staff are less prepared (12). Another study demonstrated the effect of racial and ethnic differences on the mode of delivery, proposing that different races are at increased risk for cesarean section presenting with different indications (2,14,17). The evidence displayed women with normal birth weight infants who were African American and Latino were at an increased risk for cesarean section when compared to other races (2,14,17).

The aims of this study are to analyze the frequency of the factors listed below in the study questions that are associated with unplanned cesarean section procedures and to compare the frequency of these factors per cesarean section with the time of day the cesarean section procedure occurred.

Study Questions

1. What is the frequency of time, race, gravida/para, gestational age, previous cesarean sections, labor type, augmentation, and indication as it relates to unplanned cesarean section procedures?

2. When using a multiple linear regression, can factors such as race, gravida/para, gestational age, previous cesarean sections, labor type, augmentation, and indication statistically significantly predict the time of day an unplanned cesarean section is likely to occur?

Methodology

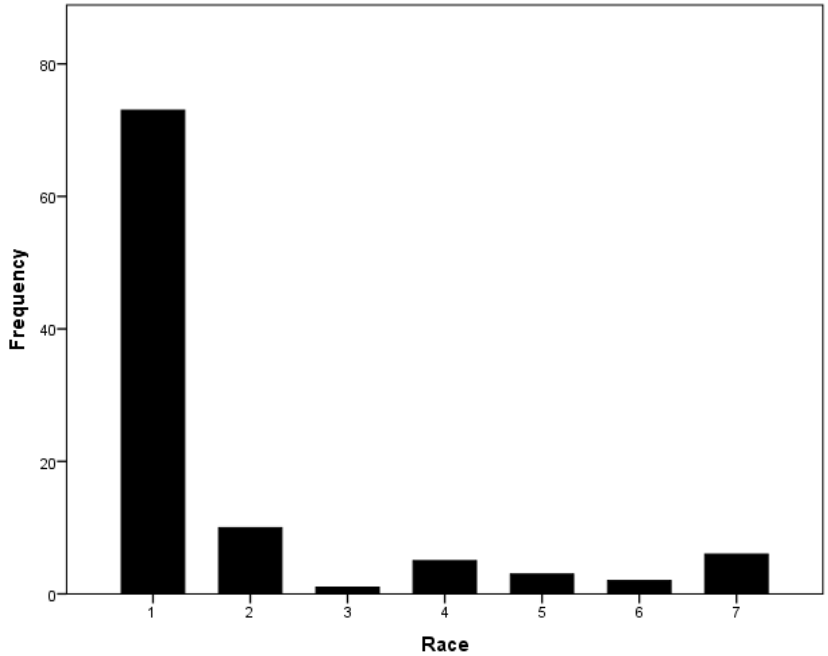
This study was performed following approval by the University of Arkansas Institutional Review Board and Washington Regional Medical Center Quality Assurance Department. The design of this study was a retrospective study using existing data obtained from the electronic medical records of patients who received an unplanned cesarean section between January 1st, 2014 and December 31st, 2014. The specific factors of time of day, race, labor type, augmentation, previous cesarean section, indication of procedure, gravida/para, and gestational age were evaluated to determine if the presence of these factors contribute to a maternal risk for an unplanned cesarean section. This data collected from these charts was statistically analyzed to determine commonalities between each group and to determine a statistically significant link between them. All patient information was de-identified according to the Health Insurance Portability and Accountability Act (HIPAA). All electronic medical records reviewed were given a random number as an identifier. Therefore, once the medical record was reviewed, there was not a way to identify the data collected to the patient. All data was kept on a password protected computer. All data was reported in the aggregate. Patient demographics (e.g., age, race, number of previous deliveries, number of previous cesarean sections, prenatal care, payer status) and risk factors for obstetrical delivery by cesarean section were collected.

Statistical Analysis

Demographic data was analyzed with descriptive statistics (frequencies, means, standard deviations, medians, and interquartile ranges). A multiple linear regression analysis was conducted to evaluate the prediction of time from race, gravida, para, gestational age, labor type, indication augmentation, and repeat cesarean sections for indications for unplanned cesarean sections.

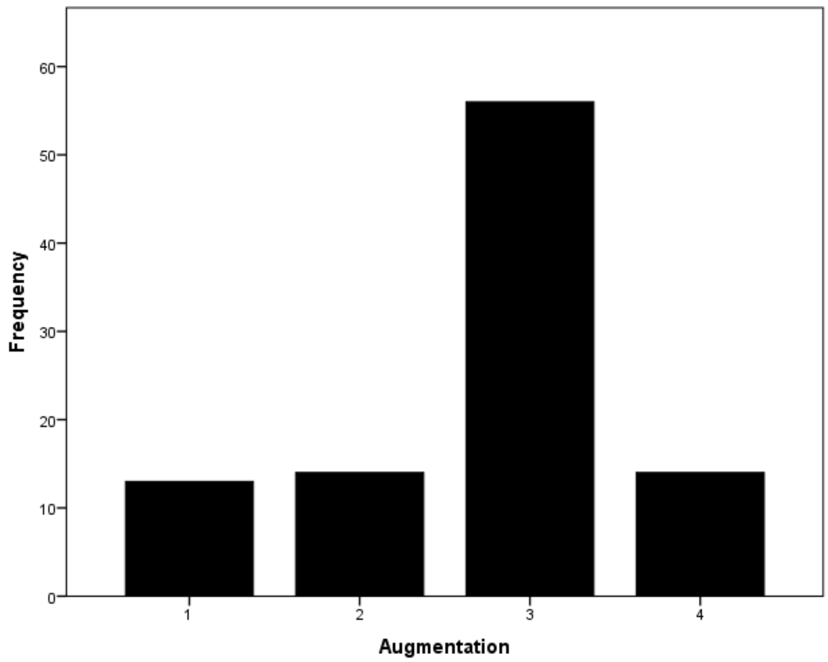
Results

Between January 1st, 2014 and December 31st, 2014 a total of 295 unplanned cesarean sections were performed at Washington Regional Medical Center. From these 295 procedures, a retrospective sample of 100 charts was selected at random for review. A study of frequencies revealed the following data. The majority of this sample was Caucasian (73%), followed by Hispanic (10%), and the remaining a collection of Asian, African American, Pacific Islander, Marshallese, and other/ non specified (17%). This information is represented by the graph below.



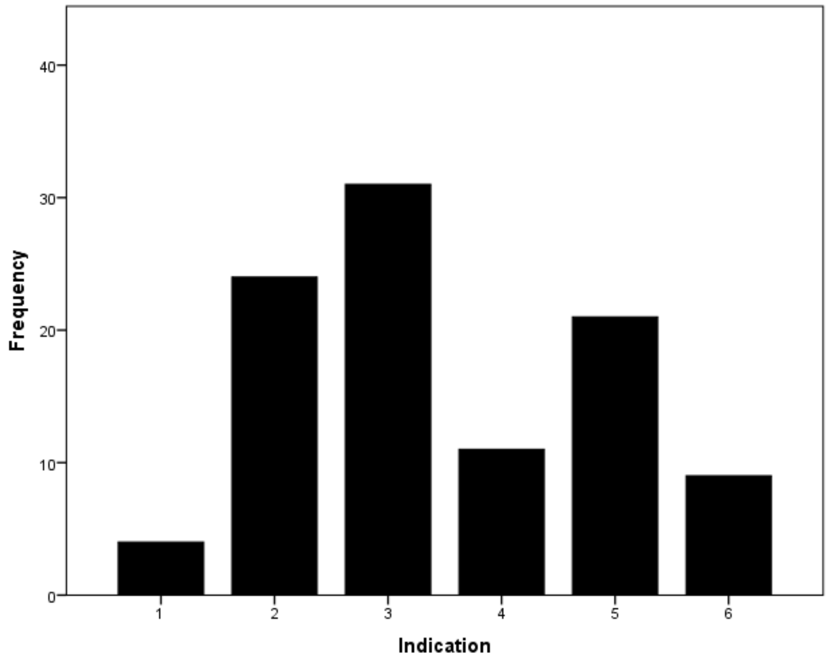
Graph represents frequency of each race identified in the study. Along the X axis the numbers indicate the specific ethnicity: 1. Caucasian 2. Hispanic 3. Asian/ Oriental 4. African American 5. Pacific Islander 6. Marshallese 7. Other/ Not specified.

A number of less than four gravida comprised 89% of the sample, with one gravida being 38% of that. Para, in connection with gravida, also revealed a number less than four accounted for the majority of this sample at 94%, with one para being 45% of that number. At 64.8% the majority of this sample was not undergoing a repeat cesarean section. Gestation age frequency was divided into groups based on the definition of term. Less than 37 weeks is considered pre-term and accounted for 23% of this sample. 37- 38 weeks is considered early term and accounted for 43% of this sample. 39-40 weeks is considered full term and accounted for 32% of this sample. In this full term category, 39.86 was the highest frequency at 8%. 41-41 and 6/7 weeks is considered late term and accounted for 1% of this sample. Finally, 42 + weeks is considered post term and accounted for 1% of this sample. An analysis of labor type revealed 52.5% of the sample was in spontaneous labor, 24.2% was in medically induced labor, and 13.1% was in elective labor. During labor 57.7% had no augmentation, 13.4% of the sample were augmented with Pitocin, 14.4% augmented with AROM, and 14.4% augmented with both Pitocin and AROM. The results from this frequency are displayed in the graph below.



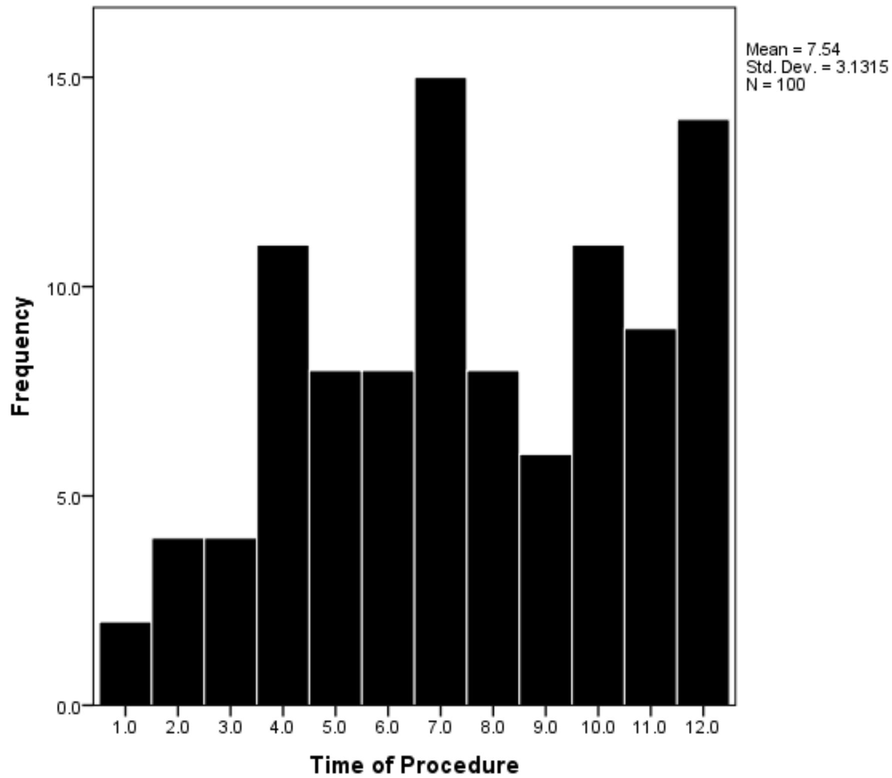
Graph represents the frequency of each augmentation measure in the sample. Where the numbers represent 1. Pitocin 2. Artificial rupture of membranes 3. No augmentation 4. Use of both Pitocin and AROM

Different from labor type (reason by which the patient went into labor) is the indication type (reason the patient had to undergo unplanned cesarean section). The indication signifies the reason for the unplanned procedure to occur. Slightly less than a third of the occurrences, at the largest percentage of 31%, the procedure was performed due to fetal indications. The second majority at 24% occurred due to a previous cesarean section. And thirdly, 21% of the procedures occurred due the arrest of labor. The graph below displays this frequency of indication.



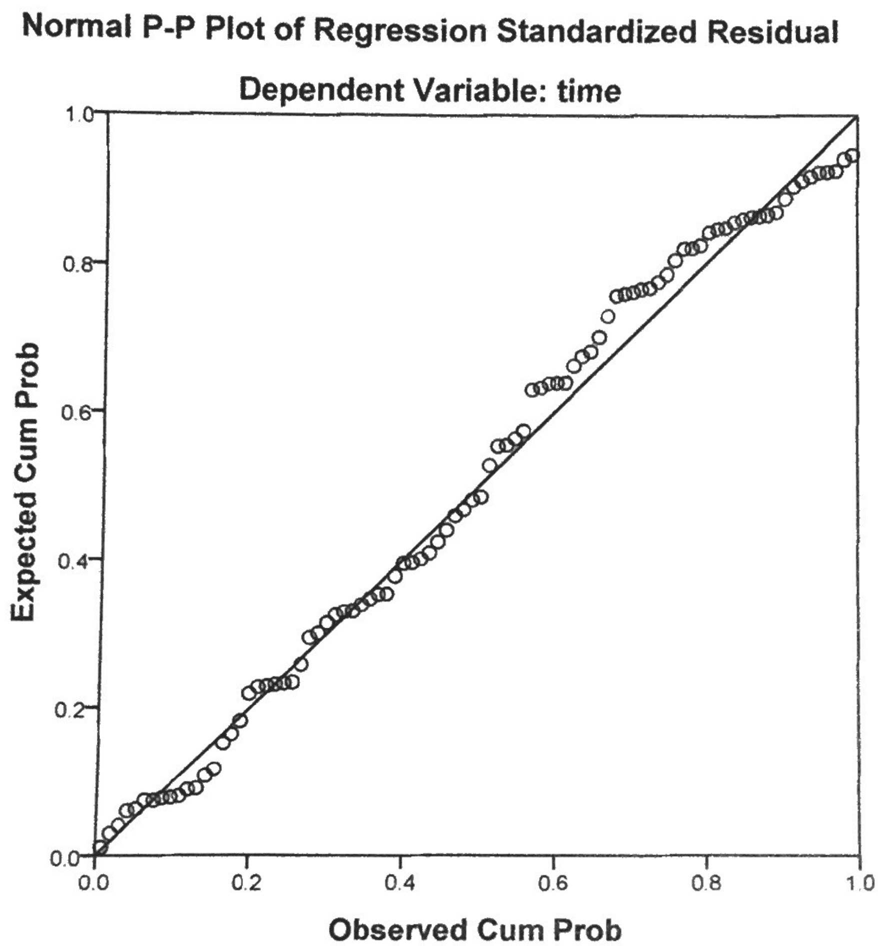
Graph represents frequency of each indication mentioned in the study. numbers on the X-axis represent: 1. Failure to progress 2. Previous cesarean section 3. Fetal indication 4. Maternal indication 5. Arrest of labor 6. Breech/ Malpresentation

Time of day was both evaluated as a frequency as well as a dependent variable of a regression. In frequency, four 2-hour time intervals were over 10%. These time intervals were 0600-0759 at 11%, 1200-1359 at 15%, 1800-1959 at 11%, and 2200-2359 at 14%. The graph below displays these results.



Graph represents amount of cesarean section procedures performed at each time of day. Times are displayed in two-hour intervals as follows: 1. 0-0159 2. 0200-0359 3. 0400-0559 4. 0600-0759 5. 0800-0959 6. 1000-1159 7. 1200-1359 8. 1400-1559 9. 1600-1759 10. 1800-1959 11. 2000-2159 12. 2200-2359

A multiple linear regression analysis was conducted. The following five required assumptions of the linear regression were validated; (1.) linear relationship between the two variables, (2.) no significant outliers or influential points present, as proved by above frequencies. Once the initial two assumptions were proved, the last three were then evaluated; (3.) independence of errors as proved by residuals, as shown in the normal p-plot below, (4.) homoscedasticity of residuals as proved by partial p-plots, and finally (5.) errors are normally distributed. The normal p plot of regression standardized residual (assumption three) was graphed with time as a dependent variable. Observed cumulative probability was graphed against expected cumulative probability and was evaluated for normal distribution of residuals. This plot shown below demonstrated that residuals were normally distributed along the line.



Graph represents the line of regression with the observed cumulative probability graphed against the expected cumulative probability. The residuals are evenly distributed along the line of regression. The closer they are, the more homoscedastic they are. Variation is inevitable, this plot will not have perfect plots along the line, however, they are close enough to indicate the residuals are normally distributed. No transformations need to take place. The assumption of normality is not violated.

After residuals were graphed, each constant was plotted individually against time on a partial regression plot to determine if the dependent variable (time) exhibits similar amounts of variance across the range of values for an independent variable (assumption four). Of eight separate plots, four were homoscedastic (error term was the same across all variables) and four were not (error term was not the same across all variables). Homoscedastic plots include para, indication, augmentation, and repeat cesarean section. Non-homoscedastic plots include race, gravida, gestational age, and labor type. When calculated as a regression, all previously mentioned variables were used as constants and time was used as a dependent variable to determine if using these constants could predict the time of day when an unplanned cesarean section had increased probability of occurring. A multiple linear regression analysis established that race, gravida, para, gestational age, labor type, augmentation, repeat cesarean sections, and indication could not statistically significantly predict the time of day cesarean sections were performed, $F(8,80) = 0.823$, $p = 0.59$. The R constant of the model proved the strength of the relationship between the independent variables and the dependent variable to be 27%. An R^2 value of .076 determined that only 8% of the variance of time of day is associated with race, gravida, para, gestational age, labor type, augmentation, repeat cesarean sections, and indication. Furthermore based on the magnitude of the correlation coefficients for each constant (labeled beta below) it is determined that the constants are minor in relation to time of day. Additionally the 95% confidence interval contained the value of zero, further proves the above constants do not relate to time of day the procedure occurred. These results can be seen in the tables below.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of Estimate	Durbin-Watson

1	.276[a]	.076	-.016	3.1299	2.368

a. Predictors: (constants) race, gravida, para, gestational age, labor type, augmentation, repeat cesarean sections, and indication

b. Dependent Variable: Time

ANOVA[a]

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	64.479	8	8.060	.823	.585[b]
Residual	783.701	80	9.796		
Total	848.180	88			

a. Dependent Variable: Time

b. Predictors: (constants) race, gravida, para, gestational age, labor type, augmentation, repeat cesarean sections, and indication

Coefficients[a]

	Unstandardized coefficients		Stand. Coeff.		
Model	B	Std. Error	Beta	t	Sig
1 Constant	2.425	5.901		.411	.682
Race	-.296	.222	-.157	-1.333	.186
Gravida	.007	.452	.003	.015	.988
Para	.359	.581	.138	.618	.539
Gestationalage	.157	.146	.126	1.078	.284
Labortype	.121	.293	.046	.413	.681

Augementation	-.646	.406	-.182	-1.593	.115
Repeatc/s	.000	.850	.000	.000	1.000
Indications	.137	.279	.063	.493	.624

Discussion

Based on the results of this study, there is no correlation between the discussed constant factors and the time of day, meaning the presence or absence of any factor will not accurately predict the time the cesarean section will occur. In this sample, the most frequent constants were as follows: Caucasian females, gravida one para one, full term pregnancy, spontaneous labor type ,no augmentation, fetal indications, and between the times of 1200-1359 and 2200-2359. The majority of the results from this sample were consistent with current peer reviewed literature and other research studies. The result of gravida/para less than four and having no previous cesarean section procedures was consistent with the notion that if complications arose from a previous pregnancy and cesarean section, the succeeding deliveries would be scheduled procedures, and therefore not included in this sample. There are some previous cesarean sections present in the study results but are explained by the new implementation of VBAC (vaginal birth after cesarean). Patients who opted to deliver by VBAC but then suddenly had to undergo an unplanned cesarean section explain this statistic. Spontaneous labor with fetal indication is also consistent with current research. It is logical that patients with spontaneous labor and fetal distress do not receive augmentation. For the purpose of this study, augmentation is defined as the use of Pitocin, artificial rupture of the membranes, the use of both Pitocin and artificial rupture, or the use of neither (or lack of augmentation). The use of augmentation can potentially exacerbate fetal distress and non- reassuring fetal heart tones on patients with previously stated fetal distress and can precipitate further complications leading to emergency cesarean section. The timing frequencies were somewhat consistent with the literature and previous studies. Studies reflect unplanned cesarean sections to be more frequent at night shift. This data demonstrated this finding as well as the same frequency between the hours of 1200-1359. The impact of race was difficult to compare to the literature and other studies. The majority of the sample was Caucasian females. This was an unexpected result, due to the high population of Hispanic and Marshallese females of childbearing age in the local community. A future study with an even amount of mothers from each race would better determine if race was a contributing factor. In other future studies, the correlation between the constants of race, gravida/para, gestational age, previous cesarean sections, labor type, augmentation, and indication may also be studied as they relate to each other as opposed to all the constants in relation to time.

This study is not without limitation. The relatively small sample size could present data that may not hold true if analyzed in a larger sample. In this study time was presented as categorical, not continuous, so the type of statistical analysis was limited. Another limitation is the subjectivity of charting. Although the data collected was objective data, it is up to each individual nurse to decide which information correlates best with their patient, and it may or may not be consistent with the previous or future nurses who are also charting on the same patient. Thirdly, literature directly related to the study questions was limited, and a more thorough review would be beneficial as future research on these factors emerges.

Conclusion

Although the linear regression did not prove statistically significant, the frequencies among the constants are notable. In summary, the information learned in the frequencies will help to further identify patients at increased risk for unplanned cesarean sections. In the future, the knowledge of these common frequencies should be utilized to develop a rating system implemented in the chart, similar to the Braden score or Morse fall risk. The possibility of this system should be explored in order to identify and streamline patients at increased risk. The results of this study were inconsistent with initial assumptions, especially in relation to time. Per assumption, timing of unplanned cesarean sections was believed to correlate with rounding of physicians and shift change. However, this was clearly not the result. The frequency of cesarean sections related to timing demonstrates sound medical judgment as it relates to the best interest of the patients.

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