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Certified Nurse Midwife (CNM) Attitudes about Birth and Primary Cesarean Section Rates

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Epidemiology

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Certified Nurse Midwife (CNM) Attitudes about Birth and Primary Cesarean Section Rates

By
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B.S., University of Wisconsin-Madison, 2014
Emory University, Rollins School of Public Health
2016

Faculty Thesis Advisor: Roger Rochat, M.D.

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Abstract

Certified Nurse Midwife (CNM) Attitudes about Birth and Primary Cesarean Section Rates

By Chelsea J Riley

In this small retrospective cohort study we analyzed birth data from the International Center for Maternity's [CIMA] birth data from 2009-2015 (n=5,291) to evaluate if primary cesarean section rates are associated with midwives' attitudes towards the medical model of birth. CIMA is a midwife-led prenatal care, labor, and delivery practice that mainly serves Hispanic immigrants in the Atlanta, GA area. CIMA has a primary cesarean section rate of 13.7%; the national average is 21.5%. After developing survey questions, we conducted a focus group of 5 midwives to validate the questions. Two identified with the holistic model of birth and 3 identified with the medical model of birth. After validation, the survey was administered to CIMA's 11 midwives. There were a total 13 questions to evaluate support for holistic or medical model of birth in the final survey. The survey had a total of 13 points possible; a midwife who answered holistically to every question would have a score of 13. Simple linear regression was used to investigate each of the survey questions and the total score as the independent variable with primary cesarean section rates as the dependent variable. Scores ranged from 6.4-12.8 out of 13 possible points. The average score for CIMA's 11 midwives was 10.33 [95% CI: (8.82, 11.83)]. The mean primary cesarean section rate is 13.70 [95% CI: (11.93, 15.48)]. The results suggested an inverse relationship between the survey's holistic score and primary cesarean section rates. When the totaled score was used as the independent variable, the model yielded an r^2 of .45. The linear regression model predicts a decrease of .79% in primary cesarean section rates for every 1-point increase on in a midwife's holistic midwife score. In conclusion, our results indicate that CIMA's midwives identify more with the holistic model of birth and that a holistic midwife scoring algorithm could predict, to some degree, a midwife's primary cesarean section rate. Our findings, taken in context with previous midwife studies, suggest that a survey detailing midwives attitudes towards the medical model of birth could be used to predict primary cesarean section rates.

Acknowledgments

I would like to extend my deepest gratitude to Dr. Roger Rochat for being a fabulous thesis advisor and for inspiring me to take the stairs. This deep gratitude applies to Dr. Andrew Dott who was always willing to lend me a hand in planning, writing, editing, and fact checking. Without these two impeccable humans, this paper would have never happened.

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Chapter 1: Background

A Brief History of Cesarean Sections

The history of cesarean sections goes back to Ancient Greek mythology, where Apollo, the Greek god of plagues and medicine, cut his son Asclepius from his mortal mother's womb to save the child even though the mother was doomed(1). Ancient Indian and Egyptian religious laws required abdominal delivery if the mother died; ancient Chinese texts depict the procedure as well (2). Cesarean sections also have roots in Ancient Rome, where Caesar was rumored to have been cut from his mother's womb. Roman law under Caesar decreed that all women who would have died during childbirth must be cut open and the child removed, perhaps why a cesarean section is called what it is (1). Regardless of its etymology and origins, cesarean sections have been an obstetric fixture for thousands of years.

The first documented successful cesarean in the British Empire, however, was performed much later that the mythologies, sometime between 1815 and 1821. In 1879 native Ugandans were recorded performing cesarean sections (3). A healer would use banana wine to semi-intoxicate the woman and to sanitize his hands and her abdomen. This technique seemed well-developed and is thought to have been employed for a long time. Similar reports in the same time period had also come from Rwanda (3).

In Europe and the Americas, many cesarean sections first took place in homes on beds, tables, and other makeshift operation tables. Oftentimes, proper anesthesia, sterilization, and equipment were not available. Many documented cases of successful cesarean sections were actually completed by farmers- men with animal husbandry

and reproductive anatomy knowledge who could have performed such procedures on their livestock during emergencies were the mother died while giving birth to a calf (1). As technological advances in medicine progressed, so too did obstetric interventions. At the beginning of the 20th century, in the US, the maternal mortality from births was approximately 800 out of 100,000 live births (4). The graph below, taken from Our World in Data, illustrates a sharp decline in maternal mortality between 1920 and 1940, right around the time births shifted into hospitals (4).

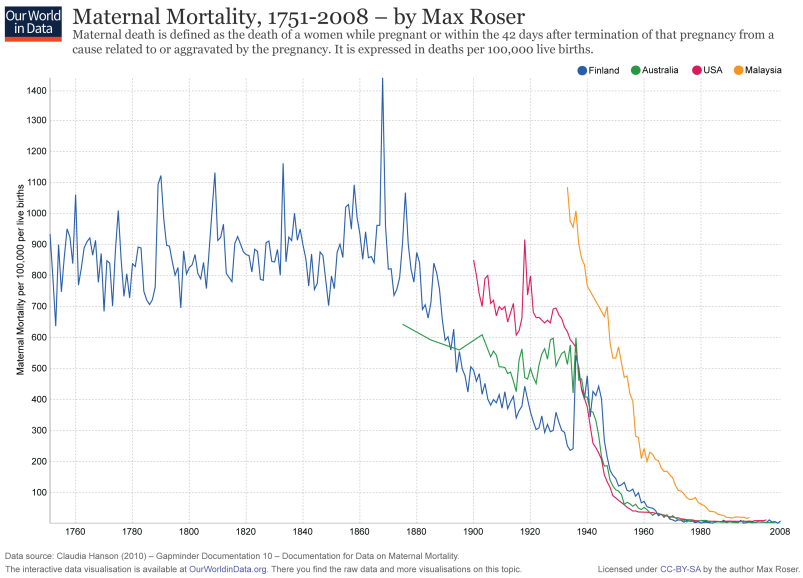


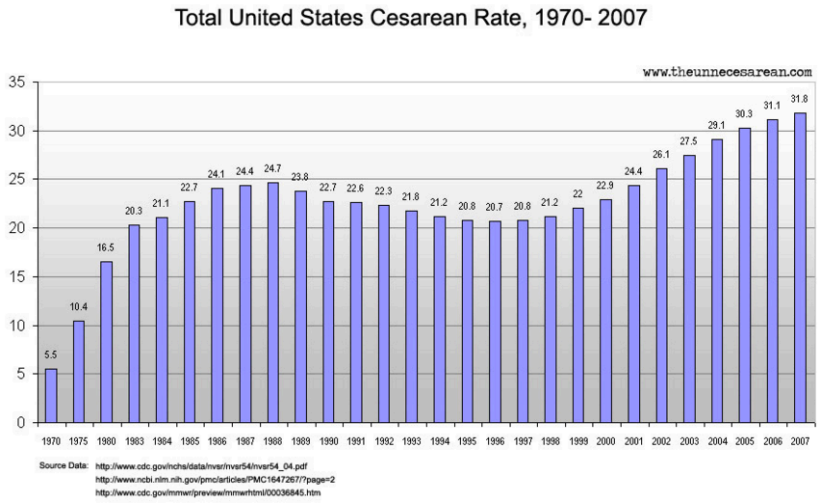
Figure 1. Our World In Data Maternal Mortality, 1751-2008

The formation of hospitals, where the operation began to be a routine occurrence, changed the way these statistics looked. Due to urbanization, women couldn't rely on traditional community-supported births. Many states banned the practice of midwifery by untrained attendants. As a result, specialized hospitals

mainly for women and childbirth began to dot cities throughout the United States and Europe in the second half of the nineteenth century. Anesthesia was developed in the mid 19th century, allowing the surgeons to take the time to be more detailed and thorough, preventing gruesome procedures like the craniotomy. Anesthesia was also used during labor and deliveries, to give women a brief reprieve. Unfortunately, surgical techniques of that time period contributed to the extremely high maternal mortality rates. According to one estimate, from 1777 to 1887 in Paris not one woman survived a cesarean section (3). One contributing factor is that they did not stitch the uterine walls closed, medical knowledge was limited and it was believed the uterus would contract itself shut. By the late 19th century, this problem was remedied; hysterectomies and cesarean sections were becoming less painful and more successful in preventing fetal and maternal losses. The development of antibiotics, blood banking and good anesthesia contributed to the rapid for in maternal mortality in developed nations.

By 1938, half of all births in the United States were occurring in hospitals; by 1955 it had risen to 99%. In 1970, the approximate cesarean section rate for the country was 5%. In 1988 the cesarean section rate was 24.7%. During the 1960s-1990s, new concepts arose, changing the standards of care for conducting labor such as reducing forcep and breech births. Vaginal births after cesarean sections (VBACs), the institution of fetal monitoring, and the fear of litigation all contributed to a rapid rise in the cesarean section rates (5). In 2014, the national overall cesarean rate was 32.2 (6). The current primary cesarean section rate is 21.5%; in the state of Georgia in 2012, the primary cesarean section rate was 22.7% for singleton births (7).

Figure 2. United States cesarean section rates from 1970-2007 from The Unnecesarean, using data from CDC vital statistics (8)



Modern Cesarean Sections

Mayo Clinic defines a cesarean section as an invasive surgical procedure where the abdomen and uterine walls are cut in order to retrieve the infant (9). Cesarean sections are performed for numerous reasons that factor in both infant and maternal health. An obstetrician might elect for a cesarean section delivery over a vaginal delivery if the baby is showing signs of hypoxia, cardiovascular distress, breech or transverse position, placenta previa, or if the baby is preterm and not strong enough to tolerate a vaginal birth, among others (9). Maternal factors that could lead to a cesarean section involve a stalled labor, health concerns such as infections like HIV that could be passed to the baby through the birthing canal, a mechanical obstruction, among other factors (9). Other factors include the factor I unwillingness of obstetricians to offer a Vaginal Birth after a cesarean section (VBAC), despite

published recommendations by the American Congress of Ob-Gyn to the contrary (10).

Cesarean sections, while a low risk surgery, are accompanied by all the risks of major surgeries including but not limited to: wound infection, hemorrhage, blood clots, and complications from anesthesia (11). 36 women per 100,000 died during or as a result of a cesarean section while 9.2 died per 100,000 as a result of vaginal delivery between 2000 and 2006 (12). Complications specific to cesarean sections and surgeries in the pelvic area for women include uterine rupture, endometriosis, vaginal bleeding, uterine infection, and risks for multiple complications in future pregnancies(13).

Cesarean sections are an important portion of obstetrics. In some cases, a cesarean section is absolutely necessary for maternal and infant health, survival, and wellbeing. Women and infants who are high risk for severe complications may not survive a vaginal birth; cesarean sections have undoubtedly helped increase maternal and child survival over the years. However, the rising trend in the number of cesarean sections is alarming.

Cesarean Section Trends

Since 1985, the World Health Organization's recommendations on cesarean section suggest a rate between 10 and 15 percent (16). Caesarean sections have become increasingly common in developed and developing countries while evidence showing the benefit to both mother and baby when the pregnancy did not necessitate the procedure is lacking. In a worldwide ecological study, WHO found that below a

10% caesarean section rate, maternal and neonatal mortality decreased when caesarean section rates increased. As caesarean section rates increased above 10% and up to 30% no effect on mortality rates were shown (12). At population level, caesarean section rates higher than 10% are not associated with reductions in maternal and newborn mortality rates(16). While these WHO recommendations are over 30 years dated, they point to a trend within obstetrics- a rising number of elective cesarean sections. Elective cesarean sections, for the purposes of this paper, refer to cesarean sections that were not necessary for the survival or wellbeing of the mother or infant.

At the release of CDC's vital statistics from 2014, 32.2% of documented live births in the United States were completed with cesarean sections(16). This is 0.5% down from 2013. A 2010 WHO report on caesarean sections resulted in the following finding: in 2008 an estimated 3.18 million additional caesarean section were needed and approximately 6.20 million medically unnecessary sections were performed (7). The modern medical model of birth could be partially responsible for the high cesarean section rates in the United States of America.

Aside for medical reasons, there are many reported reasons why cesarean sections are performed. One study found that mothers thought that a cesarean section was actually safer for the baby than a vaginal birth (17). In Mexico, cesarean sections are often seen as a status symbol; women who can afford the procedure elect to do so to help boost their social status (17). Areas of Brazil have cesarean section rates of up to 75%- these women opt for the procedure to avoid genital damage, thinking a cesarean will help keep their vaginas tight for their husbands (17). Women also

reported liking the level of control a scheduled delivery gave them (18). A small study analyzing the decision making process of women during childbirth between El Paso, Texas and Ciudad Juarez, Mexico found that some women trusted their doctors implicitly, following their recommendations. This same study reported that some women were too shy to ask questions because their doctors were male (21). WHO estimates that up to 40% of cesarean sections performed in the last decade were medically unnecessary (14).

Figure. 3 Cesarean Delivery (CD) Trends from 1989-2011 in the United States (19).

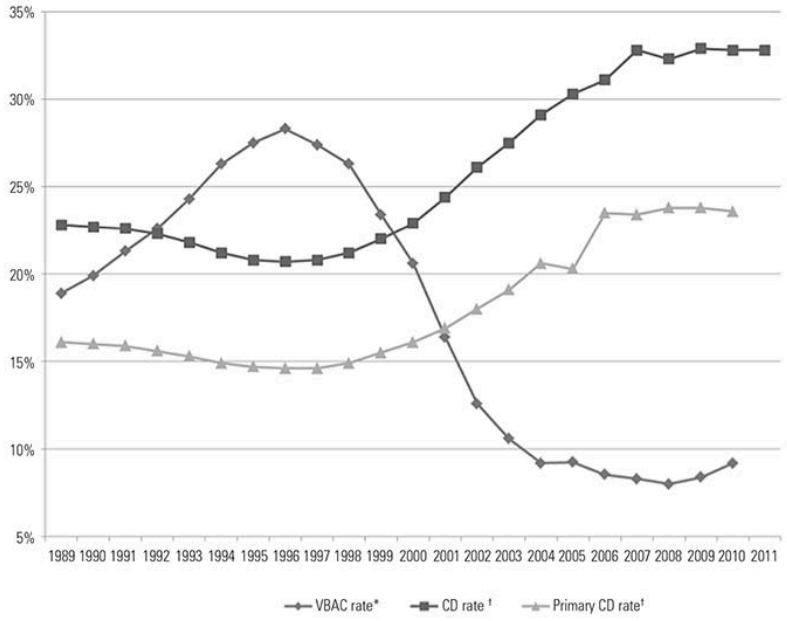


Fig. 1. U.S. delivery rates, 1989–2011. Data from National Vital Statistics. Abbreviations: CD, cesarean delivery; VBAC, vaginal birth after cesarean delivery . *Percent of women who have a vaginal birth after prior cesarean delivery. †Rate based on total number of deliveries. (Data from Martin JA, Hamilton BE, Ventura SJ, Osterman MJ, Mathews TJ. Births: final data for 2011. Natl Vital Stat Rep 2013;62(2):1–90.)

Cesarean Sections: Medical and Holistic models of Delivery

The term ‘medical model of birth’ was coined in 1979 by sociologist Barbara Katz-Rothman (20). Hospital births delivered by physicians in the United States of America were drastically different than births led by midwives at home, in birthing centers, or at midwife communities: medications, repositioning the woman in labor, deadlines for labor progression all these components actively managed a birth compared to the holistic approach- letting the birth happen. The medical model of birth divides the birth into stages with definition and guidelines on the length of each stage. These definition and guidelines construct their own versions of labor and birth, providing a ‘norm’. Obstetric intervention has become routine in a modern hospital birth Obstetric intervention has become common in a modern hospital birth, including the use of narcotics, epidural anesthesia, and/or oxytocin to stimulate labor, fetal monitoring, forceps, vacuum deliveries, and episiotomies. Physicians have to balance the wellbeing of the mother and baby in addition to pressures from the mother during labor- some mothers begin labor with the plan to refuse interventions but later request them, despite their previous intentions (18). After all, Queen Victoria knighted Dr. John Snow for using chloroform on her during 2 of her births (22). Physicians find themselves conflicted between the desire to relieve suffering, to navigate between a potentially traumatic vaginal birth and less traumatic cesarean section, and fetal distress.

The medicalization of birth shows that obstetrician intervention in childbirth has become routine, its necessity not always clear. In some cases, obstetricians in Brazil have been known to actively convince laboring mothers to opt for a cesarean

section over a vaginal delivery without a medical cause for the interventional procedure (23). Barbara Katz-Rothman regarded switching from clinical hospital models to home births, birthing centers, and midwife-lead practices as a social redefinition of birth (20).

The holistic midwifery model used by many modern midwives does a tremendous amount of observing labor and its processes with little to no active management. It is a midwife's job to know the signs of fetal and maternal distress during pregnancy and labor and to make the decision to intervene or seek assistance from an obstetrician should the pregnancy or delivery require it. Midwives, on average spend more time with their patients, have lower rates of post-partum hemorrhage (24), episiotomies, and perineal tears of all degrees and try more varieties of birthing positions that their physician counterparts(25, 26).

Contrasted with the holistic midwifery model, the medical model of birth is more costly(25), requires much more medication, requires more interventions, and is not proven to be safer or more effective than the holistic midwifery model of birth for low-risk pregnancies. There is evidence, however, that avoiding initial obstetric intervention while providing women with one-to-one prenatal and labor support increases the chances that a woman will give birth spontaneously and vaginally while avoiding the "increased risks of surgery, perineal trauma, and separation from their baby associated with more complex births," (23). A way to combat the increasing cesarean section rates is with an increase in midwife-lead care. An example of a midwife-lead practice that brings with it all the benefits of the holistic midwifery

model is the International Maternity Center, Centro Internacional de Maternidad, [CIMA].

The History of Centro Internacional de Maternidad

The International Maternity Center, Centro Internacional de Maternidad, was founded in 1998 by two obstetricians and one Hispanic businessman. Prenatal care for undocumented Latin immigrant families was disorganized in the 1990s for a number of reasons. Mainly, the geographic locations that these immigrants could afford to live in lacked hospitals and had limited care services for poor uninsured families. There were also the barriers of language and pricing for services which working class families could not afford, and the fear that if one applied for emergency medical assistance and is undocumented, that they would be deported. Two physicians from Northside Hospital in Atlanta organized CIMA to fill in this dire gap in care. The practice's growth was explosive because of the need for these services. Since 2002, after some administrative rearrangement, CIMA conducted about 300,000 office visits and helped bring over 19,000 babies into the world born to primarily Hispanic, Brazilian, and Vietnamese immigrant families.

Centro Internacional de Maternidad is unique due to both its goals and midwives in addition to its successful economic model. CIMA seeks to: provide services to immigrants keeping with their culture, provide community-based prenatal care using centering, provide all-inclusive fixed price prenatal services so that families can budget their care without surprises and provide a full affordable range of well woman and family planning services. The midwives of CIMA all speak Spanish

to better care for their patients; this detail sets CIMA's midwives apart from every other midwife clinic in the Atlanta area. CIMA's model of care is very different than other clinics and hospitals because of its patients and midwives. By prioritizing the needs of the specific communities it serves, CIMA actively tailors its services to those who need them; no other clinics or hospitals have done this. In many ways, CIMA acts like an insurance company or middleman by negotiating contracts for laboratory services, medical care, vitamins, ultrasounds etc, to control costs and pass the savings on to its consumers. The International Maternity Center is fighting a constant battle between providing excellent care, employing a diverse and effective staff, and keeping costs down.

CIMA is a success story from many facets. It succeeded in fulfilling care gaps for Latin American immigrants by delivering thousands of healthy babies. Centro Internacional de Maternidad succeeded financially by creating a new economic model that focuses on keeping the cost of care down while still employing high quality health care methods. This economic model is very management heavy, requiring trimming the budget on a constant basis in order to not lose the ability to pay staff members while maintaining reasonable prices. This model involves a decentralized operation. Women receive their prenatal care and checkups in the neighborhoods they live in and then deliver in one central birth facility. Certified nurse midwives conduct the prenatal care and labor. The deliveries are supervised by the midwives if the baby and the mother are both tolerating labor well and showing minimal signs of stress. If the midwife decides the labor is not going well or the baby or mother are in distress, and obstetrician is called in to evaluate if a cesarean section is necessary. If a cesarean

is deemed necessary for the well being of the mother and baby, the midwife will also attend the surgery.

In the Atlanta area, immigrant women often have to live far away from hospitals. This model allows the clinics used for routine visits to be closer the place of residence of the women so they can still receive prenatal care in a convenient manner. As access to care providers in rural Georgia continue to plummet, this model could easily be used in rural areas. Driving prices down is of the utmost importance for CIMA and its patients. Out of 9339 births, 73% of the mothers paid for their deliveries out of pocket and 20% used Medicaid. The remaining 7% used private insurance and other methods. This unique model of care provides much needed support for a marginalized population.

In 2014, CIMA's clinics were sold to Kane Clinics LLC. Kane Clinics LLC was better equipped to handle the expanding practice, the burdening administrative workload, and its financial needs. The two physicians that founded CIMA were eager to leave the practice and its intense administrative tasks in capable hands in favor of returning to birthing suites and delivery rooms.

Chapter 2: Manuscript

By: Chelsea J Riley

Author contribution:

Chelsea J Riley completed a preliminary data cleaning in both excel and SAS. She formulated research questions under the advice of Dr. Dott and Dr. Rochat. She self-developed the survey questions under the advice of Dr. Dott. She wrote the manuscript and conducted the statistical analysis. Dr. Rochat, as her thesis advisor, contributed greatly to the editing process.

Title: Certified Nurse Midwife (CNM) Attitudes about Birth and Primary Cesarean Section Rates

Abstract

In this small retrospective cohort study we analyzed birth data from the International Center for Maternity's [CIMA] birth data from 2009-2015 (n=5,291) to evaluate if primary cesarean section rates are associated with midwives' attitudes towards the medical model of birth. CIMA is a midwife-led prenatal care, labor, and delivery practice that mainly serves Hispanic immigrants in the Atlanta, GA area. CIMA has a primary cesarean section rate of 13.7%; the national average is 21.5%. After developing survey questions, we conducted a focus group of 5 midwives to validate the questions. Two identified with the holistic model of birth and 3 identified with the medical model of birth. After validation, the survey was administered to CIMA's 11 midwives. There were a total 13 questions to evaluate support for holistic or medical model of birth in the final survey. The survey had a total of 13 points possible; a midwife who answered holistically to every question would have a score of 13. Simple linear regression was used to investigate each of the survey questions and the total score as the independent variable with primary cesarean section rates as the dependent variable. Scores ranged from 6.4-12.8 out of 13 possible points. The average score for CIMA's 11 midwives was 10.33 [95% CI: (8.82, 11.83)]. The mean primary cesarean section rate is 13.70 [95% CI: (11.93, 15.48)]. The results suggested an inverse relationship between the survey's holistic score and primary cesarean section rates. When the totaled score was used as the independent variable, the model yielded an r^2 of .45. The linear regression model predicts a decrease of .79% in primary cesarean section rates for every 1-point increase on in a midwife's holistic midwife score. In conclusion, our results indicate that CIMA's midwives identify more with the holistic model of birth and that a holistic midwife scoring algorithm could predict, to some degree, a midwife's primary cesarean section rate. Our findings, taken in context with previous midwife studies, suggest that a survey detailing midwives attitudes towards the medical model of birth could be used to predict primary cesarean section rates.

Introduction

The history of cesarean sections goes all the way back to Ancient Greek mythology, where Apollo cut his son Aclepius from his mother's womb to save the child even though the mother was doomed (1). A cesarean section is an invasive surgical operation accompanied by all the risks of major surgeries such as infection, hemorrhage, uterine rupture, and complications from anesthesia (11) among many other neonatal complications. While it is considered a safe operation with 36 women per 100,000 diying during the procedure or as a result of a cesarean section, only 9.2 died per 100,000 as a result of vaginal delivery between 2000 and 2006 (12). When this procedure became standard for certain types of medical cases and conditions in modern medicine around the late 1940s(1), it was originally viewed by some obstetricians as a great advancement in obstetric procedures, as a "life-enhancing" procedure, seemingly easier and less gruesome with increased survival than a traditional vaginal delivery (3). Infants and mothers who would have died otherwise could be saved. Obstetricians also gained more control over their patients' births with cesarean sections. Mothers could effectively schedule their deliveries too, streamlining and actively managing the birthing process.

The medical model of birth in the United States of America was coined in 1979 by sociologist Barbara Katz-Rothman. Barbara Katz-Rothman regarded switching from clinical hospital models to home births and birthing centers as a social redefinition of birth(18). Hospital births lead by physicians were drastically different: medications, repositioning the woman in labor, deadlines for labor progression all these components actively managed a birth compared to the holistic approach, letting

the birth happen. The medical [hospital] model of birth divides the birth into stages with guidelines on the length of each stage, constructing its own versions of labor and birth.

The holistic midwifery model used by many modern midwives does a tremendous amount of observing labor and its processes with little to no active management. It is a midwife's job to know the signs of fetal and maternal distress during pregnancy and labor and to make the decision to intervene or seek assistance from an obstetrician should the pregnancy or delivery require it. Midwives, on average, spend more time with their patients , have lower rates of post-partum hemorrhage, episiotomies, and perineal tears of all degrees and try more numbers of alternative birthing positions that their physician counterparts(24-28).

Contrasted with the holistic midwifery model, the medical model of birth is more costly, upwards of $8,000 compared to $3,500- the average midwife-led birth (25), requires much more medication, requires more interventions, and is not proven to be safer or more effective than the holistic midwifery model of birth for low-risk pregnancies. There is evidence, however, that avoiding initial obstetric intervention while providing women with one-to-one prenatal and labor support increases the chances that a woman will give birth spontaneously and vaginally while avoiding the "increased risks of surgery, perineal trauma, and separation from their baby associated with more complex births," (29).

Chelsea Riley 4/21/16 11:03 PM
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Since 1985, the World Health Organization's recommendations on cesarean section rate suggest a rate between 10 and 15 percent. Caesarean sections have become increasingly common in developed and developing countries, lacking

evidence showing the benefit to both mother and baby when the pregnancy did not necessitate the procedure. In a worldwide ecological study, WHO found that below a 10% ceasarean section rate, maternal and neonatal mortality decreased when caesarean section rates increased- an inverse relationship. As caesarean section rates increased above 10% and up to 30% no effect on mortality rates were shown (14). At population level, caesarean section rates higher than 10% are not associated with reductions in maternal and newborn mortality rates (14). While these WHO recommendations are over 30 years dated, they point to a trend obstetrics has been showing, a rising number of elective caesarean sections and the idea that women in need should be provided caesarean sections in lieu of attempting to achieve a certain rate.

At the release of CDC's vital statistics from 2014, 32.2% of documented live births in the United States were completed with cesarean sections (15). This is .5% down from 2013. A 2010 WHO report on caesarean sections resulted in the following finding: in 2008 an estimated 3.18 million additional caesarean section were needed and approximately 6.20 million medically unnecessary sections were performed (30). The national average primary cesarean rate is 21.5% (7); Georgia's average primary cesarean rate is 22.7% (8). There are many interventions that could decrease caesarean section rates, one is midwife-led deliveries.

Certified Nurse-Midwives, CNMS, hereby referred to as simply midwives for the purposes of this paper, go through extensive training to be certified to deliver their patients' babies. Midwives attended 313,516 births in 2009, accounting for 7.6% of all deliveries in the United States of America that year (25). Specifically, midwives

have lower rates of caesarean sections than their physician counterparts. In a study of 15,574 low-risk pregnant women planning on delivering in midwife-led birthing center across the nation, only 6% ended up with a caesarean section, compared to a 27% rate in a similar low-risk population (37).

The International Maternity Center, Centro Internacional de Maternidad, [CIMA] is a midwife-delivery led practice offering comprehensive prenatal care and delivery assistance to mothers of all races, ages, and backgrounds in the Atlanta, Ga area. These midwives operate prenatal care visits in CIMA's clinics and lead their births at the popular Northside Hospital. These midwives are all certified nurse-midwives, coming from a variety of backgrounds, each having a unique view on motherhood, pregnancy, labor, and childbirth. CIMA's midwives all practice the holistic midwifery model of care.

This preliminary study will help provide a better understanding of CIMA's midwives' attitudes towards the medical model of giving birth. By quantifying these attitudes through a scaled questionnaire, this study will investigate the association between attitudes to the modern medical model of giving birth and primary caesarean section rates, providing valuable insight on how midwifery- at a large scale- could affect national caesarean section trends.

Methods:

Study Population and Data Collection

This was a retrospective cohort study using data collected by the international Maternity Center [CIMA] on its patients and survey results from the midwives.

CIMA began collecting electronic data on their patients starting in 2005. Midwives and their assistants were responsible for data entry. Information on women who visited one of CIMA's clinics was entered into the database after proper consent was obtained. Information on individual births was entered anywhere from immediately following birth to one week after birth. Midwives and/or their assistants were responsible for entering the information. IRB approval was granted by Emory's IRB institution in June of 2015.

The original database contained information on 9,699 births. Those with multiple births (twins), duplicate entries, miscarriages, still births, non-primary caesarean sections or were missing information on the person who completed the delivery or critical birth outcome variables such as APGAR scores and birth weight were excluded from the analytic dataset. A total of 5,291 births were used for this analysis; forty five percent of births in CIMA's database from 2009-2015 were excluded.

Medical staff measured infant exposure variables, such as delivery complications, type of birth, and others, during the birth. It is common routine to record these data during or immediately following a birth. The midwife who led the delivery or his or her assistant would enter the data from the medical records of the mother and infant within a timely manner following the birth.

The survey was written with the close advice of a practicing obstetrician with a long-standing background of working alongside midwives. There was a focus group of 5 midwives with varying attitudes on the medical and holistic models of birth to check the questions for bias, necessity, and logic. Two holistic model based midwives

and three clinical model based midwives were used to evaluate the questionnaire. The questions on the survey were designed to be purposefully dividing. If the answers were not split in a two to three ratio between the medical and holistic model midwives, that question was not included in the final survey. The final survey in its entirety can be found in the appendix.

The survey was sent out electronically using Google Forms as the survey platform. Emails were sent to each midwife containing the link to the survey; all responses were submitted within two weeks. The midwives were not told how it would be scored to keep their answers as unaffected by social norms and pressures as possible.

Statistical Analysis:

Survey results were exported from Google Forms into Microsoft Excel. Within Excel, the questions were scaled to each be worth 1 point. Questions where all midwives answered homogenously were removed from the total score because they could not be used in the analysis. Questions with completely homogenous answers will not yield informative responses when used in simple linear regression. After exclusions, 13 questions remained. 13 points was the highest holistic score, demonstrating a midwife who is committed to the holistic midwifery model of birth. The lower the score of the midwife, the more she or he is committed to the hospital model of birth.

Qualitative analysis was conducted in SAS 9.4. Simple linear regression was performed using cesarean sections as the dependent variable and the holistic score as

the independent. Each survey question was analyzed individually as the independent variable to see which questions predicted the cesarean section rate best. The aim of data analysis was to gain a sense of the association between cesarean section rates and the holistic score while identifying any key survey questions that are impactful.

Results and Conclusions

Survey Results

All eleven main midwives completed the survey, making the response rate 100%. Three questions had homogenous answer schemes- where all respondents answered the same. These questions were excluded from the final analysis, leaving 13 questions and 13 possible holistic score points. The homogenous questions were questions all answered in the affirmative regarding: if water births are a reasonable alternative to traditional birthing practices, if all births should happen in a hospital, and if all pregnant women should be offered influenza vaccines. The final scores and responses from the survey can be found in table 1. A trend is seen in the data, as both the lowest holistic scored midwives have the highest primary cesarean section rates. This trend was not as evident in the upper values of the holistic midwife score.

Scores ranged from 6.4-12.8 out of 13 possible points. The average score for CIMA's 11 midwives was 10.33 [95% CI: (8.82, 11.83)]. The mean primary cesarean section rate is 13.70 [95% CI: (11.93, 15.48)]. The national average primary cesarean section rate is 21.5%. This difference in means in considered to be highly significant ($p<.0001$).

Linear Regression Results

Linear regression was performed to investigate the association between primary cesarean section rates and the holistic midwife score. We were also interested in the predictive uses of the scoring system; primary cesarean section rates were used as the dependent variable for our linear regression analysis.

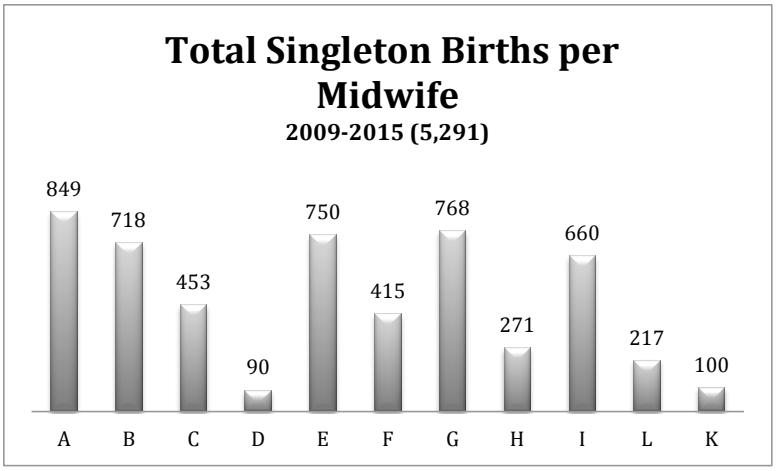

Figure 4. Number of births per midwife, CIMA 2009-2015

Table 1. Average primary cesarean section (c-section) rates (%) and holistic scores from the midwife survey by midwife

Midwife Code	Average Primary C-section (%)	95% Confidence Interval*	Survey Score
A	10.0	8.1, 12.2	10.4
B	13.3	10.8, 15.9	9
C	16.2	12.8, 19.8	10.6
D	13.9	7.9, 23.4	12.8
E	14.7	12.2, 17.4	10
F	17.2	13.6, 21.1	6.6
G	11.2	9.1, 13.6	12.8
H	10.0	6.7, 14.2	11.6
I	17.8	15.0, 21.0	6.4
J	13.2	9.1, 18.6	12.6
K	13.2	7.1, 21.2	10.8

*calculated using exact binomial

The questions could not each be included in a model due to high collinearity. Therefore, each of the questions was modeled separately and then the total was modeled. Results from questions with an r^2 of .4 or higher can be found in table 2 and table 3. There are three questions that we want to highlight, meeting the r^2 requirements previously described.

When the totaled score was used in the model as the independent variable, the model yielded an r^2 of .45 (see table 4); about 45% of the variation in primary cesarean section rates can be attributed to the differences in midwife scores. The linear regression estimates predict a decrease of .79% in primary cesarean section rates for every 1 point increase on a 13 point scale in a midwife's holistic midwife score. We can conclude that CIMA's midwives, on average, positively identify with the holistic model of birth.

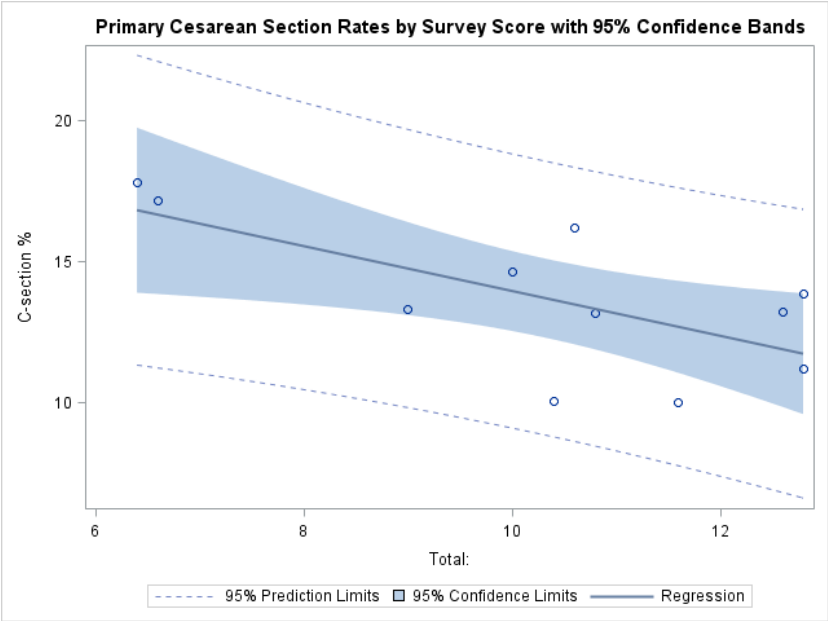

Figure 5. Primary cesarean section rate by holistic survey score for each midwife including a linear trend line

Table 2. Highlighted questions that met the .4 r^2 criterion from linear regression models by answer type (n=11)

Question:	**Holistic Answer (%)**	**Clinical Answer (%)**
(5) Would you support a friend or family member who decided that a home birth was the right course of action for her pregnancy?	**Yes(82)**	**No(18)**
(13) Would you allow a woman to continue with active labor for more than 10 hours (greater than 6cm)?	**Yes(64)**	**No(36)**
(14) Would you allow a laboring primigravid woman to continue in the second stage of labor for more than 3 hours?	**Yes(82)**	**No(18)**

Table 5. Linear Regression Results using each individual question as the independent variable and primary cesarean section rate as the dependent

Question Number	Model r^2	p-value*
5	.5	.015
13	.53	.011
14	.5	.015

*Intercept p-values all <.0001

Table 6. Linear Regression Results using the totaled score as the independent variable and primary cesarean section rate as the dependent

Independent Variable	Estimate	Model r^2	p-value*
Total Score	-.79	.46	.023

*Intercept p-value of <.0001

Discussion

Our results indicate that a holistic midwife scoring algorithm could predict, to some degree, a midwife's primary cesarean section rate. The linear regression results predict a decrease of .79% in primary cesarean section rates for every 1-point increase in a midwife's holistic midwife score. The more technical questions regarding progressing though the stages of labor showed the most correlation with cesarean section rates. These preliminary results are consistent with the hypothesis that a higher holistic midwife score results in a reduced primary cesarean section rate compared to the national average and support further investigation in a widespread study.

These findings are plausible in several respects. Consider some specific questions from the survey, such as the one regarding home births. It is likely that a midwife who agrees that home births can be a safe alternative to hospital births is more likely to be more patient in a difficult labor that is prolonged or no progressing because she believes in less interventions or respecting a mother's wishes. A midwife who doesn't feel she needs to work in a hospital is more likely to be comfortable waiting to see how a labor progresses before intervening. One midwife commented in the survey, "The ideal birth is any birth that both the mother and baby are healthy and have good outcomes."

The strengths of this research and analysis are mainly that a scoring system to predict midwives' primary cesarean section rates has not been investigated yet. The self-developed survey is one of the first ventures into midwifery's effect on cesareans sections using attitudes on models of birth as the predictor. The dataset used is from a longstanding midwife-driven practice that deals with mainly immigrant mothers, arguably a high-risk population. CIMA is a distinct practice in the Atlanta area fulfilling a niche need in prenatal care, sexual health, and family planning for women who may not be able to get it elsewhere while not requiring documentation of citizenship to receive care.

There are many limitations to this study. While it is a pilot study by nature, the main limitation is the small sample size of 11 midwives. The results and conclusions in this study might not be applicable to a different set of midwives or a different practice or a different patient population. This small sample size compromises the generalizability of the results and the scope of the survey. Despite recommendations, many obstetricians and midwives do not perform vaginal birth after cesarean sections (VBAC). CIMA is ready and willing to perform VBACs, making their cesarean section rate lower. The survey was self-developed by a small but informed team. A reevaluation of the survey, using the results of the question-by-question analysis and incorporating more clinical knowledge based questions could help strengthen the survey for future and broader uses.

A reevaluation of the survey questions would involve including more clinical-based questions like questions 13 and 14. Question 13 regards allowing a woman to continue with active labor for more than 10 hours (greater than 6cm), which according to the American Congress of Obstetricians and Gynecologists (ACOG), is perfectly normal

and should be considered as a reason for induction or cesarean section according to the American Congress of Obstetricians and Gynecologists. ACOG even says more than 20 hours in active labor is not cause for concern (10). Question 14 regards allowing a primigravid woman to continue in the second stage of labor for more than 3 hours. ACOG recommends at least 2 hours be spent in the second stage, but does not issue a maximum, stating that some women can be in this stage for 5 hours or more and deliver healthy babies (10). Clinical-based questions like these are good at teasing out the midwives who aren't as concerned with the amount of time the mother spends in specific stages, but rather focus on the status of mom and baby as indications for complications.

Chelsea Riley 4/21/16 11:03 PM
Comment [2]: Added ACOG stuff here

Our results, in context with previous studies on midwives and delivery in the United States, suggest there could be predictive value of a scoring system gauging midwives' attitudes towards the medical model of birth in predicting cesarean section rates. On a large scale, midwives less inclined to follow the medical model of birth could help lower the cesarean section rate of a specific geographic location to a value closer to WHO's recommendation. Midwives on average complete many actions that can stave off cesarean sections: patience with laboring mothers, free mobility for laboring mothers, and fetal rotation all play a part in preventing cesarean sections (31). Increasing the number of midwives able and willing to stake the necessary steps towards preventing interventions and allowing a birth to progress is likely to decrease local cesarean section rates. Multiple studies indicate that a switch from private or hospital birth setting to a more collaborative midwifery-style birth lowers cesarean section rates and increases VBAC rates (31-37). A large-scale investigation using a significantly greater number of

midwives in addition to a survey reevaluation could help strengthen the survey' predictive value and expand the scope and generalizability.

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Chapter 3: Public Health Implications

This pilot study conducted with The International Maternity Center indicates a correlation between a midwife's primary cesarean section rate and her attitudes toward the medical model of birth. The stronger the midwife disconnects with the medical model of birth the lower the midwife's cesarean section rate will be. While at a small scale, this study points to a correlation that could help hospitals and birthing centers chose midwives in a way to lower their cesarean section rates, potentially improving local infant and maternal health through reductions in complications from interventions and surgical procedures.

On a small scale, prenatal care practices like CIMA could impact local cesarean section rates. CIMA's midwives are the primary laborist, calling in the doctors only when necessary. Since midwives aim to be patient during labor and spend more time with their patients than an average obstetrician, mothers under their care would be less inclined to ask for interventions or procedures. Labor and delivery interventions and procedures would be reserved for cases where they are necessary for the health and wellbeing of the mother and/or the infant.

On large scale, clinics and practices that follow CIMA's model could help change patient care for soon-to-be-mothers and current mothers for the better. Affordable prenatal care, family planning, and well woman visits could directly help improve the health of women within the community, benefitting their families and the community. As el Centro Internacional de Maternidad puts it- healthy mothers, healthy babies.

Appendix:

Survey Scoring:

(Each question is worth 1 point. The answer will be listed directly after each question. An answer in favor of the holistic model is worth 1 point; an answer in favor of the medical model is worth zero points. The answer with a plus sign after indicates it is in favor of the holistic model. Questions with a scale are scored in .2 increments. On a scale of 1 to 5, 1 is worth .2 points, 2 is worth .4 points, 3 is worth .6 points, 4 is worth .8 points and 5 is worth 1.0 points. Questions with 3 asterisks following them were not used in the final analysis because they were answer homogenously.)

Survey:

This survey was designed to help tease out fundamental attitudes towards births not taking place in a hospital setting and other non-traditional birthing methods. These questions are meant to be difficult to answer in a binary yes/no format. I have provided a comments section after each question to be used to explain any reservations or reasoning as you see fit.

I will be using the responses as part of my thesis. I am Chelsea Riley, a second year MPH student at Rollins School of Public Health. This is my first excursion out of vector-borne disease; I am delighted to be working with such an important group of people!

Your answers will only be viewed by the surveyor. They will be kept confidential.

If you have any concerns, questions, or comments I can be reached at:

chelsea.jenna.riley@emory.edu
xxx-xxx-xxxx

I cannot thank Dr. Roger Rochat, Dr. Andy Dott, and my 'focus group' midwives enough!

Thank you for your participation!

*** ***

1. Do you primarily consider yourself a midwife or an advanced nurse practitioner?
(midwife+/ advanced nurse practitioner)

2. How important is the word ‘midwife’ to you as it applies to your concept of your practice?
(scaled 1-5)

3. How important is the word 'nurse' to you as it applies to your concept of your practice?
(scaled 1-5)

4. Do you feel that home birth, for a woman with no known risk factors, is a safe alternative to a hospital birth?
(yes+/no)

5. Would you support a friend or family member who decided that a home birth was the right course of action for her pregnancy?
(yes+/no)

6. Do you believe that water births, in some instances, can be a reasonable alternative to traditional vaginal births?***
(yes+/no)

7. Friedman curves are a useful tool in the management of the progression of labor.
(True/False+)

8. Pregnant women with no known risk factors should be encouraged to have their births conducted by midwives rather than doctors.
(True+/False)

9. Do you believe the process of birth should be actively managed or that it is a process meant to be mainly observed?
(actively managed/ mainly observed+)

10. The ideal birth always occurs at a hospital.***
(True/False+)

11. A pregnancy is primarily a biological process and secondarily an emotional one.
(True+/False)

12. A hospital is the safest place to deliver a baby.
(True/False+)

13. Would you allow a woman to continue with active labor for more than 10 hours (greater than 6cm)?
(Yes+/No)

14. Would you allow a laboring primigravid woman to continue in the second stage of labor for more than 3 hours?
(Yes+/No)

15. Do you think the following vaccination should be recommended to pregnant women during their pregnancy: Influenza Vaccine***
(Yes/No+)

16. Do you think the following vaccination should be recommended to pregnant women during their pregnancy: TDAP Vaccine
(Yes/No+)

Table 5. Survey scores of each of the 13 questions by 11 midwives

	1	2	3	4	5	7	8	9	11	12	13	14	16	Total**
A	1	1	0.4	1	1	0	1	1	0	1	1	1	1	10.4
B	1	0.8	0.2	1	1	1	1	1	1	0	0	1	0	9
C	1	0.8	0.8	1	1	0	1	1	1	1	0	1	1	10.6
D	1	1	0.8	1	1	1	1	1	1	1	1	1	1	12.8
E	1	1	1	1	1	1	0	1	0	0	1	1	1	10
F	1	0.8	0.8	0	0	1	0	1	0	1	0	0	1	6.6
G	1	0.8	1	1	1	1	1	1	1	1	1	1	1	12.8
H	1	0.8	0.8	0	1	1	1	1	1	1	1	1	1	11.6
I	1	0.8	0.6	0	0	1	1	0	1	0	0	0	1	6.4
J	1	1	0.6	1	1	1	1	1	1	1	1	1	1	12.6
K	0	0.4	0.4	1	1	1	1	1	1	1	1	1	1	10.8
Total*:	10	9.2	7.4	8	9	9	9	10	8	8	7	9	10	113.6

* The largest value possible is 11, meaning all midwives answered the same
**The largest value possible is 13, meaning a midwives answers in favor of the holistic model for every question

Questions that did not pass the 2:3 focus group test.

The question will be listed. Directly after the question the reasoning why it was left out will be listed as well.

Question: Do you believe that CNMs should always have some independence from physicians? (Y/N)

Reasoning: The focus group midwives felt that this question is moot because CNMS are required by law to work directly with physicians.

Question: 4. Do you feel that CNMs should always have collaboration with medical doctors during vaginal birth of a low-risk pregnancy? (Y/N)

Reasoning: The focus group midwives felt that this question is moot because CNMS are required by law to collaborate with physicians.

Question: The process of birthing a baby is a (series of trials) disaster waiting to happen. (T/F)

Reasoning: This question was worldly poorly and the midwives did not split 2 to 3, so it failed our inclusion test. Everyone answered False.

Question: Births should only be conducted in clinical settings such as hospitals or birthing centers. (T/F)

Reasoning: This question was worldly poorly and the midwives did not split 2 to 3, so it failed our inclusion test. 1 answered false, the others answered true.

Question: The ideal birth always occurs at a hospital under physician supervision (T/F)

Reasoning: All answered false, because they are midwives and felt that all births don't need to be physician supervised. It failed our inclusion criterion.

Question: CNMs should be free to define their own scope of practice (T/F)

Reasoning: This question was worldly poorly and the midwives did not split 2 to 3. Many mentioned it was moot, because there are laws and regulations both federal and state level that govern midwives' scope of practice.

Question: Do you have reservations about multiple ultrasounds during pregnancy? (Y/N)

Reasoning: All midwives answered no. It was not included because it failed the 2 to 3 test.

IRB Approval for data usage:

TO: Chelsea Riley
Principal Investigator
Public Health

DATE: July 02, 2015

RE: **Expedited Approval**
IRB00081958
Centering Midwife Strategy: Improving Birth Weights and APGAR Scores

Thank you for submitting a new application for this protocol. This research is eligible for expedited review under 45 CFR.46.110 and/or 21 CFR 56.110 because it poses minimal risk and fits the regulatory category F[5] as set forth in the Federal Register. The Emory IRB reviewed it by expedited process on **7/2/2015** and granted approval effective from **7/2/2015** through 7/1/2016. Thereafter, continuation of human subjects research activities requires the submission of a renewal application, which must be reviewed and approved by the IRB prior to the expiration date noted above. Please note carefully the following items with respect to this approval:

- A complete HIPAA-Consent waiver was granted

Any reportable events (e.g., unanticipated problems involving risk to subjects or others, noncompliance, breaches of confidentiality, HIPAA violations, protocol deviations) must be reported to the IRB according to our Policies & Procedures at www.irb.emory.edu, immediately, promptly, or periodically. Be sure to check the reporting guidance and contact us if you have questions. Terms and conditions of sponsors, if any, also apply to reporting.

Before implementing any change to this protocol (including but not limited to sample size, informed consent, study design, you must submit an amendment request and secure IRB approval.

In future correspondence about this matter, please refer to the IRB file ID, name of the Principal Investigator, and study title. Thank you

Micole Hasan
IRB Analyst Assistant
This letter has been digitally signed