12-2000

An Analysis of Risk Factors Associated with High Rates of Cesarean Births in Three Selected Northeast Tennessee Hospitals.

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AN ANALYSIS OF RISK FACTORS ASSOCIATED WITH HIGH RATES OF CESAREAN BIRTHS IN THREE SELECTED NORTHEAST TENNESSEE HOSPITALS

A Thesis

Presented to the Faculty of

the Department of Public and Allied Health

East Tennessee State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Public Health

by

Karen Stewart-Hall

December 2000

ABSTRACT

AN ANALYSIS OF RISK FACTORS ASSOCIATED WITH HIGH RATES OF CESAREAN BIRTHS IN THREE SELECTED NORTHEAST TENNESSEE HOSPITALS

by

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This study consists of an analysis of hospital discharge data from three Northeast Tennessee hospitals to identify maternal demographic factors that may be linked to higher rates of cesarean sections in this region of Appalachia. Maternal age, race, insurance status, length of stay, and birth weight were evaluated to identify regional trends in the prevalence of these factors over a two-year period.

There were 1,678 (23.3%) singleton live births by cesarean section of which 7.6% were repeat cesarean section deliveries. Less than one percent of the 7,181 births were vaginal births after cesarean (VBAC) delivery. Overall, insurance and maternal age was found to be significant predictors of cesarean delivery. Using stepwise logistic regression, age was found to be a significant predictor of cesarean birth for women less than 35 years of age. Significance was found for cesarean birth and insurance status (OR=1.09, 95% CI=1.00,1.19) and for cesarean birth and mother's age (OR=1.31, 95% CI=1.21,1.41).

Mothers under the age of 35 who were insured under a managed care plan were at significant risk for cesarean section delivery. This study was limited in that only hospital discharge data were available and the study population was relatively homogeneous. Further research of this population is needed to continue investigation of the predictors of cesarean birth.

ACKNOWLEDGEMENTS

The writer wished to express her appreciation to the following persons for their contribution to this study:

To committee chairman and advisor, Dr. Joanne Shields, whose direction and creativity helped see this thesis to completion. Her guidance and statistical knowledge helped developed my statistical skills and enhanced my devotion for the profession of public health. I was lucky to work with such a knowledgeable and fun epidemiologist.

To my committee members, Dr. Jim Florence and Dr. Evelyn Knight for their assistance and evaluation of my research work. Their contributions to my work helped further my understanding of research theory, design, and practice.

To the administration and employees of the three hospitals who were generous enough to allow me access to their data and assisted me in receiving the data in a workable format.

To Dr. Bruce Goodrow who has been a tremendous mentor and guide throughout my academic and professional work.

To my husband and best friend, John Hall, who has supported and encouraged me throughout my undergraduate and graduate studies.

To all of these and many others not named I extend my deepest gratitude.

CONTENTS

CHAPTER 1
INTRODUCTION

Cesarean delivery is one of the most common surgical procedures for women in the childbearing years. The cesarean section rate in the United States increased almost fivefold between 1965 and 1990, rising from 4.5% in 1965 to 22.7% in 1990 with over one fourth of the four million live births by cesarean section (Taffel, 1994). The dramatic rise in the cesarean birth rate may have been due to the increase in obstetrical technology such as fetal monitoring, the rising age of mothers, and repeat cesarean sections. Although vaginal birth after cesarean (VBAC) has increased over the past decade from 19.9% in 1990 to 28.3% in 1996, repeat cesarean sections accounted for almost a third of all cesarean sections in 1996 (National Vital Statistics Report, 1999).

Statement of the Problem

In 1996, Tennessee ranked 11th in the nation among states with the highest rates of Cesarean births. The 1996 cesarean delivery rate for Tennessee was 21.7% (National Vital Statistics Report, 1998) while the cesarean delivery rate for Northeast Tennessee was 23% 1996 (Health Information Tennessee (HIT), 2000). In Taffel's 1994 report on US cesarean births, the South as a region was shown to have the highest rates of total and primary cesarean births and the lowest rates of vaginal births after cesarean (VBAC) delivery when compared to the nation as a whole. Northeast Tennessee, like other Southern regions, falls short of the goals set out by the Healthy People 2000 objectives in relation to cesarean birth rates (Taffel, 1994).

The Healthy People 2000 target objective for cesarean births was 15 per 100 deliveries and the year 2000 target for repeat cesarean deliveries was 65 per 100 deliveries (U.S. Department of Health and Human Services (USDHHS), 1990). The U. S. Department of Health and Human Services' target benchmark for vaginal birth after cesarean (VBAC) was at least 35 VBACs per 100 births. The efforts of health practitioners and health organizations have resulted in the national rate of cesarean sections declining from 22.7% in 1990 to 20.7% in 1996 while VBAC rates increased from 19.9% in 1990 to 28.3% in 1996 (National Vital Statistics Report, 1999), yet more work is needed to continue to decrease cesarean birth rates.

Purpose of Study

The purpose of this epidemiologic study was to identify maternal demographics and other risk factors that are associated with cesarean section births. This study was important in that it examined the impact of cesarean birth on maternal and child health.

Although many studies have looked at the cesarean birth rates of specific hospitals or regions, there is an obvious lack of descriptive data in the literature in regards to demographics of patients having cesarean deliveries in the Northeast Tennessee region.

Other studies have reviewed numerous factors associated with cesarean birth rates; however, this study focused on three patient variables identified in previous research as being significantly associated with cesarean birth. This study was a descriptive study that reviewed the associations between age, insurance status, and newborn weight in relation to cesarean delivery at three Northeast Tennessee hospitals.

Limitations

The study group consisted of all mothers delivering at three selected Northeast Tennessee hospitals between July 1, 1996 and June 30, 1998. Mothers delivering vaginally were compared with mothers delivering by cesarean section. (Delivering vaginally included all vaginal births, or all births that did not occur by cesarean section. Delivering by c-section included emergency, planned, and intra-partum c-section deliveries).

This study did not look at the physician factor (or a physician's influence on Cesarean birth rates, i.e. provider convenience and avoidance of mal-practice suits) in regards to cesarean birth rates, although other researchers have studied this subject. Several maternal variables such as education, prenatal care visits, and marital status were not analyzed in this study because those data were not included in the hospital discharge data. Medico-legal factors have been studied in relation to cesarean birth rates in other research but were not addressed in this study.

The study population was not truly representative of Northeast Tennessee because the study population was not randomly selected. However, the majority of births in this region occur at one of the three selected hospitals in this study. Because Northeast Tennessee is a predominantly Caucasian population (97%), race was not examined as a study variable (Health Information Tennessee (HIT), 2000).

Definition of Terms

1. Appalachia – the highland region of the Eastern United States including the Central and Southern Appalachian mountains and the Piedmont Plateau: it is characterized generally by economic depression and poverty.
2. Cesarean section (c-section) or cesarean birth - a surgical operation for delivering a baby by cutting though the mother's abdominal walls.
3. Dystocia – difficult childbirth. It is called fetal distress if the cause is some abnormality of the fetus, and maternal distress if the cause is maternal.
4. Emergency c-section – an un-looked for cesarean section delivery.
5. Intrapartum c-section – an unplanned delivery by cesarean section conducted during childbirth.
6. Multiparous – bringing forth two or more children at one birth.
7. Northeast Tennessee – seven county region defined by the Tennessee Department of Health that includes Carter, Hawkins, Hancock, Greene, Johnson, Unicoi, and Washington Counties; this study also included Sullivan County under the term Northeast Tennessee.
8. Nulliparous – never having born children.
9. Planned c-section – a predetermined scheme to conduct delivery by cesarean.
10. Singleton birth – a birth occurring singly and not as one of a pair or of a group.
11. Uniparous – giving birth to one young at one time. Primiparous.
12. Vaginal birth after cesarean (VBAC) – an occurrence of a patient delivering vaginally after having previously delivered by cesarean.
13. Vaginal delivery – birthing one or more young via the vagina.

CHAPTER 2

REVIEW OF THE LITERATURE

Exploring the predictors of cesarean delivery revealed a complicated health issue. Many influences on cesarean birth rates have been studied. Contributions to the literature surrounding predictors of cesarean birth span from patient factors such as age, parity, insurance status, and birth weight to physician practice settings and provider and hospital financial incentives. This review of the literature addressed the prevalence of cesarean sections in relation to the United States while focusing on documented predictors of cesarean birth. Many of the areas of research in the pursuit of understanding and addressing the escalating rates of c-section births in the U.S. were included in this summary of the literature.

Patient Risk Factors

Maternal Risk Factors

In North America the four most common medical causes contributing to high rates of cesarean section births included routine repeat cesareans, dystocia or non-progressive labor, breech presentation, and fetal distress (Statistics Canada, 1992). Other factors that the literature reported as being associated with cesarean delivery included a short stature, pre-pregnancy obesity (Crane, Wojtowycz, Dye, Aubry, & Artal, 1997), a post-term pregnancy, large infant, and at least one antepartum or intrapartum risk condition such as fever (McClosky, 1988). Elevated intrapartum temperatures have been shown to double the risk of cesarean delivery (Lieberman, Cohen, Lange, Frigoletto, & Goetzl, 1999). Cesarean birth places a mother at increased risks for higher postpartum morbidity and

mortality (Baruffi, Strobino, & Paine 1990; Gilbert, 1998; Miller, 1988; Rogers, 1988;). Documented maternal mortality with cesarean delivery has been shown to be between two and four times greater than that for a vaginal birth and maternal delivery related morbidity is documented to be five to ten times higher with cesarean delivery (Schearer, 1993). Documented medical risks associated with a mother's health having a cesarean section surgery include infections (Litta, Vita, Konishi de Toffoli, & Onnis, 1995), hemorrhage, transfusion, injury to other organs, anesthesia complications, and psychological problems (DiMatteo, Morton, Lepper, Damush, Carney, Pearson & Kahn, 1996; Perez-Escamilla, Maulen-Radovan & Dewey, 1996); (Parrish, Holt, Easterling, Connell, & LoGerfo, 1994; Taffel, 1994). Although some researchers have reported that cesarean-delivered women do not demonstrate lower levels of self-esteem when compared to vaginally delivered women (Cathers, 1982; Lyter, 1986), additional research is needed to clarify these psychological issues. Other studies have found psychological problems to be related to cesarean delivery. Women delivering by c-section suffer immediate and long-term dissatisfaction with the birth of their child, including prolonged intervals between time of birth and initial contact with the newborn in comparison with that of a vaginal delivery experience. Mothers delivering by c-section are also less likely to breastfeed (DiMatteo et al., 1996; Perez-Escamilla et al., 1996). Delivering by c-section also results in a mother spending more time in bed, perceiving more pain, and feeling more limited in her ability to care for the newborn when compared with vaginally delivered women (Lyter, 1986).

Infant Risk Factors

Although infant mortality has decreased as cesarean rates have increased in the U.S. it is not widely viewed that cesarean delivery is the cause of this decrease in infant mortality (Malloy, Rhoads, Schramm, & Land, 1989; Shearer, 1993; Statistics Canada, 1992). Conversely, there are increased risks to the infant when delivered by cesarean section. These risks to the infant include the risk of premature birth and respiratory distress syndrome, which are both associated with multiple complications, intensive care, and burdensome financial costs. Newborns delivered by c-section are also more likely to suffer from meconium aspiration syndrome, which affects the lower respiratory system, and the need for assisted ventilation (Taffel, 1994).

Other Risk Factors

Cesarean sections are performed for reasons other than maternal or fetal well being. Baruffi et al. (1990) mention several reasons including avoidance of patient pain, patient or provider convenience, and changes in the characteristics of the childbearing population. There has been an increase in the number of older mothers who are in higher socioeconomic groups. It has also been suggested that the rise in cesarean birth rates may be attributable to the threat of economic and legal costs to the practitioner (Centers for Disease Control and Prevention, 1993; Jonas & Dooley, 1989; Localio, et al., 1993; National Institutes of Health (NIH), 1981; Schimmel et al., 1997) and provider financial incentives (Keeler & Brodie, 1993). In 1981, National Institutes for Health suggested that ethical as well as legal and economic factors be examined as potential variables influencing the rate of surgical intervention (USDHHS, 1981).

Non-medical factors have also been found to be associated with cesarean birth. Parrish et al. (1994) cited changes in the childbearing population as a significant cause of the increase of cesarean birth rates. The literature revealed strong relationships between the age of the mother and her risk of a cesarean section. Several studies have found that as the age of mothers increases so does the likelihood of cesarean birth (Irwin, Savitz, Bowes, & St. Andres, 1996; McClosky, 1988; Parrish et al., 1994; Statistics Canada, 1992; Taffel, 1994). Race or ethnicity of mother (Braveman, Egerter, Edmonston, & Verdon, 1995; Butcher, Fos, Zuniga, & Pane, 1997; Higgins, 1985; Schimmel, Lee, Benner, & Schimmel, 1994; Taffel, 1994; Woolbright, 1996) has also been found to be significantly associated with cesarean birth rates. In particular, Caucasian mothers (Butcher et al., 1997; Taffel, 1994) and African American mothers (Braveman et al., 1995; Stafford, 1990; Taffel, 1994) have been found to be at a higher risk for c-section deliveries. Parity and newborn birth weight are said to be significant determinants of primary cesarean birth (Braveman et al., 1995; Schimmel et al., 1994; Taffel, 1994; Woolbright, 1996). First-time mothers and mothers delivering infants weighing over 4000 grams are at higher risks for c-section deliveries. Parrish et al. (1994) found in a study of Washington State cesarean rates that maternal age, parity, birth weight, and plurality accounted for a quarter of the rise in cesarean births. Taffel (1994) suggested that age and parity alone account for most demographic changes because there is a high primary cesarean rate for first births to women 30 years of age and older. Prenatal care history (Braveman et al., 1995; Taffel, 1994), marital status, and educational status (Braveman et al., 1995; Parrish et al., 1994; Taffel, 1994) have all been studied in association with the incidence of cesarean birth. It is well documented that mothers who

are married are more likely to have a cesarean delivery (Taffel, 1994). The distribution of medical complications in the childbearing population along with patient education and expectations has also been implicated as contributors to the increase in abdominal deliveries (Baruffi et al., 1990).

Type of Hospital

Cesarean birth research has shown variability between geographic areas (Bare, Bonfill, Roura, Marti, & Foradada, 1997; Socol, Garcia, Peaceman & Dooley, 1993) and between type of hospital (Bare et al., 1997; Hueston, 1995; Sanchez-Ramos, Moorhead & Kavnitz, 1994) with teaching hospitals showing lower rates of cesarean births than non-teaching hospitals (Oleske, Glandon, Giacomelli, & Hohmann, 1991; Sanchez-Ramos et al., 1994) and for-profit hospitals having high rates of cesarean births than non-profit or public hospitals (Weinstein, 1997). Yet one study found little difference in maternal and pediatric delivery related morbidity rates between urban and rural hospitals as well as between obstetricians and family practitioners (Richards & Richards, 1982). Guidelines issued by the American College of Obstetricians and Gynecologists have influenced the increase in the rate of vaginal deliveries after Cesarean sections (Moy & Levin, 1997). The introduction of VBAC has been shown to help stabilize overall cesarean birth rates (Pridjuan, Hibbard, & Moawad, 1991). In their 1997 report, Moy and Levin found that VBACs are more common in academic medical centers than other hospitals with academic medical centers meeting the recommended benchmark for VBACs. This knowledge may explain why Sanchez-Ramos et al. (1994) found lower cesarean rates in the teaching hospitals.

Physician Training and Type of Practice

Cesarean birth rates have also been associated with physician training and the rise in the use of obstetric technology, which has changed obstetrical practice. A 1990 American College of Obstetricians and Gynecologists survey of 2,213 obstetricians reported that women under the care of younger physicians and physicians in practice for fewer years were more likely to accept the option of vaginal birth after c-section (VBAC) than women under the care of older physicians in practice the longest. In a study by Socol et al. (1993) differences in individual physician practice patterns were shown to contribute to a higher incidence of cesarean birth in the private service than physicians working in HMO settings (McCloskey, 1988).

Type of practice has also been shown to be associated with cesarean births. Joint obstetric practices including nurse midwives, nurse practitioners, and obstetricians have been related to lower cesarean birth rates (Schimmel et al., 1994) and are used to effectively lower Cesarean birth rates (Schimmel et al., 1997). Schimmel et al. found in a 1994 comparison study of private versus joint practice that patients using joint practice experienced significantly fewer surgical deliveries. The comparison study also found that patients of mid-wives (in the joint practice) consistently experienced low rates of cesarean birth and that the numbers of cesarean births were inversely correlated with the number of women receiving mid-wivery care. Correspondingly, the cesarean rate for women attended by mid-wives is one-fifth that of the national average. The selection of a nurse mid-wife provider has been shown to lower cesarean rates (King, 1995) with no increase in maternal and infant morbidity or mortality (Davis, Riedmann, Sapiro, Minogue, & Kazer, 1994; Sakala, 1993).

Socioeconomics and Insurance Status

Studies have also found socioeconomic status and insurance status to be significantly associated with Cesarean births (CDC, 1993; Gould, Davey, & Stafford, 1989; Stafford, 1990; Taffel, Placek & Kosary, 1991). Women with private medical insurance, who are private (rather than public clinic) patients (Stafford, 1990; Weinstein, 1997), who are older, married and with higher education and socioeconomic status (Baruffi et al., 1990) have higher rates of cesarean sections. There is disagreement in the literature in regards to managed care insured women and cesarean birth rates. One study found managed care patients to have lower rates of c-sections (Higgins, 1995) and another did not find managed care to be significantly associated with low cesarean birth rates (Weinstein, 1997). Women who are uninsured or on Medicaid have lower cesarean rates (Haas, Udvarhelyi & Epstein, 1993; Weinstein, 1997). During the 1980s and early 1990's, the highest rates of cesarean birth occurred among predominately white women who were well-educated and who had private insurance (Schimmel, Schimmel & DeJoseph 1997).

Cesarean birth rates exceeding the standard 15 per 100 births cost the health care system more than $1 billion dollars in 1991 (Schimmel, et al., 1997). Increased costs due to cesarean surgery are related to surgical costs, longer hospital stays, direct delivery costs, and post-surgical complications (Gilbert, 1998). Traynor and Peaceman (1998) found trial of labor, or vaginal birth, to be associated with an overall 14% reduction in maternal hospital charges and a 31% reduction in length of stay when comparing vaginal birth after cesarean (VBAC) delivery patients versus elective repeat cesarean section (ERCS) patients. Reducing the primary cesarean rate results in the saving of health care

dollars for excess cesarean births (Keeler & Brodie, 1993; Schimmel et al., 1997). Sanchez-Ramos et al. (1994) suggest that teaching hospitals or residency programs are a good way to decrease hospital cesarean rates, while (Lagrew & Adashek, 1998) suggest reducing individual physician cesarean rates by successful labor management and attempting VBACs. In regards to overall high rates of cesarean surgeries, Schimmel et al. (1997) suggest broad-based interventions as a means to address "the complex interactions among the pregnant woman, her economic, physical, and social environments, the practitioner, and public health policies."

Although many studies have looked at the cesarean birth rates of specific hospitals or regions little work has been done toward reviewing the high cesarean birth rates in the South. There is an obvious lack of descriptive data in the literature in regards to demographics of patients having c-section deliveries in this region of Northeast Tennessee. The purpose of this epidemiological assessment is to examine relationships between patient demographics and the high rates of cesarean births seen in Northeast Tennessee. Although numerous variables have been studied in relation to cesarean births, this study will focus on three patient variables identified in previous research as being significantly associated with cesarean birth. This study reviews the association between age, insurance status, and newborn weight in relation to cesarean delivery at three Northeast Tennessee hospitals.

CHAPTER 3

METHODS

Data Source and Sample

This study consisted of a review of hospital discharge data to identify variables that may contribute to higher rates of cesarean births in this region of Appalachia. Associations between age, insurance status, and newborn weight in relation to cesarean delivery are reviewed in this study. Hospital discharge data for three Northeast Tennessee hospitals were collected and analyzed. All singleton births occurring at the hospitals between July 1, 1996, and June 30, 1998, were included in this study. Maternal age, insurance status, and newborn birth-weight were analyzed to identify regional trends in the prevalence of these variables associated with cesarean birth.

Hospital Characteristics

Data from three hospitals located in Northeast Tennessee were reviewed. All three hospitals serve a four-state region including Northeast Tennessee, Southwestern Virginia, Southeastern Kentucky, and Western North Carolina. Hospital One is a not-for-profit hospital whose facilities include infant care. The hospital staffs pediatric neonatologists and pediatric cardiologists. Hospital Two is equipped with facilities to include neonatal and perinatal care along with a center for women's health. Hospital Three is a not-for-profit hospital offering infant care as well as pediatric care.

Maternal Demographic Characteristics

Delivery mode was categorized as vaginal birth, primary cesarean birth, repeat cesarean birth, and vaginal birth after cesarean (VBAC). Cesarean birth was determined by the patient's principal procedure ICD-9 code of 74 (74.0-74.9) (International Classification of Diseases (ICD-9), 1992). Repeat cesarean birth was identified by the principal diagnosis ICD-9 code of 654.2, {0, 1, 3}. Vaginal birth after cesarean section or VBAC was determined by those patients with a principal procedure code other than a 74.0 yet having a principal diagnosis code of 654.2, {0, 1, 3}.

Maternal age was calculated by taking the difference of the mother's admission date and birth date. Two categories of maternal age were defined: 34 and younger and 35 and older.

Ethnic groups were categorized as African American, Caucasian, and "other" which included Asian, Hispanic, Native American, and "other" data. The lack of diversity within this sample defined these limited race categories.

Using hospital discharge data on principal delivery, insurance status was categorized as uninsured, TennCare/Medicaid (including Champus and TennCare, the state-managed Medicaid program), managed care (including all health maintenance organization plans), and commercial (including only point of service or fee for service health plans).

Newborn weight was defined as $\leq$2500 grams and >2500 grams. These categories are based on the categorization of newborn weight by other studies. (Very low birthweight infants are defined as weighing less than 1,500 grams or 3 pound 4 ounces (Taffel, 1994)).

Data Analyses

Hospital discharge data were provided from each of the three Northeast Tennessee hospitals in spreadsheet format. The data were analyzed using Microsoft Excel, SPSS®, and SAS®.

Descriptive statistics were conducted with the variables of interest. Cross-tabs were done to match mothers having cesarean births with the variables of interest including age, insurance status, and newborn birth weight. Chi-square analysis and stepwise logistic regression were performed to determine adjusted odds ratios (OR) and 95% confidence intervals.

Limitations

This study is hindered by limited data drawn from hospital discharge data for only three hospitals. The scope of the data reviewed is based on the availability of the hospital discharge data. The hospital discharge data did not contain such variables as parity (Braveman et al., 1995; Parrish et al., 1994; Schimmel et al., 1994; Taffel, 1994; Woolbright, 1996), number of prenatal care visits (Braveman et al., 1995; Taffel, 1994) and level of education of mother (Braveman et al., 1995; Parrish et al., 1994; Taffel, 1994) all of which are patient demographic variables used by other researchers to describe patient populations. The newborn weight data were from only one hospital because such data were not available from the other two hospitals and thus the data analysis for this variable was limited.

The study sample was not randomly selected, yet findings from this research may be applicable to other rural areas with similar patient demographics. A further limitation

of this study was that it only described patient demographics, one of many documented factors related to cesarean birth rates. This study did not look at physician practice patterns (for cesarean birth) (Socol et al., 1993) and private versus group practice, both having been associated with cesarean birth rates in hospitals (Goyert, Bottoms, Treadwell & Nehra, 1989; Schimmel et al.; 1994, and Schimmel et al., 1997*).* One particular ethnic group, Caucasians, dominated the population described in this study. (Caucasian women made up approximately 97% of our study population, located in rural Northeast Tennessee, Southwestern Virginia, Southeastern Kentucky, and Western North Carolina). Therefore, the results of this study may not be applicable to more culturally diverse populations.

CHAPTER 4

RESULTS

Univariate Analyses

Tables 1 and 2 show a summary of demographic characteristics for the study population. (For a further breakdown of race and age categories for cesarean rates, see Tables 3 and 4). In total, 1,678 (23.4%) singleton live births were by cesarean section (Table 2). Of those 1,678, 7.6% (n=129) (Table 2) were repeat cesarean section deliveries. Singleton live births accounted for a total of 7,179 births. Only 0.8% (n=55) were vaginal births after cesarean section (VBAC) (Table 2). A review of c-sections by maternal age revealed that cesarean rates by age were lowest among women 34 or younger and highest among women 35 or older (Figure 1).

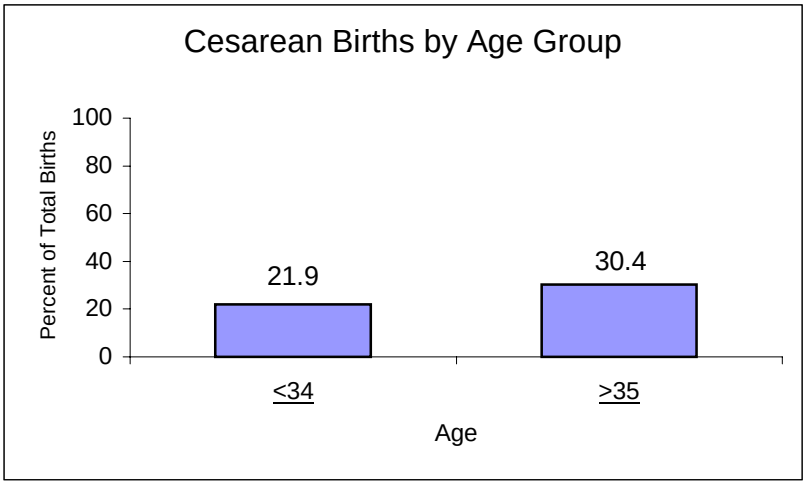

Figure 1. Cesarean Births by Age Group (percentage) for Three Northeast Tennessee Hospitals between July 1, 1996 and June 30, 1998.

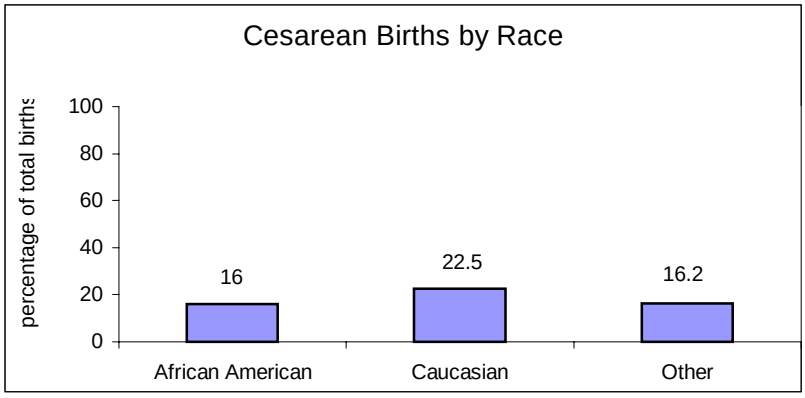

Figure 2. Cesarean Births by Race Group (percentage) for Three Northeast Tennessee Hospitals between July 1, 1996 and June 30, 1998.

Note: For the "Other" category, n=11.

Cesarean birth rates by race were lowest among African Americans and highest among Caucasian patients (Figure 2). Cesarean birth rates by insurance were lowest among TennCare/MediCaid insured patients and highest with managed care insured patients (Figure 3).

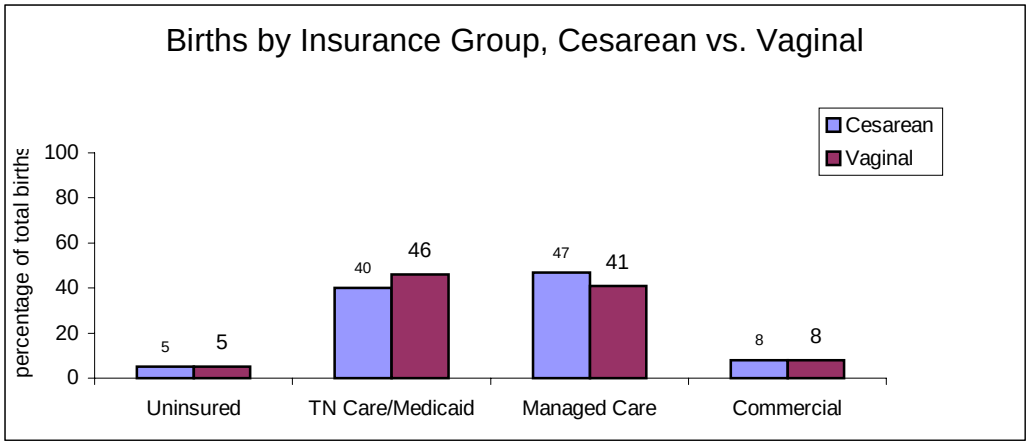

Figure 3. Births by Insurance Group, Cesarean vs. Vaginal Birth (Percentage) for Three Northeast Tennessee Hospitals between July 1, 1996 and June 30, 1998.

Newborn birth weights were not available for 65% of the 7,181 births in this study population because only one hospital provided newborn birth weight data. For those births in which these data were available, cesarean rates by newborn birth weight were highest among newborns weighing less than 2500 grams and lowest among newborns weighing 2500 grams or greater (Table 1). In reviewing maternal age and newborn birth weight, it was observed that the percentage of cesarean births for babies weighing less than 2500 grams was lowest among mothers who were 34 or younger and highest for mothers 35 and older. For babies weighing 2500 grams or greater, more cesarean births were found among mothers 35 years of age and older (Figure 4).

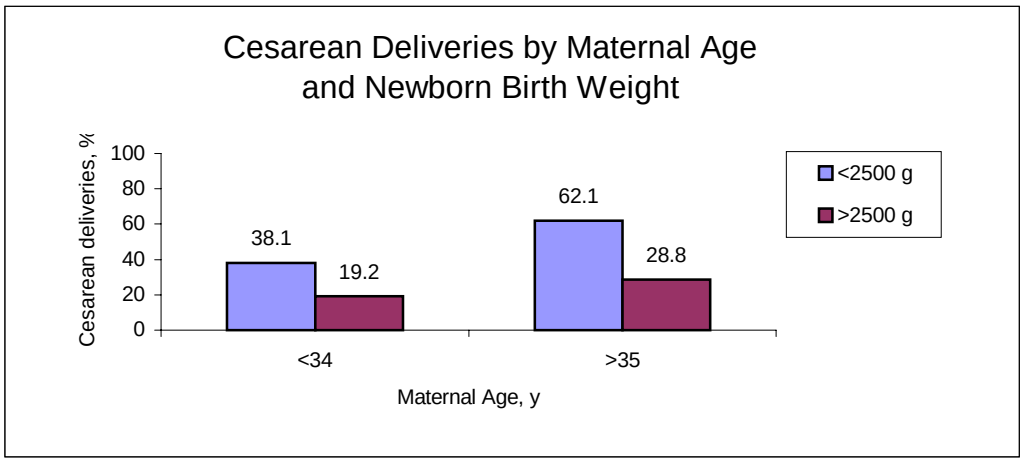

Figure 4. Newborn Birth Weight by Maternal Age (percent cesarean delivery) for One Northeast Tennessee Hospital between July 1, 1996 and June 30, 1998.

Note: Newborn weight data from one hospital only

Table 1

Likelihood of Cesarean vs. Vaginal Delivery among Singleton Births to Northeast Tennessee Resident Women, by Demographic Characteristics, July 1996 – June 1998

	Total Number of Deliveries	Percent Non-cesarean	Number of Cesarean Deliveries	Percent Cesarean
	n=7181	**%**	**n=1473**	**%**
Maternal race / ethnicity				
African American	**181**	**84.0**	**29**	**16.0**
Caucasian	**6359**	**77.5**	**1433**	**22.5**
Other	**68**	**83.8**	**11**	**16.2**
Missing data	**573**			
	n=7181	**%**	**n=1623**	**%**
Maternal age, y				
≤ 34	**6599**	**78.1**	**1446**	**21.9**
≥ 35	**582**	**69.6**	**177**	**30.4**
	n=7174	**%**	**n=1621**	**%**
Insurance				
1 Uninsured	**388**	**78.4**	**84**	**21.6**
2 TN Care/Medicaid	**3220**	**79.8**	**652**	**20.2**
3 Managed Care	**3006**	**74.9**	**755**	**25.1**
4 Commercial	**560**	**76.8**	**130**	**23.2**
	Medical Risk Factor			
	n=2537	**%**	**n=575**	**%**
Birth weight, g				
<2500	**331**	**59.8**	**133**	**40.2**
≥2500	**2206**	**80.0**	**442**	**20.0**

Table 2

Likelihood of Primary Cesarean, Repeat Cesarean or Vaginal Birth After Cesarean Delivery among Singleton Births to Northeast Tennessee Resident Women, by Demographic Characteristics, July 1996 – June 1998

	Total No. Deliveries	Percent Non-cesarean, %	No. Primary Cesarean Deliveries	Percent Primary Cesarean %	No. Repeat Cesarean Deliveries	Percent Repeat Cesarean %	No. VBAC Deliveries	Percent VBAC, %
	n=6608	**%**	**n=1354**	**%**	**n=119**	**%**	**n=53**	**%**
Maternal race/ethnicity								
Afr American	**181**	**81.2**	**27**	**14.9**	**2**	**1.1**	**5**	**2.8**
Caucasian	**6359**	**76.7**	**1317**	**20.7**	**116**	**1.8**	**47**	**0.7**
Other	**68**	**82.4**	**10**	**14.7**	**1**	**1.5**	**1**	**1.5**
Missing data	**(573)**							
	n=7179	**%**	**n=1494**	**%**	**n=129**	**%**	**n=55**	**%**
Maternal age, y								
≤34	**6599**	**77.3**	**1333**	**20.2**	**113**	**1.7**	**51**	**0.8**
≥ 35	**580**	**68.8**	**161**	**27.8**	**16**	**2.8**	**4**	**0.7**
	n=7174	**%**	**n=1492**	**%**	**n=129**	**%**	**n=55**	**%**
Insurance								
Uninsured	**388**	**5.4**	**71**	**4.8**	**13**	**10.1**	**10**	**18.2**
TN Care/ Medicaid	**3220**	**44.9**	**590**	**39.5**	**62**	**48.1**	**28**	**50.9**
Managed Care	**3006**	**41.9**	**730**	**48.9**	**25**	**19.4**	**8**	**14.5**
Commercial	**560**	**7.8**	**101**	**6.8**	**29**	**22.5**	**9**	**16.4**

Table 3

Likelihood of Cesarean vs. Vaginal Delivery among Singleton Births to Northeast Tennessee Resident Women, by Demographic Characteristics (detailed categories), July 1996 – June 1998

	Total Number of Deliveries	Percent Non-cesarean	Number of Cesarean Deliveries	Percent Cesarean
	n=7181	**%**	**n=1475**	**%**
Maternal race / ethnicity				
African American	**181**	**84.0**	**29**	**16.0**
Asian	**9**	**77.8**	**2**	**22.2**
Caucasian	**6359**	**77.5**	**1433**	**22.5**
Hispanic	**49**	**81.6**	**9**	**18.4**
Native American	**3**	**100.0**	**0**	**0.0**
Other	**20**	**90.0**	**2**	**10.0**
Missing data	**560**			
	n=7181	**%**	**n=1623**	**%**
Maternal age, y				
≤ 15	**62**	**79.0**	**13**	**21.0**
16-18	**578**	**82.7**	**100**	**17.3**
19-24	**2667**	**81.9**	**484**	**18.1**
25-34	**3292**	**74.2**	**849**	**25.8**
35-44	**580**	**69.5**	**177**	**30.5**
≥ 45	**2**	**100.0**	**0**	**0.0**
	n=7174	**%**	**n=1621**	**%**
Insurance				
1 Uninsured	**388**	**78.4**	**84**	**21.6**
2 TN Care/Medicaid	**3220**	**79.8**	**652**	**20.2**
3 Managed Care	**3006**	**74.9**	**755**	**25.1**
4 Commercial	**560**	**76.8**	**130**	**23.2**
	n=7181	**%**	**n=1623**	**%**
Length of Stay, d				
0-5	**6973**	**78.5**	**1499**	**21.5**
6-10	**140**	**36.4**	**89**	**63.6**
11-15	**35**	**54.3**	**16**	**45.7**
16-20	**14**	**57.1**	**6**	**42.9**
21+	**19**	**31.6**	**13**	**68.4**
	Medical Risk Factor			
	n=2537	**%**	**n=575**	**%**
Birthweight, g				
<2500	**331**	**13.0**	**133**	**23.1**
2500-3500	**1330**	**52.4**	**237**	**41.2**
3501-3999	**686**	**27.0**	**135**	**23.5**
>4000	**190**	**7.5**	**70**	**12.2**

Table 4

Likelihood of Primary Cesarean, Repeat Cesarean or Vaginal Birth After Cesarean Delivery among Singleton Births to Northeast Tennessee Resident Women, by Demographic Characteristics (detailed categories), July 1996 – June 1998

	Total No. of Deliveries	Percent Non-cesarean, %	No. of Primary Cesarean Deliveries	Percent Primary Cesarean, %	No. of Repeat Cesarean Deliveries	Percent Repeat Cesarean, %	No. of VBAC Deliveries	Percent VBAC, %
	n=6608	%	n=1354	%	n=119	%	n=53	%
Maternal race / ethnicity								
African American	181	2.7	27	2.0	2	1.7	5	9.4
Asian	9	0.1	2	0.1	0	0	0	0
Caucasian	6359	96.2	1317	97.3	116	97.5	47	88.7
Hispanic	41	0.6	7	0.5	0	0	1	1.9
Native American	3	0	0	0	0	0	0	0
Other	15	0.2	1	0.1	1	0	0	0
Missing data	(573)							
	n=7181	%	n=1494	%	n=129	%	n=55	%
Maternal age, y								
≤15	62	0.9	13	0.9	0	0	0	0
16-18	578	8.0	99	6.6	1	0.8	1	1.8
19-24	2667	37.1	451	30.2	33	25.6	14	25.5
25-34	3292	45.8	770	51.5	79	61.2	36	65.5
35-44	580	8.1	161	10.8	16	12.4	4	7.3
≥45	2	0.0	0	0	0	0	0	0
	n=7174	%	n=1492	%	n=129	%	n=55	%
Insurance								
Uninsured	388	5.4	71	4.8	13	10.1	10	18.2
TN Care/ Medicaid	3220	44.9	590	39.5	62	48.1	28	50.9
Managed Care	3006	41.9	730	48.9	25	19.4	8	14.5
Commercial	560	7.8	101	6.8	29	22.5	9	16.4
	n=7181		n=1494		n=129		n=55	
Length of Stay, d								
0-5	6973	97.1	1372	91.8	127	98.4	55	100.0
6-10	140	1.9	87	5.8	2	1.6	0	0
11-15	35	0.5	16	1.1	0	0	0	0
16-20	14	0.2	6	0.4	0	0	0	0
21+	19	0.3	13	0.9	0	0	0	0

Multivariate Analyses

Stepwise logistic regression was performed to determine whether the logistic regression model significantly predicted cesarean sections. Type of insurance was found to be a significant predictor of cesarean birth (OR=1.09, 95% CI=1.00, 1.19). Age of mother was also found to be a significant predictor of cesarean birth (OR=1.49, 95% CI= 1.22, 1.81). Caucasian mothers under the age of 35 who were subscribers to a managed care plan were at significant risk for cesarean delivery (OR=1.54, 95% CI=1.18, 2.00). Due to the low numbers for African Americans and other races, no significance was found between cesarean births and age or insurance status. No significant associations were found between cesarean births and age or insurance status for African Americans and other non-white mothers. Minorities were underrepresented in the patient population in comparison to other studies of cesarean births. However, the lack of diversity among the patient population reflects the community of Northeast Tennessee, which is less than 3% minority (HIT, 2000).

CHAPTER 5

DISCUSSION

This descriptive study of hospital discharge data revealed statistics that were comparable to similar studies in other regions of the country in that maternal age, insurance status, and newborn birth weight are significantly associated with cesarean birth rates. The findings of Parrish et al. (1994) suggest the importance of using maternal age, birth weight, and parity to compare populations and study temporal trends. Although this study did not look at parity, maternal age and birth weight were examined and found to be significant predictors of cesarean delivery among this population. Many studies have used logistic regression to estimate the risk of cesarean delivery (Braveman et al., 1995; Irwin et al., 1996; Davis et al., 1994; McClosky, 1988; King, 1995) and significant predictors of cesarean delivery have been found.

Although unadjusted rates of cesarean birth in this study showed the highest percentage of cesarean births among women 35 or older, using logistic regression, this study found that women under the age of 35 were at significant increased risk of cesarean delivery. There was no significance found among women over 35 in regards to age and risk of cesarean delivery when using logistic regression. However, Taffel (1994) found women over the age of 35 to have a significant increased risk for cesarean delivery and Parrish et al., (1994) found women over the age of 40 to be 2.6 times more likely to delivery by cesarean compared to 15-19 year olds.

King (1995) found participation in a health maintenance organization to be significantly associated with VBAC, so in effect HMO insured patients were less likely to

have a cesarean delivery. King's (1995) findings are not consistent with the findings in this study, which found managed care insured patients to be at a significant risk of cesarean delivery.

A large proportion (92%) of this study was under the age of 35 years. The research implications in this analysis may be skewed due to the large percentage of women less than 35 years of age. However, managed care insured women comprised only 42% of this study population and thus, it is apparent from these data that managed care insurance status is a predictor of cesarean birth.

CHAPTER 6

CONCLUSIONS

In this study, an initial examination of possible risk factors of elevated rates of cesarean birth in Northeast Tennessee is made. The applicability of the study is limited by the lack of truly random study population representative of the region. Further, there is the potential for selection bias by the participation of only a limited number of hospitals.

By describing the patient population in regards to regional risks factors associated with cesarean birth, regional obstetrical health care providers will have a source of information to aid in addressing this health problem. The findings of this study provide us with some information regarding the cesarean birth rate problem and emphasize the need for additional research as there were factors related to cesarean birth rates not explored. Additional information regarding the role of insurance coverage and how it directly or indirectly influences increased risk of c-sections is needed. This risk may be associated with the other cesarean birth related risks such as access to prenatal care. Other risk factors may be a function of the socioeconomic status of the mother as measured through maternal education and/or household median income.

Future research might explore individual hospital guidelines and procedures such as setting goals for cesarean and VBAC rates as well as circulating physician c-section rates among hospital staff. Finally, with the emergence of multidisciplinary health care teams in this region, it would be interesting to compare cesarean rates for such practices with single provider practices.

Demographic changes are linked to the rise in cesarean birth rates and, therefore, must be taken into account when examining populations. Based on the findings of this study, future research should review maternal age, maternal race, and insurance status when examining predictors of cesarean birth.

When addressing the overall cesarean birth rate in Northeast Tennessee, several strategies should be considered. This study found that unadjusted VBAC's comprised less than 1% of all births in this population; therefore, a concerted effort to increase VBAC rates in these hospitals, including patient education and physician incentives, might help decrease the overall cesarean birth rates. Another effective strategy for decreasing cesarean rates in this population would be to circulate individual physician's cesarean delivery rates to all practitioners within each hospital. The advent of more obstetrical multidisciplinary teams including nurse practitioners and nurse midwives could work to reduce the cesarean rates in Northeast Tennessee.

Delivery by cesarean birth is a complicated health issue. Efforts to reduce cesarean section births in Northeast Tennessee will require a comprehensive approach to address patient variables, care giver practices, and hospital policies. This study concluded that maternal age, insurance status, and race were significant predictors of cesarean birth and, therefore, must be considered when addressing the reduction of cesarean rates in Northeast Tennessee.

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