INTRODUCTION

Cesarean section rates vary significantly between states across the USA. According to the Center for Disease Control\textsuperscript{[1]}, one third of women giving birth in US hospitals are likely to end up with a Cesarean delivery, with a range of 7-70\% cesarean section depending upon the hospital.\textsuperscript{[2]} Cesarean policy reforms have been suggested with little progress, and there exists a broad range of policies and philosophies between hospital practitioners and out-of-hospital midwives in regard to what is commonly considered best practice in Cesarean prevention.\textsuperscript{[3,4,5,6,7]}

Observation of discrepancies in the rate of Cesarean section between hospital and out-of-hospital maternity care led to the subject matter for this project. Homebirth midwives have an average transport rate of 12\%\textsuperscript{[6]} for emergency as well as precautionary measures and a profession wide Cesarean rate of 4\%\textsuperscript{[6]}, while the national Cesarean Section rate for hospital-based maternity care averages over 32\% including both emergency surgeries and precautionary surgeries. In order for hospital-based care providers to understand necessary adjustments in maternity protocols, out-of-hospital birth must be considered as one of the solutions for reducing the Cesarean rate.

The need for maternity care reform is summarized in the words of former Director-General of the World Health Organization, Lee Jong-Wook: “Mothers, the Newborn and Children represent the well-being of a society and its potential for the future. Their health needs cannot be left unmet without harming the whole of society.”\textsuperscript{[8]}

This review of the current rates of Cesarean delivery has led to the development of the thesis question: Do states with more access to out-of-hospital midwives compared to obstetricians have lower Cesarean rates than states with a lower ratio of out-of-hospital midwives to obstetricians? This thesis is to explore whether there is a correlation between the ratio of regulated midwives and obstetricians and the incidence of Cesarean Section births on a state level.
THESIS

The 21 states with state accountable out-of-hospital midwives in 2009 have Cesarean rates ranging between 22.8% and 39.6%, averaging 30.8%.\textsuperscript{[9-37]}

Eleven of these states had Cesarean rates under 30% with an average of 26.6% Cesareans and an average ratio of midwives to OB’s at 1/15 while ten states had rates over 30% at an average of 35.4% Cesareans with an average midwife to OB ratio at 1/39.

Converting the numbers of midwives and obstetricians to ratios and comparing those with the Cesarean rates presents a view of disparities among states. (See Diagram A.)

LITERATURE

Since 1996, of the research on Cesarean rates and some of the risks associated with surgical birth practices in the United States, very little has focused on the effect of access to midwifery care in reducing Cesarean section rates. No studies were found that compared Cesarean rates per state with ratios of out-of-hospital midwives to obstetricians.

The national Cesarean section rate for 2009 was 32.9% with more than half of all births before 34 weeks gestation by Cesarean section (surgical birth). In hospitals, Cesarean section rates in the United States rose by 50% since 1996 along with a declining VBAC (vaginal birth after Cesarean) rate according to National Center for Health Statistics, with less than 10% of

<table>
<thead>
<tr>
<th>STATE</th>
<th>MW/OB</th>
<th>% C-SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Mexico</td>
<td>1/5</td>
<td>22.8</td>
</tr>
<tr>
<td>Utah</td>
<td>1/22</td>
<td>22.9</td>
</tr>
<tr>
<td>Alaska</td>
<td>1/3</td>
<td>23.8</td>
</tr>
<tr>
<td>Wisconsin</td>
<td>1/13</td>
<td>25.8</td>
</tr>
<tr>
<td>Colorado</td>
<td>1/13</td>
<td>26.4</td>
</tr>
<tr>
<td>Arizona</td>
<td>1/29</td>
<td>27.4</td>
</tr>
<tr>
<td>Minnesota</td>
<td>1/56</td>
<td>27.4</td>
</tr>
<tr>
<td>Vermont</td>
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</tr>
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</tr>
<tr>
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<td>1/20</td>
<td>38.1</td>
</tr>
<tr>
<td>New Jersey</td>
<td>1/171</td>
<td>39.4</td>
</tr>
<tr>
<td>Louisiana</td>
<td>1/68</td>
<td>39.6</td>
</tr>
</tbody>
</table>

2009

Diagram A
women with a previous Cesarean birth delivering vaginally.\cite{1,38,39} Despite the high maternal mortality rate in the U.S., no specific study has been performed that addresses a possible correlation with the high Cesarean rate. Research conducted with The Health Policy Institute in Boston: “Midwifery care and out-of-hospital settings - how do they reduce Cesarean section births?” compared matched cases of women beginning labor in hospital settings and out-of-hospital midwife care in the United States. The out-of-hospital births had considerably lower Cesarean rates without compromising mortality and morbidity outcomes. The article highlights the controversy about current medical indications for Cesarean being in conflict with medical knowledge and also the lack of attention given by medical birth attendants to measures for reducing the number of Cesarean births, including access to more out-of-hospital midwives.\cite{4}

Between 1987 to 2009 the Cesarean rate rose from 20.7 to 32.3\cite{38}. During those years the U.S. maternal mortality rate went from 6.6 per 100,000 live births up to 7.6 in 1996. Access to midwifery care remained minimal with low income and discrimination creating barriers while the maternal mortality rate had doubled between 1987 and 2006.\cite{39} There was no federal requirement for accurate reporting of maternal deaths. The CDC considers the actual rate to be up to 3% higher.\cite{40} Maternal mortality rates were 4 times higher for women of color, specifically black women, with the Cesarean rate for black women at 35.2% compared with the national percentage of 32.9 by 2009, by which time the Cesarean rate for all U.S. women had risen nearly 60%.\cite{41,42,43,44}

A 2010 study of the Eunice Kennedy Shriver National Institute of Child Health and Human Development reported that 44% of hospital VBAC (vaginal birth after Cesarean) had induced labors -- which doubled the likelihood of birth resulting in Cesarean section occurring by only 6 centimeters dilation of the cervix. This was considered a typical point of beginning active labor for women who have given birth before.\cite{45} Other studies on VBAC in a hospital setting indicated a variety of problems including higher risk of ruptured uterus with induced labors, the restrictive “trial of labor” protocols resulting in repeat Cesareans, and the absence of VBAC options in most U.S. hospitals\cite{46,47}. In the 2010 revised VBAC guidelines by the American
College of Obstetrics and Gynecology (ACOG), it is now recommended to allow vaginal birth after Cesarean. Guidelines affirm that induction with misoprostol (Cytotec) should not be used and include a revised requirement that hospitals have ready availability of surgeons and anesthesiologists.\textsuperscript{[48,49]}

The National Institute for Health based a determination that if there is one prior low transverse uterine incision the “risks and benefits differ for the woman and her fetus” and that being “mindful of these clinical and ethical uncertainties” support women to make “informed decisions” and “whenever possible, the woman’s preference should be honored.”\textsuperscript{[50]} Although the statement was based on the “medically equivalent options” of “trial of labor” (with medical obstetrical protocols) comparing elective repeat Cesarean delivery, it indicated the need to honor informed choices. Increased incidents of Cesarean section has happened simultaneously with a higher prematurity rate in newborns. Low birth weight, higher risk of respiratory disease and other extrauterine adjustment issues including those related to bonding are seen in significantly increased numbers after Cesarean birth. Problems for the mother range from pain, emotional trauma and repeat Cesareans to reactions from anesthesia, infections and death.\textsuperscript{[51,52,53,54,55,56]} Studies concerning the use of anesthesia in childbirth, such as epidurals and others used in Cesarean sections have noted short- and long-term effects. Dr. Lewis Mehl-Madrona, MD, PhD, a family practice physician, psychiatrist and renowned researcher of alternative medicine wrote in a 1975 article that "...neonatal mortality and morbidity are lower in an unanesthetized natural childbirth population than in the population as a whole. It is also suggested that selected women with benign prenatal courses can labor and deliver at home without a significant increase in neonatal and maternal risks...confirms that utilization of midwives would benefit the public health..."\textsuperscript{[57]} In a 2005 article “Midwives Credited with Reducing C-Section Rate” in Health Science News, New Jersey’s Cesarean rate of 33.1% was compared with the 22% of one particular hospital in that state which included a midwifery program within its hospital maternity care setting, stating that “mothers receiving collaborative midwifery care spend less time in the
hospital and have fewer Cesarean births” indicating that within the hospital setting collaborative care with midwives can make a difference.

The Cochrane Library published a 2009 report comparing midwife-led care with international outcomes and concluded that most women should be offered midwife-led care based upon the statistical findings of same or better results when compared to medical obstetrical care. However, the opinion of the American College of Obstetrics and Gynecology (ACOG) Committee on Planned Home Birth advises obstetricians to refrain from participating or collaborating with home birth options. ACOG acknowledges the need to reduce the “undeniably high” cesarean rate and recommend revision of VBAC guidelines. These recommendations include shared patient-doctor decision making and patient autonomy along with collaborative care, with an emphasis on insurance providers as collaborators. The organization’s statement does not address routine hospital procedures such as effects of induced labor on VBAC risk.

A study based on The Farm midwives in Tennessee was published in 1992, which analyzed 1707 out-of-hospital births with the midwives compared with 14,033 physician-attended hospital births. The midwife group resulted in a 1.46 Cesarean rate and the physician group Cesarean rate was 16.46. Infants deaths were 1.0% with the midwives and 1.33 with the physicians. Midwives had a birth injury rate of 0.23% and physician group’s birth injuries were 3.34%. The maternal mortality rate with the midwives was zero. These statistics occurred between 1971 and 1989, when out-of-hospital midwives were not yet licensed and U.S. hospitals performed about half as many Cesarean sections than in 2009. Since The Farm Study, more recent research indicates a consistent trend in the safety of planned out-of-hospital birth with skilled midwives as well as contributing to a reduction in the number of Cesarean sections performed. Publications such as “Evidence Based Maternity Care” (Sakala) and “Midwifery in the United States Fact Sheet” (Midwives Alliance of North America), and that of a government funded entity (The American Public Health Association) in “Increasing Access to Out of Hospital Maternity Care Services”, analyzed the performance of out-of-hospital midwives and make comparisons
with hospital birth outcomes. The research determined midwifery care to be a healthy option for low-risk pregnant women in the United States, including those wanting to avoid repeat Cesareans.

METHODOLOGY

Each of the 50 states was reviewed to ascertain those with statistically identifiable out-of-hospital midwives. While traditional or unlicensed midwives may practice in some states and are respected by this researcher, there is inconsistent statistical accountability for those midwives. There are a few nurse-midwives offering out-of-hospital birth, yet specific numbers were not accessible. Therefore, midwives known to state governmental entities as licensed (or registered) direct-entry practitioners represent the midwives for this project. The individual states with these midwives were then researched for numbers of obstetricians. An obstetrician is not licensed as such but individual physicians may apply to their certifying board for recognition in the specialty of medical obstetrics. Most hospitals grant delivery room privileges only to those physicians certified in obstetrics. As the numbers of practicing obstetricians could not be identified publicly at the state levels, information about the number of obstetricians was obtained from the leading national certification board for physician specialties. Family practice physicians attending homebirths could not be located and are therefore not itemized in this research.

Certain practice limitations or restrictions might be considered statistical variables. In some of the states, midwives may not attend Vaginal Birth After Cesarean (VBAC). In some hospitals, protocols requiring doctors to perform Cesareans may be more specific. These vast differences of reason for performing Cesarean sections could contribute to the specific disparity revealed in this research.
SAMPLE USED

This thesis includes a comparison of a total of 1143 out-of-hospital midwives and 20,487 hospital based obstetricians with the corresponding Cesarean section rates, using the numbers per each state of 21 states in the USA.

INFORMED CONSENT

All information included is based upon information collected by state and national databases for 2009. Respect for the privacy of individuals is the responsibility of each state and has been so maintained for this research.

CONFIDENTIALITY

The information compiled and calculated is a matter of public record. No names or personal data was used in the research.

DATA COLLECTION

This thesis is based upon available data from the National Center for Health Statistics, state departments of vital statistics, and medical and midwifery regulatory agencies and registries on both national and state levels (see References). Use of such data compilation methods to research statistical outcomes has been included in other publications, such as The Cochrane Database, the Coalition for Improving Maternity Services Expert Work Group, and The Joint Commission’s Journal on Quality and Patient Safety.

Available data included only those out-of-hospital midwives licensed in each state. The data for both midwives and obstetricians include an insignificant number of practitioners who maintain a license in a state different from their residences or the state where they are currently working. Some obstetricians may be listed with more than one residence (in different states).
A Country Surgically Divided

Of states with lower Cesarean rates, 73% averaged a ratio of 1/15 out-of-hospital midwives to obstetricians.

Of states with higher Cesarean rates, 70% averaged a ratio of 1/39 out-of-hospital midwives to obstetricians.

Diagram B

States with available statistics in 2009 are highlighted (blue and green).
Diagram C

2009 Cesarean Rate
per Out-of-Hospital Midwives to Certified Obstetricians

% Cesarean

# Practitioners

NM UT AK WI CO AZ MN VT WA OR MT NH CA TN VA AR SC TX FL NJ LA

CESAREAN %
# MIDWIVES
# OBSTETRICIANS
STATE
DATA ANALYSIS

The results were calculated to demonstrate ratios and then developed into graphs for a visual expression of the results using the iWorks Numbers application (Apple, Inc.) commonly used with current medical and scientific articles. A Corel program was used to design part of the graphics. The final document was then converted to PDF format to maintain its parameters for easy access.

RESULTS

Results show states with a higher ratio of midwives to obstetricians were more likely to have lower Cesarean rates, with a few exceptions. (See Diagrams B & C.) Rates of Cesarean Section were divided into two groups: those with a lower Cesarean rate ranging 22.8% to 29.6% and those with a higher Cesarean rate ranging 30.8% to 39.6%. The two groups were then examined for ratios of regulated out-of-hospital midwives to obstetricians. Of the states with lower Cesarean rates, 73% had a high ratio of midwives to obstetricians between 1/3 to 1/56, averaging 1/15. Of the states with the higher Cesarean rates, 70% had a low ratio of midwives to obstetricians between 1/10 to 1/171, averaging 1/39.

New Mexico with the lowest and Alaska with the third lowest Cesarean rates have midwife to obstetrician ratios of 1/5 (NM) and 1/3 (AK). Conversely, the two highest Cesarean rates were in New Jersey and Louisiana which also have the lowest ratio of licensed midwives to obstetricians at 1/171 and 1/68 respectively.

DISCUSSION

This research supports the possibility that a higher midwife to obstetrician ratio may be beneficial for reducing Cesarean rates in the USA, however, more thorough research is needed before these results can draw a firm conclusion. When comparing state outcomes on Amnesty International’s Maternal Outcomes and Accountability Table, the states with the higher Cesarean rates averaged twice as many maternal mortalities as did states with the lower Cesarean rates.
Louisiana, with the low midwife to obstetrician ratio and highest Cesarean rate, ranked 46th in the country for maternal mortalities. By 2008, the maternal mortality rate for vaginal delivery was at 0.2 per 100,000 and for Cesarean delivery at 2.2 per 100,000 (an increase of 2000%).\[38]\n
Many factors may influence maternal and fetal outcomes and cesarean rates in the United States including regional, social, economical and practical conditions. Obstetrical practices vary with location which may be affected by socio-political factors.\[37]\ Of states in the USA, Utah has a relatively high number of obstetricians and the second lowest Cesarean rate.\[67]\ Utah also maintains much of its history of large families and a strong cultural emphasis on healthy living. Another example is in the southwestern states with strong multicultural influences. Arizona, with its high number of obstetricians maintains a Cesarean rate of 27.4 which in the lower 25% of Cesarean rates in the states with licensed midwives.

Influences at state levels might have an effect on the ways this data interprets the practices of midwives. Both Oregon and Utah include voluntary licensing of midwives. Unlicensed traditional midwives legally attend pregnancy and births in these states though are not certified to carry certain pharmaceuticals. There were estimated to be about as many traditional midwives in Oregon and Utah as licensed midwives. The Cesarean section numbers in both states are in the lower 50% of states’ rates. New Mexico, with the lowest at 22.8% Cesarean rate, allows only licensed midwives yet includes their own Maternal Health Division that not only licenses and oversees out-of-hospital midwives, but also has historically been a state whose government publicly encourages, honors and supports its midwifery heritage.

More than half of the 50 states have enacted legislature to regulate the ancient art of midwifery by way of licensing or registering. Most use the national Certified Professional Midwife (CPM) credential by the North American Registry of Midwives (NARM). Some states recognize but did not license midwives as was the case in Idaho up until 2009, where the Cesarean rate remained one of the lowest in the country at 24.5%, with traditional midwives attending about 2% of births. Mandatory licensing was not implemented in Idaho until mid 2010, and the new laws placed certain limitations on VBAC’s attended by midwives.
Of the states included in this study, the lowest Cesarean rates were in New Mexico, where licensed midwives attend VBAC if no more than one prior c-section in a row and in Utah, where licensed midwives may attend VBAC births if a woman has had no more than two prior c-sections. New Jersey where midwives may not attend VBAC has the second highest Cesarean rate and in Louisiana, the highest, may attend only with the approval of a doctor.

Previous guidelines for how to implement VBAC have had such restrictive requirements that many hospitals refused to provide a VBAC option. The revised guidelines by ACOG in 2010 were responded to by the Citizens for Improving Maternity Services (CIMS) and by the International Cesarean Awareness Network (ICAN). CIMS response was appreciative of ACOG’s slight change from the overly restrictive requirement for having immediate availability of a physician capable of performing Cesarean section, anesthesiologists and supporting personnel, to a somewhat less restrictive requirement that hospitals must have these professionals “readily” available. Since many hospitals did not have such resources, VBAC was banned in most hospitals due to liability. With ICAN’s response encouraging more support for evidence based care, the emphases were on ACOG’s acknowledgement that respect for women’s autonomy requires that a cesarean cannot be forced on a woman and on the need for ACOG’s latest guideline to help reverse damage done by previously published guidelines that caused at least half of U.S. hospitals to ban VBAC. The recommendation that the drug Misoprostol not be used during VBAC suggests that induction during a trial of labor after previous cesarean delivery (TOLAC) may have affected the previous statistical outcomes of VBAC labors. While this raises questions regarding the practice of imposing a set pattern of labor for women to fit into, whether VBAC or not, researchers have done little to address potential problems caused by such methods that may leave individual women and newborns vulnerable to systems of care which adhere to one-size-fits-all policies. Such policies may preserve the limited functionalities of hospital labor and delivery units while omitting the more women-friendly/baby-friendly models of care for low-risk women. An article in the Journal of Perinatology suggests the need for further studies to
determine the reasons for maternal mortality and “preventable events”\cite{70}, no mention is made of the high rate of Cesarean section nor its possible role as a preventable event. Women who have access only to institutional birth methods without enough care providers who are able to take into consideration the variations of normal, are at higher risk of having Cesareans and the risks that come with surgical birth.

As licensing of midwives is implemented in more and more states, guidelines for licensed midwives are more restrictive in and most notably in regard to Vaginal Birth After Cesarean (VBAC)\cite{38-64}. State laws impose these restrictions for homebirth midwives often using available statistical outcomes that are based, in large part, upon routine hospital methods, such as labor induction and trial of labor protocols. If out-of-hospital midwives, including those able to attend women having a VBAC (vaginal birth after Cesarean) can make a difference in lowering Cesarean rates, then it may be advisable to incorporate that model of care into programs advocated by state governments. New Mexico, which boasts the lowest Cesarean rate in the country, can be held as example for demonstrating more functional support of maternity care options via its Maternal Health Program and Birthing Options Program.

CONCLUSION

Though the practice of Cesarean section birth and regulations vary per state, 73% of those with the highest ratio of midwives to obstetricians have the lowest Cesarean rates. Conversely, 70% of those states with the lowest ratio of midwives to obstetricians have the highest Cesarean rates. Results indicate imbalance in access to maternity care choices.

The high and varying Cesarean section rates and the risks involved indicate a need for studying specific models of care and regulations such as outcomes of replacing some surgical justifications with more evidence based options. Urgent study is needed to circumvent disparities in maternal mortality and cesarean rates with women of color and to determine related causes, such as a lack of access to quality maternity care options or possible discrimination within maternity care practices. Evidence indicates the benefit of out-of-hospital midwifery in reducing...
Cesarean rates yet there is an ongoing campaign by medical model organizations to eliminate models of care that are outside of current medical system. Further disparities in varying Cesarean rates within each state may be studied with reference to the ratios of midwives to obstetricians. More objective medical research to include specific qualitative differences between hospital obstetrical care and out-of-hospital midwifery care for low-risk women and VBAC, may give a more comprehensive view of how different maternity practices affect outcomes across the country.
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