

MONITORING RISK, TRACING EXPECTATIONS:
Electronic fetal monitoring and the heart of American obstetrics

Jennifer McCoy

Honors Thesis in Sociocultural Anthropology

University of Michigan

2011

ACKNOWLEDGEMENTS

This thesis would not have been possible without the help, contributions, and patience of many wonderful people. I would like to thank the obstetricians who took the time out of their busy schedules to talk with a lowly undergraduate student. I am incredibly grateful for the faculty members who guided me through every stage of this process. Professor Holly Peters-Golden, thank you for always asking the perfect question or finding just the right reference to propel my thinking. Your insights often revealed a perspective that I could not see on my own. Professor Zeynep Gursel, thank you for all of the tools and feedback that helped me grow not only as an anthropologist, but also as a writer. Your encouragement motivated me through even the most frustrating times and made me believe that I had something meaningful to say. To my honors anthropology cohort- thank you for your tolerance, commiseration, and your excellent work that often inspired my own. To my roommates and friends: thank you for your constant positivity. You are a phenomenal cheering section. And, finally, thank you to my family for your unwavering love and support.

ABSTRACT

The electronic fetal monitor is a device commonly used in American hospital obstetrics to monitor the fetal heart rate and uterine contractions during labor. This technology has been in use since the 1950s, and it is the most commonly used medical intervention in obstetrics.

Electronic fetal monitoring is intended to detect abnormalities in the fetal heart rate that indicate problems with the fetus so that obstetricians can intervene to prevent fetal injury or death during delivery. However, decades of research conclusively demonstrate that using the electronic fetal monitor is no more effective than manually monitoring the fetal heart with a stethoscope.

Additionally, the use of the electronic fetal monitor has been shown to result in a substantial increase in the number of cesarean deliveries and other medical interventions.

This thesis examines the cultural factors that contribute to the continued use of this technology. In addition to an overview of the invention and dissemination of the technology, this thesis explores how electronic fetal monitoring brought the concept of fetal risk to the forefront of obstetrics and altered the authoritative knowledge surrounding hospital births. Additionally, it examines how electronic fetal monitoring contributes to the construction and meaning of evidence in hospital obstetrics. Ultimately, this thesis illuminates how social and cultural forces create a need for this problematic technology in spite of substantial evidence that it produces more harm than benefit.

TABLE OF CONTENTS

Introduction	page 1
Chapter 1: <i>Electronic Fetal Monitoring and American Obstetrics</i>	page 7
Chapter 2: <i>Focus on the Fetus: Fetal Monitoring and Obstetric Surveillance</i>	page 23
Chapter 3: <i>Managing Birth, Managing Risk: Medicine, Litigation, and Authority</i>	page 40
Chapter 4: <i>Evidence that Counts: Chasing Perfection in Obstetrics</i>	page 58
Conclusion	page 75
Appendix	page 80
Works Cited	page 81

INTRODUCTION

Childbirth is highly visible in American popular culture; movies and television shows often depict women in labor, and magazines and books devoted to pregnancy and birth fill store shelves. The image of a screaming woman clenching the hand of her nervous partner while an obstetrician confidently catches the baby is mundanely familiar. Equally recognizable is the urgent scene of medical staff rushing a laboring woman to the operating room for an emergency cesarean to save the lives of both her and the fetus. Usually absent from such common representations is the notion that anything could or should be done differently. However, behind the typical childbirth scenarios that most people recognize exists a great deal of controversy over many obstetrical practices.

A range of researchers, activists, and childbirth practitioners hold varying views on how birth should ideally occur. Though all approaches share the common goal of delivering healthy babies, there is no shortage of stridency between ideologies. Supporters of non-medicalized birth argue that it is naturally successful and medical intervention is rarely needed and usually harmful. Others maintain that giving birth outside of the hospital is reckless and dangerous for both the woman and the fetus. Indeed, there is support for both mentalities, and advocates of both views often call on dramatic statistics and heart-wrenching stories to advance their philosophy. From obstetricians¹ performing patient-request cesarean deliveries in sterile operating rooms to women giving birth completely unassisted in private homes, an entire spectrum of birthing options exists, along with persuasive support for every approach.

¹ For the purposes of this thesis, the physicians who care for pregnant and laboring women are referred to exclusively as obstetricians. Most obstetricians also practice gynecology and are therefore called obstetrician-gynecologists (OB/GYNs), but since this thesis only addresses their role as obstetricians, they are specifically addressed as such.

While divisions remain, in recent decades, proponents of every birthing ideology have increasingly acknowledged that birth in American hospitals is overmedicalized. It is generally accepted that the overuse of many medical interventions has detrimental consequences for women, babies, and the healthcare system as a whole. Efforts to study the overmedicalization of hospital obstetrics usually focus on the alarmingly high rates of cesarean section, pharmacological labor induction and pain relief methods, and surgical vaginal deliveries. In the midst of major abdominal surgeries, powerful drugs injected via lumbar puncture, and vacuums and forceps pulling babies down the birth canal, the electronic fetal monitor (EFM) receives comparatively little attention. This ostensibly innocuous device, used to track the fetal heart rate during labor, often seems to be the least worrisome artifact of the high-technology obstetrical environment. Attached via cables to the laboring woman, this machine produces a visual tracing of fetal heart rate and beeps rhythmically with each beat. A computer screen located beside the woman's hospital bed displays the tracings, and it receives much attention from physicians, nurses, families, and even women themselves during labor (the monitor is typically just behind the woman's head, so when lying in bed, she must turn in order to see it, but it is easily visible to everyone else). Because the EFM does not actually *do* anything other than produce information, it is often overlooked in many analyses of obstetrical interventions. However, it is an incredibly important element of hospital obstetrics and is essential to understanding the overmedicalization of American childbirth.

Since its widespread adoption as the in US hospital births in the 1970s, electronic fetal monitoring has grown to be the single most prevalent obstetrical intervention, used in over 85 percent of hospital births as of 2010 (ACOG Practice Bulletin 132). Despite its ubiquity, this technology is the subject of longstanding controversy. Decades of scientific research demonstrate

that electronic fetal monitoring does not improve maternal or fetal morbidity or mortality. While a few studies have suggested that electronic fetal monitoring may help reduce rates of perinatal seizures, these effects are small and it is unclear if they are truly attributable to the use of the EFM, or are instead the result of general advancements in public health (Parer 2003, Cunningham et al. 2005). What has been repeatedly, convincingly shown is that electronic fetal monitoring is associated with dramatic increases in other interventions, including cesarean deliveries and forceps and vacuum extractions. As one obstetrician caustically joked on an online forum for physicians, “Evidence demonstrates that electronic fetal monitoring is highly effective at preventing vaginal delivery.”²

Although the use of the EFM in and of itself may not be especially damaging to the woman or fetus (though it does carry some notable risks that are discussed in chapter 1), the other interventions with which it is strongly correlated have very significant negative consequences. For instance, cesarean section carries all the risks of any major abdominal surgery (complications related to anesthesia, wound infection, hemorrhage, urinary and bowel dysfunction, pain, scarring, etc.), in addition to potential long term problems with breastfeeding, postpartum depression, and maternal-fetal bonding (Wagner 2006). While cesarean section is considered a relatively safe surgery, women are still four times more likely to die from a cesarean than a vaginal delivery (Cunningham et al 2005). Considering that electronic fetal monitoring has never been proven to improve birth outcomes but is significantly correlated with increasing rates of costly surgical deliveries, it is rather alarming that it remains so common. This thesis is driven by the seemingly obvious question: in light of such damning evidence, why is electronic fetal monitoring still so widely used?

² www.forums.obgyn.net

Physicians, medical researchers, homebirth advocates, and others have offered a variety of answers to this query, but few consider the entire scope of the issue. At first glance, it may seem sufficient to conclude that the biomedical system supports the use of “technology for technology’s sake,” but this claim is rather outdated and does not reflect the complexity of the situation. The suggestion that electronic fetal monitoring continues to be used simply because obstetricians accept it as the standard of practice is also unsatisfying; many physicians object to the use of the EFM and the major professional bodies of obstetrics acknowledge that using the EFM is not the only acceptable fetal monitoring method.

Consideration of the dramatic decrease in the rate of episiotomy, a procedure in which the obstetrician partially or completely cuts the perineum³ during labor in order to enlarge the vaginal opening, also suggests that these reasons are not sufficient. Episiotomy was standard practice in obstetrics for decades, yet its use has declined dramatically since evidence showed that it does not improve childbirth outcomes. This is only one example of many obstetrical technologies that have come and gone, yet despite decades of controversy and contestation, electronic fetal monitoring has only grown more widespread. There is more to understanding the staying power of the EFM, and an anthropological examination of the cultural factors that contextualize this technology is necessary.

Anthropologist Robbie Davis-Floyd asserts that the US medical system “...can most productively be understood as American society’s microcosm- the condensed world in which our society’s deepest beliefs, greatest triumphs, and grossest inadequacies stand out in high relief against their cultural background” (2003:48). Approaching our medical system as a microcosm is especially useful because it enables analysis of how larger structural forces and cultural values

³ The perineum is the tissue between the vagina and the anus.

influence the delivery of medical care. Furthermore, in the current era of expansive medical institutions and pervasive concerns about medical malpractice litigation, "...legal and financial deterrents...powerfully constrain our medical system, in effect forcing that system to precisely reflect and to actively perpetuate the core belief and value system of American society as a whole" (Davis-Floyd 2003:48). As Davis-Floyd states, administrative, legal, and economic forces restrict the ability of physicians to personalize their practice or alter accepted techniques. Consequently, medical practice as a whole is intricately related to and reflective of dominant societal powers and priorities.

While the entire medical system can be interpreted as a microcosm of society, the scope can be narrowed further to examine the American obstetrics system in particular. Universally, birthing systems represent a fascinating manifestation of cultural values, as anthropologist Brigitte Jordan first demonstrated in her cross-cultural comparison of childbirth customs (1992). Anthropologists like Jordan and Davis-Floyd have shown how birthing practices are both dictated by and representative of greater social imperatives. This framework provides an elucidating lens through which to examine the phenomenon of electronic fetal monitoring. A comprehensive analysis of the development, dissemination, and continued use of electronic fetal monitoring in terms of its social context offers insight into why it is so ubiquitous. Ultimately, this thesis seeks to demonstrate that the use of electronic fetal monitoring is more than simply an example of technologically inclined physicians blatantly flouting scientific evidence. Rather, the EFM is implicated in a complex array of social forces that shape obstetrical practices. A culturally oriented analysis of electronic fetal monitoring reveals how obstetricians use this technology in an attempt to accommodate structural pressures, patient expectations, and scientifically-supported practice in order to successfully deliver healthy babies.

Along with academic literature and some popular media sources, this thesis is primarily based on ethnographic interviews conducted with board-certified obstetricians who practice in a small midwestern city. Each interview was approximately one hour long and was semi-structured. A list of interview questions can be found in the Appendix. In addition to attending births in a large academic hospital, these physicians also practice outpatient obstetrics and gynecology and have faculty positions teaching medical students and residents. In order to protect their anonymity, the physicians are referred to using pseudonyms, i.e. “Dr. X,” and no other identifying information is provided. This project received approval from the Health Sciences and Behavioral Sciences Institutional Review Board at the University of Michigan, and all interviews were conducted in compliance with IRB policies.

CHAPTER 1

Electronic Fetal Monitoring and American Obstetrics

Obstetrics Overview

Before delving into the story of electronic fetal monitoring, a brief general history of childbirth practices in the US provides some useful context. In the 1800s, medicine in America was a fractured, unregulated business with allopaths, naturopaths, homeopaths, herbalists, midwives, and others offering different brands of healing with no formal oversight. Though in previous centuries doctoring had been considered a gentleman's profession associated with high social status, medicine had become a glorified trade that commanded little respect (Numbers 1997). There were no standard educational requirements to enter the field, and many for-profit medical schools produced physicians of questionable ability. With so many different practitioners competing for patients, it was difficult to make a living. In an effort to resurrect the professional status of medicine, a group of allopathic physicians formed the American Medical Association in 1847 (Numbers 1997). This organization worked to create medical licensing laws, standardize education requirements, and reduce the quantity while increasing the quality of American physicians. As a result, allopathic⁴ physicians achieved a virtual monopoly on medicine by the end of the 19th century (Numbers 1997).

To further strengthen their status as the primary providers of legitimate medical care in the US, allopathic physicians sought to extend their domain to include women's health and

⁴ Allopathic is a term originally used in the 19th century as a pejorative to describe physicians who practiced heroic medicine, which included the treatment of symptoms with many extreme methods like bloodletting. Since the beginning of the 20th century, the term has generally lost its derogatory meaning and is used to refer to physicians who practice conventional biomedicine (Leavitt and Numbers 1997).

childbirth, and to accomplish this, they needed to eliminate competition from midwives. As Borst (1997) demonstrates, the professionalization of medicine reflected a general trend in American culture at the time, and due to a variety of sociocultural factors constraining midwives and efforts by physicians to encourage the demise of midwifery, midwives failed to achieve professional status along with physicians and nurses. As a result, by 1900, the “self-consciously professional obstetrician” attended approximately half of all births while midwives were relegated to caring only for those women who could not afford to hire an obstetrician (Borst 1997:247).

By the beginning of the twentieth century, organized medicine had successfully convinced the American public “...to want and expect uniformly well-trained, well-paid physicians who themselves set the standards of practice” (Burnham 1997:285). Rapid advancements in scientific knowledge and medical technologies contributed to the cultural belief that medical care from a qualified physician was indispensable (Burnham 1997). Along with the transformation of the medical profession, another fundamental change was underway. Hospitals, previously regarded as sick houses reserved only for the poor and indigent, began to acquire a central position medical practice. Increasingly specialized medical technologies necessitated a shift from home-based care to in-hospital treatments. Additionally, new antiseptic and anesthetic techniques made surgery a much less barbaric event, and surgical interventions became more successful and accepted (Leavitt 1997).

The decline in midwifery, the increasing authority of physicians, and the movement of medical care into hospitals all had significant implications for childbirth. Pregnancy and birth were successfully integrated into the medical domain, and accordingly, medical interventions for the management of these conditions began to emerge. Cesarean delivery entered common

medical practice around the turn of the century, and in 1914, “twilight sleep,” induced by a combination of the drugs morphine and scopolamine, offered women the opportunity to give birth without remembering any pain. In the context of the widespread cultural admiration for the advancements in medicine, the chance to enter the hospital and wake up later with no memory of childbirth was attractive to many women of the Victorian age (Leavitt 1997). By 1920, approximately forty percent of American women gave birth in hospitals (Leavitt 1997).

Meanwhile, in keeping with the general cultural veneration of medical progress, the author of most prominent obstetrical textbook of the early twentieth century, Dr. Joseph DeLee, described his vision to “invest obstetrics with the dignity of a great science” (Mitford 1992:58). DeLee proclaimed that advancements in obstetrics had not kept pace with the rest of medicine, and the problem lay in the characterization of childbirth as a normal, natural process. Accordingly, in 1913 he declared that childbirth was pathological event and that preemptive interventions were necessary to prevent women from being irreparably damaged or even “...used up...” in the process (Mitford 1992:59). In an article for the first edition of the *American Journal of Obstetrics and Gynecology*, DeLee recommended that for all births, conscientious obstetricians should, “...sedate women at the onset of labor, allow the cervix to dilate, give ether during the second stage of labor, cut an episiotomy, deliver the baby with forceps, extract the placenta, give medications for the uterus to contract and repair the episiotomy” (Mitford 1992:62). Though this approach may now seem extreme, DeLee’s views were reflective of the cultural climate surrounding medical care during the first half of the twentieth century. His prescribed procedure soon dominated American childbirth and cemented both the professionalization of obstetrics and the fixation of birth in the medical domain.

It was not until the 1960s, when 97 percent of births occurred in hospitals with extensive medical intervention, that backlash against this system began to receive substantial public attention (Mitford 1992). Stories of torturous births with screaming women chained to hospital beds raised alarm, and the feminist movement encouraged women to “demystify and demedicalize” childbirth. The homebirth movement gained momentum from publications such as *Childbirth Without Fear* by Dr. Grantly Dick-Read and the theories of Dr. Robert Bradley and Dr. Ferdinand Lamaze calling for more natural, drug-free birthing methods (Mitford 1992).

Though the medical establishment successfully maintained its grip on the overwhelming majority of births, it still faced scrutiny for the excessive use of certain interventions. On April 17th, 1978, the United States Subcommittee on Health and Scientific Research of the Senate Committee on Human Resources heard testimony on obstetrical practices, focusing on four main issues: the indiscriminate use of electronic fetal monitoring, the high rate of cesarean deliveries, the increasing prevalence of elective induction of labor, and the over-administration of medications during delivery (Kay 1982:414). At this hearing, a variety of experts presented evidence demonstrating that when employed too liberally, these technologies had significant negative repercussions for both mothers and infants.

Obstetrics was by no means the only medical field that faced intense criticism during the 1960s and 1970s. The medical establishment had enjoyed half a century of reverence and largely unquestioned authority, but this began to change as the American public demanded increased patient participation and transparency in medical care (Burnham 1982). Due to mounting public dissatisfaction and internal pressures, justifying a practice as the “standard of care” was no longer sufficient. Efforts to examine the validity of various medical procedures eventually gave rise to what is now referred to as evidence-based medicine, a paradigm that will be discussed in

detail in chapter 4. Interestingly, electronic fetal monitoring was the subject of one of the first efforts to review of the scientific evidence surrounding a particular medical practice (Banta and Thacker 2001).

Overall, obstetrics in the twenty-first century looks surprisingly similar to the 1970s. The US Department of Health and Human Services recently released its Healthy People objectives for the year 2020, and included are goals to reduce complications during hospital deliveries and cesarean births among low-risk women.⁵ Significantly, these goals were also included in the Healthy People 2000 and 2010 objectives, but complications and cesareans have continued to increase nonetheless. Despite the fact that the need to reduce medical intervention in childbirth has been clearly articulated- not only by advocates of alternative birthing movements, but by the government as well- for over thirty years, statistics suggest that these goals are further out of reach than ever.

In 2008, 99 percent of all births occurred in hospitals, and of the one percent that did not, two-thirds took place at home while one-third occurred in freestanding birthing centers. Physicians attended 91.3 percent of all births, and midwives attended eight percent. Though cesareans appeared to be declining briefly at the beginning of the 1990s, the most recent data available shows that in 2008, the rate of cesarean deliveries reached an all-time high of 32.3 percent of all US births, a 56 percent increase since 1996. And perhaps most important are the statistics that contextualize all the other data: in 2005, the US ranked 41st in the world in maternal mortality and 29th in infant mortality (World Health Organization World Health Statistics 2010). Since maternal and infant mortality rates are generally considered reliable

⁵ <http://www.healthypeople.gov/2020/topicsobjectives2020/objectiveslist.aspx?topicid=26>

indicators of national development and the US spends more per capita on maternity care than any other country in the world, these rankings are especially concerning.

In the 1993 edition of her landmark ethnography *Birth in Four Cultures: A Crosscultural Investigation of Childbirth in the Yucatan, Holland, Sweden, and the United States*, Brigitte Jordan remarks:

What has been most surprising in the course of updating this book has been the fact that so much of what I thought would have changed in American obstetrics [since 1983] has not only remained the same, but has become even more rigidified and entrenched. [142]

This sentiment seems even more relevant today, given that the rates of medical intervention have increased further in the intervening eighteen years. Jordan's statement is especially applicable to electronic fetal monitoring, a technology that has been subjected to intense scrutiny for decades but has only grown more ingrained. The rest of this chapter examines the development and utilization of electronic fetal monitoring as a first step to understanding why this is so.

The Electronic Fetal Monitor

During childbirth, the fetal heart rate is considered a valuable indicator of how the fetus is tolerating labor. It is normal to observe a slight deceleration in the fetal heart rate during labor contractions as the uterine muscles temporarily restrict blood flow to the fetus. The reduced blood flow results in decreased oxygen delivery to the fetus, an event referred to as hypoxia. When the uterine muscles relax at the end of the contraction, normal blood flow resumes, oxygen delivery increases, and the fetal heart rate rebounds. This cycle is considered a normal part of the birth process and causes no identifiable harm to the fetus (Cunningham et al. 2005:46). On rare occasions, if the blood flow is too restricted or is restricted for an extended period of time, the oxygen supply to the fetus may decline more than is normal. When this happens, the fetal

heart rate decreases significantly, and the fetal heart rate may rebound slowly or not at all. Prolonged depressions and certain types of decelerations of the fetal heart rate can signal that the fetus is in distress and might possibly suffer permanent neurological damage or even die from oxygen deprivation. If the fetal heart rate measurements indicate extreme distress, immediate intervention is necessary to save the fetus.

There are two different types of fetal monitors that are used in hospitals. An external fetal monitor is attached by large elastic bands that wrap around the woman's abdomen. The bands secure ultrasound devices that detect fetal heart tones along with the frequency, duration, and relative intensity of uterine contractions. The devices are connected to a bedside monitor that converts the ultrasound waves into electronic signals. An internal fetal monitor involves the insertion of an electrode needle into the scalp of the fetus. In order to accomplish this, the woman's membranes (bag of waters) must be ruptured and her cervix must be dilated. Whereas the external monitor uses ultrasound technology to detect fetal heart sounds, the internal monitor measures electrical voltages to produce precise electrocardiographic data. The internal monitor also uses a gauge to measure the instantaneous pressure inside the uterus and provide quantified information about contraction strength. The internal monitor produces simultaneous recordings of the fetal electrocardiogram signal, the maternal electrocardiogram signal, and the uterine pressure (Cunningham et al. 2005:445). The fetal heart rate and uterine contraction measurements record simultaneously, and the fetal heart rate is displayed above the contemporary uterine contraction tracing (Cunningham et al. 2005:446).

In comparison with the external monitor, the internal monitor eliminates the possibility of confusing the mother's heart rate with that of the fetus, and it produces a more reliable signal, especially when the mother or fetus are moving around (Cunningham et al. 2005:446). Though

the external monitor was developed several years earlier, the internal monitor quickly gained popularity because it eliminated the difficulties associated with externally monitoring women who were obese or who shifted around during labor (Banta and Thacker 1979). Today, the external monitor is used preferentially unless an internal monitor is absolutely necessary to maintain a consistent reading (Cunningham et al. 2005).

Beyond the correlation with increased cesarean section as discussed earlier, both types of monitors do entail certain direct risks to the mother and the fetus. In order to use the internal fetal monitor, if a woman's bag of waters has not already ruptured naturally, the amniotic sac must be ruptured manually. To do this, the physician uses a small hook or pointed glove to break the membrane, a procedure called an amniotomy. Amniotomy has been shown to significantly increase the risk umbilical cord prolapse, a potentially fatal complication in which the umbilical cord becomes compressed and the fetus experiences sudden oxygen deprivation and distress (Cunningham et al. 2005:301). Furthermore, the repeated insertion of hands and instruments into the vagina and uterus increases the likelihood of maternal infection. The scalp wound that the fetus incurs from the internal electrode is also vulnerable to infection, and the electrode itself may introduce bacteria into the amniotic fluid and the fetus. Though such infections can usually be treated with antibiotics, the risk should not be discounted (Cunningham et al. 2005).

Additionally, with both monitor systems, the woman is confined to bed while attached to the machine. Ironically, research has suggested that such immobility causes decreased maternal blood flow and subsequent decline in fetal oxygen supply, thereby creating the circumstances that lead to the fetal distress that the monitor is intended to help prevent (Davis-Floyd 2003:106).

The original EFMs traced the fetal heart rate onto long sheets of graph paper, but most hospitals, including the one where the obstetricians I interviewed practice, now use fully

computerized monitoring. With an integrated computer system, the monitor data is continuously displayed on a computer screen beside each woman's bed. Additionally, screens at the nursing stations show the tracings, and obstetricians can access their patients' monitoring information from any authorized hospital computer. This centralized system means that a physician sitting in her office or a nurse standing in the hallway can view the same live tracing that is displayed at the bedside. While having such access to the electronic fetal monitor tracings can be convenient and beneficial, it also lessens the need for the nurses and physicians to actually go into each patient's room. Personal contact already decreases in the change from manual auscultation to electronic monitoring, and centralized monitoring further reduces the amount of direct interaction between laboring women and medical personnel. Dr. Y expressed concern about the consequences of remote monitoring:

There's the question of the psychological impact of how much someone is in the room and all that...Some people think central monitoring is good, because you can sit anywhere and watch it. But also the other part that I see about it is, for example: Say my patient gets an epidural. She's no longer moaning and now she's sleeping. [The nurse and I] leave the room and I leave her there for hours. [The nurse] has to do vitals every so often, and I have things to follow, but she's not bothering me and I'm not bothering her. She's sleeping. And I really wonder how much that has to do with increasing our c-section rate...The nurse doesn't have to be in there because you can just leave the patient alone. There's not a lot of proactive effort from our side in terms of being there for the patient.

Just as Dr. Y suggests, many studies have demonstrated the benefits of having continuous attention from a nurse or other birth attendant during labor (Wagner 2006), and the reduction in personal interactions enabled by centralized electronic monitoring likely has negative effects on the progression of labor (Davis-Floyd 2003, Cunningham et al. 2005).

The Birth of the Technology

Electronic fetal monitoring was first introduced in US hospitals in the late 1950s in order to provide constant monitoring of fetal heart tones during high-risk deliveries. The invention of the EFM was motivated by the belief that if physicians could reliably detect decelerations in the fetal heart rate, they could prevent injuries caused by oxygen deprivation during birth. Severe fetal oxygen deprivation, called perinatal asphyxia, was thought to be the primary cause of stillbirth, cerebral palsy, and mental retardation in infants. During the 1950s, approximately 5 percent of infants were stillborn or born with neurological damage, and physicians hoped that with continuous electronic fetal monitoring, they could predict when perinatal asphyxia was likely to occur and intervene before it caused injury to the fetus (Banta and Thacker 1979). Prior to the introduction of the EFM, physicians and nurses regularly monitored fetal heart sounds using a stethoscope pressed against the woman's abdomen, a technique called auscultation. Electronic fetal monitoring was initially thought to be superior to auscultation because it provides a constant supply of information, as opposed to intermittent manual auscultation, which only provides discrete measurements. Also, the electronic monitor could detect minor decelerations that auscultation missed, and it could more accurately track fetal heart rate during uterine contractions, when the movement of the woman's internal organs makes manual auscultation very difficult (Banta and Thacker 1979).

Though originally developed for use in high-risk births, the appeal of electronic fetal monitoring quickly grew. Dr. Edward Hon, the American physician credited with inventing the internal monitoring device, wrote in 1973, "At present, fetal monitors are used mainly for management of high-risk patients...but serious consideration is being given to the advisability of monitoring all patients in labor in order to decrease the birth hazards for uncomplicated as well as complicated pregnancy" (Hon and Hess 1973:63-64). Dr. Hon expressed that all births, even

those considered “uncomplicated,” had the potential to be dangerous for the fetus, and that the EFM could be used to render visible possible hazards even in low-risk births. By 1976, every US hospital with obstetrics residencies had an electronic fetal monitor (Banta and Thacker 1979). A survey in the same year found that 77 percent of obstetricians believed that electronic fetal monitoring should be used in all deliveries, and a National Institutes of Health task force estimated that up to 70 percent of births in the United States at that time were being monitored electronically (Banta and Thacker 1979). The rapid shift from only monitoring high-risk cases to using the technology in the majority of all births indicates that the medical community generally embraced electronic fetal monitoring and quickly integrated it into the standard of practice. However, this widespread acceptance did not necessarily mean that electronic fetal monitoring had actually been proven to reduce fetal injury and death, and by the end of the 1970s, data began to emerge that cast a new light on the popular practice.

In Search of Evidence

The first effort to definitively demonstrate the effectiveness of electronic fetal monitoring in preventing perinatal asphyxia was undertaken in 1977 by Dr. Albert Haverkamp in Denver, Colorado. Haverkamp later explained that he began the study with the intention of proving the usefulness of the technology to a few remaining skeptical patients and colleagues, and he was quite surprised when his results instead showed that electronic fetal monitoring was no better than manual auscultation (Banta and Thacker 2001). This was only the second attempt to study electronic fetal monitoring in a randomized controlled trial, and it attracted the attention of researchers David Banta and Stephen Thacker, physicians working for the Health Program of the Congressional Office of Technology Assessment. As part of the Health Program agenda to define the methods needed to assess medical technologies, Banta and Thacker began a systematic

review of all of the available English-language literature on electronic fetal monitoring. In 1979, Banta and Thacker published their evaluation, which raised serious questions about the usefulness of the nearly ubiquitous technology.

Based on their comprehensive analysis, Banta and Thacker concluded that the value of electronic fetal monitoring as a predictive tool to detect when a fetus was at risk for preventable asphyxia was marginal at best. The events that the technology was intended to prevent (stillbirth, cerebral palsy, mental retardation) only occurred in less than two percent percent of births at the time, and only a small fraction of these outcomes were considered attributable to events during birth (Banta and Thacker 1979). Their analysis demonstrated that the uncommon nature of these occurrences, combined with the imperfect sensitivity and specificity of the technology, created an extremely high false-positive rate. The authors concluded that electronic fetal monitoring likely only effectively prevented injury due to oxygen deprivation in one out of 1,000 births. Based on data from multiple randomized controlled trials, they also demonstrated that the use of the EFM led to a substantial rise in the number of cesarean deliveries. In one controlled trial, women with low-risk pregnancies who received electronic monitoring were over three times more likely to have a cesarean section than women who were monitored by auscultation (Banta and Thacker 1979). Banta and Thacker convincingly reasoned that electronic fetal monitoring was responsible for at least half of the increase in the national c-section rate, which had more than doubled in the preceding twelve years. According to their analysis, there was a clear relationship between the use of the EFM, diagnoses of fetal distress, and cesarean sections, yet there was no demonstrable improvement in fetal outcomes.

Along with the dramatic statistics about increasing surgical deliveries, Banta and Thacker challenged the fundamental assumption that cerebral palsy and brain damage were caused by

intrapartum events. They pointed to emerging evidence that disassociated cerebral palsy from birth events, including several studies of infants who were hypoxic at birth but showed no signs of neurological damage at 12 months and four years of age. From this data, they concluded that electronic fetal monitoring was likely to lead to the rescue of an infant who was already seriously ill or neurologically impaired before labor began, but it was unlikely to prevent any permanent damage from occurring during labor (1979:634). Finally, they drew attention to concerns about decreased personal attention from nurses and escalating health care costs associated with the use of the EFM (Banta and Thacker 1979).

Following the publication of their critical analysis, Banta and Thacker faced extensive backlash and harsh attacks from many members of the obstetrics community. The controversy surrounding electronic fetal monitoring intensified, and the National Institute of Health (NIH) convened a consensus development conference to discuss the fetal distress and efforts to prevent it. The review by the NIH reached the conclusion that electronic fetal monitoring conferred no significant advantage over auscultation in most births, but that the technology was preferable in high-risk deliveries. The American media began to publicize the concerns about the overuse of electronic fetal monitoring, and the topic received much attention within obstetrics (Cohn 1979, Fried 1989).

By 1989, the American College of Obstetricians and Gynecologists (ACOG),⁶ which had previously exclusively endorsed electronic fetal monitoring, officially revised its position and

⁶ The ACOG identifies itself as the “nation’s leading group of professionals providing health care for women” (acog.org) According to the mission statement on its website, the ACOG is “dedicated to the advancement of women’s health care and the professional and socioeconomic interests of its members through continuing medical education, practice, research, and advocacy.” In light of the controversies surround many hospital practices, this mission statement invites questions about what happens when the socioeconomic and professional interests of its members do not align with the best interests of women. Although physicians are under no legal

released a bulletin stating that manual auscultation and electronic monitoring were both acceptable techniques for low-risk deliveries (ACOG Practice Bulletin 132). The ACOG is a powerful force in US obstetrics, and its positions on various issues significantly influence the way most obstetricians practice. While the ACOG acknowledge that manual auscultation was permissible, they continued to indirectly encourage the use of the EFM by holding conferences and publicizing research about improving EFM tracing interpretation methods.

Decades of research have continually reaffirmed Banta and Thacker's findings and supported the many criticisms they posed. *William's Obstetrics*, the leading American obstetrics textbook, asserts:

The contribution of intrapartum events to subsequent neurological handicaps has been greatly overestimated...Clearly, for brain damage to occur, the fetus must be exposed to much more than a brief period of hypoxia. Moreover, hypoxia must cause profound, just barely sublethal metabolic acidemia⁷. Fetal heart rate patterns consistent with these sublethal conditions are fortunately rare. [2005:464]

The textbook emphasizes that in order for intrapartum hypoxia to cause permanent brain damage, it must be very severe, almost to the point of being completely fatal. The most recent guidelines published by ACOG echo these conclusions (ACOG Practice Bulletin 106). This bulletin also states that in comparison with intermittent auscultation, electronic fetal monitoring leads to increases the cesarean delivery rate and the use of forceps and vacuum extraction, in addition to producing a greater than 99 percent false-positive rate in predicting cerebral palsy. In spite of acknowledging these negative consequences, the ACOG maintains the position that either electronic fetal monitoring or intermittent auscultation is acceptable for low-risk births, but recommends that high-risk deliveries be continuously monitored electronically.

obligation to join the ACOG nor abide by its recommendations, it has a virtual monopoly on establishing the standards of practice in American obstetrics.

⁷ Acidemia refers to a state of low blood pH caused by severe lack of oxygen in the blood.

Complicated Usage

One of the greatest difficulties associated with the clinical use of electronic fetal monitoring is what to do with the information it produces. Though the monitor generates exact, quantifiable data, the interpretation of this output is highly subjective and imprecise. In order for the tracings created by the monitor to inform meaningful clinical decision-making, three things must happen. First, a recognizable pattern must be identified in the tracing. Second, this pattern must be interpreted and translated into clinical information about the state of the fetus. Third, this clinical information must be used to decide a course of action (or inaction). Up until 1997, there was no standardized approach to accomplishing any of these three steps, and as a result, clinical practice varied widely. In an effort to resolve the confusion surrounding the interpretation of the monitor strips, the National Institute of Child Health and Human Development hosted a conference to establish agreed-upon guidelines. After much disagreement among the convened experts, the conference recognized three fetal heart rate patterns as consistently indicative of distress, additional patterns that suggest a normally oxygenated fetus, and other ambiguous patterns that remained unclassified (Freeman 2002:820). Though this conference successfully accomplished the first step of defining fetal heart rate patterns, the guidelines apparently did little to standardize interpretation of monitor strips in clinical practice. Subsequent studies found that even those physicians considered experts in electronic fetal monitoring only agreed on the identification of pathological patterns 25 percent of the time, and when asked to review the same tracing a month later, 20 percent changed their own assessment (Ayres-de-Campo 1999, Keith et al. 1995).

In 2009, the ACOG released new recommendations designed to further standardize the classification, interpretation and management of fetal heart rate tracings (ACOG bulletin 106). In

this bulletin, the ACOG recognized eight distinct fetal heart rate patterns and defined the identifiable characteristics of each. They recommend that these patterns be interpreted based on a three-tiered classification system that categorizes fetal heart rate tracings as either normal, intermediate, or abnormal. In terms of clinical management, for category I (normal), “no specific action is required,” category II (intermediate) requires “evaluation and continued surveillance and reevaluation,” and category III (abnormal) necessitates efforts to “expeditiously resolve the abnormal pattern” or “delivery should be undertaken” (ACOG Practice Bulletin 106). Even with such guidelines for analyzing fetal heart tracings, a high degree of variance still exists in clinical practice.

When all of the data surrounding electronic fetal monitoring is considered, it is no wonder that this practice has generated so much confusion and controversy. The events that the technology was intended to prevent are very rare, and evidence increasingly shows that the causal link between perinatal asphyxia and neurological damage to the fetus is dubious at best. Furthermore, the use of electronic fetal monitoring drastically increases the risks of complications and surgical interventions in birth- all of which carry their own significant risks to the mother and fetus. Compounded with the challenges of translating the monitor tracings into accurate, reliable clinical information, the validity of this practice is highly questionable.

The history of electronic fetal monitoring raises many questions that are unanswered by research data and official policies. Instead, the sociocultural meaning surrounding this technology must be examined. An anthropological perspective provides insight into why the EFM so quickly gained favor when there was no proof that it worked, how its popularity withstood Banta and Thacker’s thorough condemnation, and why physicians have not abandoned the much-maligned technology in the subsequent decades.

CHAPTER 2

Focus on the Fetus: Fetal Monitoring and Obstetric Surveillance

A Shifting Focus

Until the late 1950s, birth was typically described in obstetrical texts as the process in which a woman expelled the “passenger” fetus through her birth canal, and the fetus was no more than a “transient, maternal organ” (Williams 1956:267). Such characterizations emphasized that the woman was the patient, and the fetus was little more than an element of her physiology. A few decades later, a newer version of the same leading obstetric textbook proclaimed a dramatic transformation of fetal identity: “Happily, we have entered an era in which the fetus can be rightfully considered and treated as our second patient...we are of a view that it is the most exciting of times to be an obstetrician. Who would have dreamed-even a few years ago- that we could serve the fetus as physician?” (Prichard and Macdonald 1980:vii). Others went even further than declaring the fetus the second patient and began to regard it as the obstetrician’s primary focus during pregnancy and birth. Richard Beard, a prominent British obstetrician, expressed this new alignment in 1977: “The problem of maternal mortality has been largely overcome...It is the problem of the fetus that concerns us at the moment” (Beard 1977:251). As the fetus began to occupy the attention of obstetricians, the new medical specialties of maternal-fetal medicine and neonatology emerged to care specifically for the fetus and newborn infant, along with the pioneering of fetal surgery and extensive advancements in other fetal-oriented practices.

Due to these significant developments, modern obstetricians are often characterized as “fetal champions” whose primary objective is to “protect” the fetus from the risks of pregnancy and birth (Bassett 2000). Though the physiological process of childbirth remains the same,

culturally, American birth has shifted from a female process enabled by the physician to a dramatic event that endangers the new primary patient: the fetus. Electronic fetal monitoring played a significant role in the transformation of American obstetrics from woman-centered to fetus-centered practice, and its usage continues to influence the way the medical system and American society in general conceptualize the relationship between the physician, mother, and fetus.

By the middle of the twentieth century, advancements in public health, nutrition, and medical care led to a substantial decline in maternal mortality in America, allowing physicians to turn their attention increasingly towards fetal health. When explaining his motivation for developing the EFM in 1957, physician-inventor Edward Hon noted this marked decline in poor maternal outcomes but lamented that infant mortality had shown little reduction, and cerebral palsy and mental retardation remained prevalent among American infants (Hon and Hess 1957). Outlining his vision to address this problem, Hon proposed that “reversible fetal distress,” believed to indicate hypoxia, could best be identified by specifically measuring fetal cardiac rate and rhythm, and thus proposed the use of an EFM in order to allow obstetricians to intervene “directly on behalf of the fetus” (Hon and Hess 1957).

The idea to specifically measure fetal condition instead of relying on the woman’s state as an indication of fetal status was momentous in the transition towards fetal-focused obstetrics. In advising that physicians must ascertain fetal condition directly, Hon suggested that maternal measures were not trustworthy indicators of the health of the fetus, a significant departure from the previously held belief that a healthy woman meant a healthy fetus. Implicit in Hon’s logic was the idea that an apparently healthy woman could in fact disguise a distressed fetus in mortal danger, a concept that led to the construction of “the doctor’s (cultural) body as the site of safety,

[and] the mother's (natural) body [as] the site of risk" (Wendland 2007:225). With this new technology, obstetricians began to separate fetal condition from maternal condition, and to base the perception of the need for intervention on markers of fetal status.

The notion that directly assessing fetal condition was essential to improving birth outcomes represented a significant shift in obstetrical ideology, and the invention of the EFM was both enabled by and helped propel this new approach. The transition in obstetrical thinking was also tied to a larger cultural shift that implicated the entire medical establishment. Historian David Armstrong (2005) argues that a whole new type of medicine, which he calls Surveillance Medicine, was emerging at this time. Armstrong defines the previous system, dubbed Hospital Medicine, as only concerned with treating visible disease in notably ill patients, whereas "Surveillance Medicine requires the dissolution of the distinct clinical categories of healthy and ill as it attempts to bring everyone within its network of visibility" (395). Armstrong (2005) connects the rise of Surveillance Medicine to the development of population-based preventive health movements in the first half of the century and the way the medical gaze was extended to target all individuals, both healthy and sick. Accordingly, one of the first outcomes of Surveillance Medicine, and an essential element of its proliferation, was the "problematization of the normal" (Armstrong 1995: 395).

As a result of efforts to identify "normal" and problematize any deviations from it, physicians faced the formidable challenge of deriving meaning from observed variations. This new focus on distinguishing between different gradations of normal and not, healthy and ill, created an interest in and space for diagnostic technologies like the EFM. Instead of only treating the already pathological, physicians sought to recognize that which would or could become problematic. As Armstrong explains: "Surveillance Medicine takes the discrete elements of

symptom, sign, and disease and subsumes them under a more general category of ‘factor’ that points to, though does not necessarily produce, some future illness. Such inherent contingency is embraced by the novel and pivotal medical concept of *risk*” (1995:400, emphasis original). Risk and risk factors became the crux of American medicine, with investigation, diagnosis, and treatment oriented towards preventing the future before it happened.

Dr. Hon’s ambitions of using the EFM to detect early signs of fetal distress before the onset of permanent fetal injury can be positioned as both a result of and contributor to the adoption of a new medical perspective. The introduction of the EFM prominently incorporated the mentality of Surveillance Medicine into obstetrics and established fetal risk as the central concern of obstetricians. As childbirth was reframed by the concept of risk, the quest to directly observe the fetus and identify portentous abnormalities redefined the practice of obstetrics. The rapid dissemination of the EFM reveals how compelling the idea of identifying and addressing risk factors was, and the power of risk has shaped the way the information produced by electronic fetal monitoring is used in obstetric practice.

Retracing Relationships

Due to the new cultural emphasis on surveillance and prevention in which the EFM was embedded, the implementation of electronic fetal monitoring changed more than just the manner in which medical personnel detected the fetal heart rate. The use of the technology has had profound implications for interactions between the physician, the woman, and the newly accessible fetus. Before the EFM was developed, the woman was the primary transmitter of information about the fetus growing inside her. Though the general medicalization of childbirth had diminished the value of a woman’s knowledge about her labor experience, she still retained

the exclusive direct link to the fetus, and in order to ascertain information about its status, the obstetrician had to rely on the maternal-fetal connection. However, the introduction of the EFM eliminated the woman as the necessary intermediary and allowed physicians to construct a direct informational and observational link to the fetus. In her history of medicalized pre-natal care, British sociologist Ann Oakley writes of this change: “the ‘iron curtain’ of the mother has been swept aside revealing the womb and its contents in their full glory...the era of the womb’s sanctity as a private, peaceful place is, indeed, over” (1984:180). The introduction of the EFM opened a visual and auditory window into the uterus and granted obstetricians unprecedented access to their newly conceptualized patient.⁸

Notably, although the EFM is obviously attached to the woman and records aspects of her physiology, it is definitively labeled a *fetal* monitor, with the express objective of establishing a clinical connection to the fetus, independently of the woman (Basset 1996). With the use of the EFM, information that otherwise exists only within a woman’s uterus (or temporarily in the mind of the obstetrician or nurse who presses a stethoscope to her belly) is continuously recorded by a machine, without any active participation from the woman. Davis-Floyd refers to electronic fetal monitoring as part of “an increasing insistence in obstetrics that...the fetus is a being separate from its mother and can grow and develop without the mother’s will or involvement” (2003:58). Electronic fetal monitoring enables the physician to open a line of communication with the fetus without maternal interpretation or translation, rendering the fetus observable and knowable while making the woman seem less visible and less important. The technology becomes the “locus for knowledge about the fetus,” while the woman

⁸In the 1960s, a few years after the development of the EFM, fetal sonogram machines also became popular and allowed increased visual access to the fetus, not only during birth, but throughout pregnancy. For a comprehensive analysis of the role of fetal sonography in shaping American pregnancy and birth practices, see Taylor (2008).

is "...rendered transparent...she vanishes from view" (Wendland 2007:226). The use of the EFM allows the obstetrician to bypass the intermediary woman and conceptualize the fetus as an independent patient whom she can directly observe, assess, and treat.

Furthermore, the nature of the information transmitted by the EFM not only encourages the characterization of the fetus as a distinct patient, but it also positions the woman and fetus as antagonists. When medical personnel rely on manual auscultation with a stethoscope to detect fetal heart tones, it is nearly impossible to measure the fetal heart rate during a contraction due to interfering sounds from the movement of the woman's internal organs (Cunningham et al. 2005). However, the EFM continues recording during contractions and produces tracings of the fetal heart rate and the intensity of the uterine contractions as they occur simultaneously. This creates a visual representation of the interplay between maternal condition and fetal response. As discussed in chapter 1, when the uterus contracts, the blood flow to the fetus is temporarily restricted, and the inevitable decrease in the oxygen supply to the fetus at this time often corresponds to a temporary (and usually un concerning) decline in the fetal heart rate.

Because the EFM records this happening in real time with the contractions, it graphically establishes a notion of antagonism between the mother and fetus, as each of the mother's contractions is shown to cause fetal stress. Though physicians knew of this phenomenon from manual auscultation, the EFM displays the correlation in a more tangible, dramatic way. The output of the EFM demonstrates direct opposition between the woman's body and the fetus' well-being in compelling graphic form. The presentation of information in this way solidifies the perception of labor as dangerous and reinforces the idea that the obstetrician must protect the fetus from the risks created by the maternal body during labor (Wendland 2007, Davis-Floyd 2003). Electronic fetal monitoring simultaneously constructs risk, by making signs of fetal stress

visible, and mitigates risk, by allowing obstetricians to monitor the fetus and intervene if they believe it is necessary. In this manner, the use of the EFM continuously reaffirms the need for the use of the EFM.

Risk and Priorities

With technologies like the EFM propelling the risks of childbirth for the fetus to the forefront of obstetrical concern, medical efforts have continually developed towards preventing risk from becoming reality. By allowing physicians to (graphically) visualize the fetal condition, electronic fetal monitoring necessarily fixes and intensifies the medical gaze on the fetus. Even when the importance of the birthing experience is acknowledged, having a healthy baby is always the primary concern. Dr. Z, an obstetrician who has been practicing for fifteen years, voiced this sentiment in describing efforts her efforts to use the EFM judiciously:

There are patients who are in active labor and choose to walk [around the hospital instead of staying in bed], so then we'll do intermittent [electronic] monitoring. *So, depending on how the baby is doing, if the baby is doing well and we don't have any concerns, then we can strip every couple of hours or something...I want them to walk.*

Dr. Z's assessment of "how the baby is doing" is based on the tracings of the EFM, and a woman's desire to walk is clearly subordinated to perceived risk level for the fetus. If the fetal heart rate is reassuring, the woman's laboring preferences can be entertained. Although Dr. Z recognizes the benefits of walking during labor and expresses willingness to accommodate women's desires to be mobile, she emphasizes that the ultimate priority is maintaining reassuring fetal condition as indicated by the fetal heart rate tracing on the EFM.

The role of electronic fetal monitoring in establishing the need to ensure fetal well-being above all else is exemplified by the popular cable reality television series *A Baby Story*, a show

that depicts women's pregnancy and birth experiences in US hospitals. In one episode, an ostensibly low-risk delivery is dictated by the information produced by the EFM. Throughout the episode, the monitor can be heard beeping in the background, and the camera frequently zooms in on the screen that shows the tracings. After several frames focused solely on the monitor screen, the obstetrician tells the camera: "...within the last hour, the baby's heart rate has started to drop with most of the contractions, it is evident that she will not be able to deliver vaginally, and that we will have to proceed with a cesarean."⁹ The obstetrician then takes the laboring woman's hand and assures her, "you're going to have a wonderful delivery, the baby will be fine."¹⁰ The dialogue and the camerawork in the episode are conspicuously oriented towards the EFM, and the information it produces compels the doctor to recommend a c-section. The declaration is couched in reassurances that this will ensure the safety of the fetus, and since a healthy baby is obviously the desired outcome, the decision appears prudent and justified.

Even though the mother originally wanted to delivery vaginally, as soon as the fetal heart rate suggests increased risk, a vaginal birth is transformed from desirable to dangerous, and both the woman and the obstetrician accept the need for further medical intervention. Minimizing fetal risk as constructed from the EFM is the top priority, and the tracings on the monitor become the locus of the obstetrician's decision-making. The obstetrician does not reference any other indicators of fetal condition, nor does he suggest that there are any other options to pursue; based solely on the fetal heart rate tracings, he makes an absolute declaration that he is obligated to perform a cesarean. To viewers watching the show, this scene suggests that the EFM is a very powerful piece of equipment that dictates the course of a birth. The viewer is led to perceive the

⁹<http://tlc.discovery.com/beyond/?playerId=203711705&categoryId=566566872&lineupId=151749457>

¹⁰<http://tlc.discovery.com/beyond/?playerId=203711705&categoryId=566566872&lineupId=151749457>

EFM as “saving” the fetus because it indicates that a cesarean “has to” be performed in order to achieve a successful birth outcome.

Another obstetrician I interviewed describes a similar scenario and rationalization. Dr. X recounts: “When I’m talking to a patient about a c-section, and often times they’re very disappointed, and sometimes they’re crying. And I just say, you’re going to meet the baby soon, we’re all doing this for a healthy baby...As long as you’re communicating with the person and they understand why you’re doing what you’re doing, they want the happy outcome too.” Emphasis on the overriding importance of the fetus allows the “happy outcome” to be defined entirely in terms of ensuring the delivery of a healthy baby, and the recognized disappointment of a surgical delivery becomes insignificant. Dr. X had repeatedly referred to the value of a positive birth experience, but still expresses that the dominant objective is mitigating risk to the fetus, even at the cost of an undesirable surgical intervention.

The Power of Information

As discussed in the first chapter, the medical system quickly and enthusiastically embraced electronic fetal monitoring before it was ever proven effective in preventing hypoxic brain injury. In addition to its alignment with an increasing societal focus on the fetus and the characterization of obstetricians as “fetal champions,” electronic fetal monitoring’s rapid acceptance was aided by the fact that it fit a growing cultural belief in the advantages of information. In order to fulfill Surveillance Medicine’s manifesto of identifying all abnormalities, it is necessary to gather enough information to consistently identify deviations. An emphasis on the need to monitor risk factors in order to prevent problems naturally leads to the cultural conviction that in medicine, more information is inherently better. Intermittent

auscultation only provides information about the brief, discrete intervals during which someone presses a stethoscope to a woman's abdomen and counts the fetal heart sounds. The EFM, however, constantly produces a continuous stream of data, and not only records the instantaneous fetal heart rate, but also shows its change over time and its relationship to contraction strength. Consequently, intermittent auscultation provides only roughly one to two percent of the data produced by the electronic monitor. This difference makes electronic fetal monitoring seem inherently superior to doctors who are enculturated to believe that having access to more information will automatically lead to improved patient outcomes (Banta and Thacker 1979, Davis-Floyd 2003). As one obstetrician who wrote about the persistent use of electronic monitoring confirmed, "...it is counterintuitive to believe that auscultation is better than EFM in that the data obtained with the former mode is only a fraction of that obtained electronically" (Parer 2003:561). To a physician seeking to evaluate risk and monitor abnormalities, the opportunity to have substantially more information about fetal status is powerfully appealing. This mentality was a prominent factor in the initial widespread adoption of electronic fetal monitoring, and it continues to drive its use today.

One of the obstetricians I interviewed, Dr. Y, alludes to a fundamental belief in the intrinsic value of increased information when describing one physician's early efforts to perform a randomized controlled trial in order demonstrate the effectiveness of electronic monitoring: "...he put the proposal into the NIH, and the ethics committee said it would be unethical to do the trial because it was clear that electronic fetal monitoring was more beneficial [than auscultation]." In reality, no such thing had been proven, but when the EFM was invented, many people took for granted that the ability to gather continuous data about fetal heart rate was advantageous because it was assumed that this would translate to improved risk management.

Accordingly, allocating a number of women to a control group that would not receive electronic fetal monitoring for the purposes of a randomized controlled trial was unacceptable. The fact that not using an unproven technology was dubbed unethical reveals just how strongly Surveillance Medicine gripped physician's consciences; the fixation on managing risk led to the belief that any additional information is necessarily helpful and indispensable. Although electronic fetal monitoring entered into widespread clinical use by the early 1960s, it was not formally evaluated in a clinical trial until 1976, and its dubious efficacy did not receive considerable attention until Banta and Thacker's review in 1979. During the first two decades after its invention, the EFM was simply assumed to be beneficial because of a cultural conviction that increased quantity of information translated to increased quality of care.

Interestingly, while telling this story, Dr. Y did not mention the fact a similar situation to the one she described continues today. To date, no randomized controlled trial has ever been conducted to prove that any form of auscultation, whether manual or electronic, actually leads to better outcomes than not monitoring the fetal heart rate at all (Parer 2003:561). The fundamental cultural assumption that having information about the fetal condition is valuable makes having a control group of women who receive no fetal heart monitoring whatsoever obviously unethical, and therefore such a study would be impossible to conduct. Banta and Thacker referred to the deeply ingrained cultural belief in the value of information in their landmark 1979 analysis of electronic fetal monitoring: "Although the ultimate measure of efficacy is improved patient outcome, such improvement is often assumed for diagnostic procedures if the information obtained is reliable and valid" (627-8). Because the data gathered from manual auscultation and electronic monitoring is generally regarded as legitimate and meaningful, no study has been conducted to establish the validity of fetal heart rate monitoring in the first place.

Thirty years since Banta and Thacker's initial analysis, the clinical value attributed to the EFM's ability to gather information continues to inform its use, despite decades of evidence that the data does not translate to improved outcomes. As Dr. Z describes, "most everyone who comes in, whether they come for triage for labor and delivery, whether they come for admission for preterm labor or anything that's going on with the pregnancy or labor, they will get electronic fetal monitoring." The fact that the EFM is used so indiscriminately indicates a strong belief in the relevance of the information it produces. Dr. Z admits that electronic fetal monitoring "doesn't really improve outcomes and intermittent auscultation is just as good," but explains using it on nearly 100 percent of her patients by saying, "It makes us feel better that we're always monitoring...with intermittent monitoring, you might miss a lot of those things that we wouldn't pick up otherwise." Dr. Z simultaneously acknowledges the failings of the EFM, yet professes a need to have the data it produces. The thought of "missing" information- even information that is admittedly most often useless- is unacceptable. Also, the vague description of the EFM as displaying "a lot of those things" alludes to the intangible risk factors on which Surveillance Medicine is fixated. As stated by Dr. Z, the clinical relevance of electronic monitoring lies solely in the fact that it collects more data than intermittent auscultation. This rationalization of the use of the EFM demonstrates a fundamental conviction that more information is necessarily better, and this assumption forms a cultural imperative that is difficult to overcome.

Furthermore, electronic fetal monitoring is not only propelled by a cultural desire for information, but it is also supported by the idea that the data produced directly by the machine is superior to information gathered by physicians or nurses. As Davis-Floyd asserts, "Under the technocratic model, the information produced by machines is considered more authoritative than

the information produced by people” (2003:108). The EFM generates extremely precise data and is able to detect small variations in fetal heart rate that would otherwise go unnoticed, whereas manual auscultation is entirely dependent on human interpretation. A stethoscope pressed to a woman’s abdomen does not in itself generate any data; the person using the stethoscope must detect the fetal heart sounds, count the number of beats in a certain period of time, and translate this number into an approximation of beats per minute. This method is necessarily less precise than the measures of the EFM, and it also is perceived as more vulnerable to human error¹¹. In a medical climate preoccupied with managing and avoiding risk, physicians aspire to reduce the probability of human error whenever possible. Banta and Thacker assert that “an inappropriate faith in electronic and machine-based technology” is partially responsible for the continued reliance on EFM and aversion to manual auscultation (2002:768).

Another primary reason that electronic fetal monitoring is also culturally valued is because it produces data that is characterized as factual and objective. The preference for “hard” data to evaluate fetal condition is reflective of “our higher cultural valuation of objective knowledge over subjective experience” (Davis-Floyd 2003:108). Oakley cites several obstetricians who lament their reliance on “subjective” criteria, such as maternal feedback, due to the lack of “objective criteria which the physician [had] at hand” prior to the introduction of the EFM (1984:98).

Some studies have suggested that asking non-anesthetized women to report the fetal movements they perceive during labor provides an accurate and predictable indicator of fetal distress, and that laboring women are able to alert physicians to reduced fetal movement in

¹¹ Though this is generally true, it is important to note the potential for error involved in using the electronic monitor. The machines can break down and malfunction, and when using an external monitor, the machine does occasionally transmit the maternal heart rate instead of the fetal heart rate, leading to the misconception that the fetal heart rate is dangerously low.

sufficient time to allow intervention when needed (Pearson and Weaver 1976; Sadovsky et al. 1973; Sadovsky and Yaffe 1973). Not surprisingly, such a subjective, low-tech approach to detecting fetal distress has never gained favor in American obstetrics. The medical system portrays labor as risky to the vulnerable fetus even when managed by highly-trained obstetricians commanding advanced technologies, so depending on a hormonal, emotional woman for information on the fetus' condition is easily dismissed. The idea of relying on laboring women's qualitative, individual perceptions of labor is incongruous with a medical culture that values technologically-derived information. Accordingly, the EFM is believed to produce consistently trustworthy evidence that is more reliable than subjective, non-mechanical assessments of fetal condition, and therefore electronic fetal monitoring better allows physicians to carefully manage risk and ascertain normality.

AirStrip OB™

An interesting development in the world of electronic fetal monitoring further underscores the cultural devotion to information in which this technology is embedded. In 2006, a software development company based in San Antonio, Texas released a program called AirStrip OB™. This software allows obstetricians to “remotely access real-time and historic waveform fetal heart rate, maternal heart rate, and uterine contraction strength data” from a smartphone¹². With this application, the same visual and numeric data that is recorded by a bedside EFM is instantaneously available on the four-inch screen of a smartphone via a secure internet connection. So, an obstetrician can be anywhere- at home, in the car, seeing other patients- and use her cell phone to view the live EFM tracings of any patient being monitored.

¹² airstriptechnology.com

Centralized computer monitoring systems already allow physicians to pull up EFM tracings on any hospital computer, but with this application, the network extends even further, to anywhere physicians have cell phone service.

The AirStrip OB™ website markets the software by claiming: "...our technology actually improves patient safety, reduces risk, and improves patient care...it prevents adverse outcomes from occurring in obstetrics...[and is] rapidly becoming a necessary tool for positive outcomes..." (airstriptechnology.com). The key phrases- "reduces risk," "prevents adverse outcomes"- capitalize on the greatest fears of organized obstetrics and sell the belief that using AirStrip OB™ helps guarantee healthy babies. Such assertions perfectly encapsulate the mentality of Surveillance Medicine: using information-producing technology to monitor patients enables physicians to provide proactive care that leads to better outcomes. No data is offered to support these ambitious claims, and the company makes no mention of the fact that electronic fetal monitoring in general has repeatedly been shown not to do any of the things that they claim AirStrip OB™ does.

Interestingly, the company also does not invoke a message of convenience for the physician to market their product. The entire premise of the usefulness of the application rests on the unchallenged (and possibly unconscious) assumption that allowing physicians greater access to information necessarily translates to improved obstetric care. The conspicuous lack of evidence to substantiate the grandiose claims seems to suggest that none is needed; the usefulness of such a technology is presented as self-evident. In this sense, AirStrip OB™ is a natural extension of the cultural logic that has propelled electronic fetal monitoring for decades.

The website contains links to news clips about AirStrip OB™ and testimonies from many physicians. One obstetrician is quoted as saying, "Having the ability to access that information

immediately on the phone added a degree of comfort for me, to know that I could really keep an eye on things” (airstriptechnology.com). This physician conceptualizes the application as extending his gaze; through his phone, he can “watch” his patient even when he is miles away. He also expresses that there is security and reassurance simply in having access to the information from the EFM, regardless of his ability to act upon it. Like Dr. Z, this physician is reassured by the ability to closely track the elusive “things” – risk factors- that the output of the EFM represents. Another obstetrician proclaims, “I am an AirStrip OB™ addict. Now that I have it, I don’t know how we ever covered more than one hospital without it” (airstriptechnology.com). This physician confirms that he did in fact practice successfully without this application, but the appeal of having access to more information more of the time is so strong that it makes the previous reality seem unimaginable. This quote also perfectly encapsulates the mentality that appears to surround the entire technology of EFM: now that it exists, it seems impossible to practice without it. In a medical system based on careful surveillance, AirStrip OB™ is presented as a valuable enhancement of a physician’s vigilance.

Furthermore, the marketing campaign for AirStrip OB™ capitalizes on the notion that scrupulous use of technology can reduce human error. The company CEO, an obstetrician by training, claims: “...a vast majority of adverse outcomes in labor and delivery are directly related to communication errors involving the fetal strip, or the fetal heart tracing. So the ability to close that communication gap and deliver that real-time historic data to the physician anytime, anywhere, we think will have a significant impact on patient safety” (airstriptechnology.com). He does not elaborate on exactly how “closing the communication gap” will improve patient safety nor does he substantiate his claim that communication errors cause the majority of adverse outcomes. Rather, he seems to expect his target audience of obstetricians to make the association that

having more direct access to the EFM, without an intermediary nurse or fellow doctor, will reduce the margin of error in interpreting tracings. By attributing poor obstetrical outcomes to “communication errors,” the CEO suggests that the technology is infallible, and only its human interpreters are prone to mistakes. AirStrip OB™, then, solves this problem by allowing obstetricians to constantly access the unfiltered, raw data produced by the monitor without another human mediator. This marketing angle sells the notion that the solution to the problems of EFM tracing interpretation lies in greater access to the objective data, and thereby taps into an ingrained belief in the superiority of technology.

Electronic fetal monitoring emerged out of a marked shift in priorities in American medicine, from treating evident pathologies to managing gradients of normality and their associated risk factors. The invention of the EFM and the idea of directly observing the fetus in order to allow preemptive intervention transformed obstetrical practice and redefined the way physicians approach birth. In addition to altering the way the fetus and the maternal-fetal relationship are conceptualized, electronic fetal monitoring establishes fetal risk as the primary adversary of obstetricians. With the EFM continuously producing data that is culturally constructed as factual, objective, and absolute, obstetricians not only face the challenge of converting the tracings into an effective clinical risk management tool, but they also must confront questions of responsibility and blame when their attempts to prevent bad outcomes fail.

CHAPTER 3

Managing Birth, Managing Risk: Medicine, Litigation, and Authority

A New Means, Changing Ends

The concepts of risk and surveillance are not only compelling within the medical context; they implicate entire populations and social structures. Through increasingly complicated risk-management of health as well as illness, sciences, technologies, and human interactions have been co-produced in novel ways. While the physical machinery of the EFM has not changed drastically since its introduction in the 1950s, the medico-social context in which it is embedded has. In order to understand why electronic fetal monitoring (or any technology) is used the way it is, it is imperative to consider how it is involved in the construction of new dynamics between medicine, law, and the production of authoritative knowledge.

Though technologies themselves are not active agents, neither are they passive, ineffectual objects. Because technologies are more than simply the sum of their mechanical or practical parts, their existence enables certain interpersonal, social, and structural relationships to be elaborated. Like any social entity, technologies are not static; as philosopher Bruno Latour (2002) advises, they cannot be regarded as mere instruments that only represent existing relations and ideas:

If we fail to recognize how much the use of a technique, however simple, has displaced, translated, modified, or inflected the initial intention, it is simply because we have changed the end in changing the means, and because, through a slipping of the will, we have begun to wish something quite else from what we at first desired. If you want to keep your intentions straight, your plans inflexible, your programs of action rigid, then do not pass through any form of technological life. The detour will translate, will betray, your most imperious desires. [Latour and Venn 2002:252]

Though the artifact itself may not “do” anything, the use of the technology does actively contribute to the meanings and consequences derived from it. Employing a technology does not simply enact culture as it already exists; it creates a dynamic and reciprocal relationship between the cultural context that gives rise to the technology and the influence of its use on the context in which it is utilized. Latour’s rather ominous warning about how the use of a technology can alter the objectives that it was originally intended to accomplish provides a useful framework through which to examine many of the large-scale effects of the diffusion of the EFM. Along with the understanding that technologies and the people who use them work together co-constitutively to producing meaning (Clarke et al. 2003), this approach can further illuminate how electronic fetal monitoring has shaped obstetric practice.

As discussed in chapter 2, the shift to from manual auscultation to electronic monitoring altered the way in which the fetus is observed and conceptualized in the medical setting. Along with these changes, the reasons for monitoring the fetus and the perceived consequences of doing so have also transformed significantly since the 1950s. Though the EFM was invented with the hopes that it could prevent cerebral palsy, it has repeatedly been proven not to do so, and this is no longer considered a primary objective of electronic monitoring. As of 2009, the American College of Obstetricians and Gynecologists (ACOG) has definitively declared that the use of EFM does not reduce the risk of cerebral palsy (Practice bulletin 106). According to the ACOG, fewer than ten percent of people who develop cerebral palsy also experience a measurable hypoxic event during birth, and even in those cases where intrapartum hypoxia does occur, it is not clear if the event is the true cause of the injury.¹³ Since 1992, the ACOG has recommended

¹³ Though this statistic is generally accepted as valid within the biomedical community, it is worth noting that the ACOG has a vested interest in decoupling birth injuries like cerebral palsy from detectable birth events in order to reduce the potential for litigation against obstetricians.

increasingly strict criteria that must be present in order to link fetal neurological damage to hypoxia during birth. EFM tracings are no longer considered sufficient to “prove” fetal distress; in order to conclude that intrapartum hypoxia caused damage to the fetus, a concerning tracing must also be corroborated by an acidic umbilical blood pH after birth, persistently low APGAR¹⁴, other neurological squealea such as seizures, and multiorgan dysfunction (ACOG Practice bulletin 106). However, even though the EFM officially no longer officially accomplishes the very task for which it was designed, it is far from being rendered obsolete in obstetrical practice.

While the means of electronic fetal monitoring- with all of its imprecisions and clinical ambiguities- may not have changed much since the 1970s, the ends that the technology is desired to achieve have. As Latour predicts, the intentions, responsibilities, and consequences of using the EFM have shifted, and its medico-social identity is now rather distinct from its original form. The rest of the chapter outlines how electronic fetal monitoring has come to serve radically different ends from those originally intended by examining the ways knowledge, power, and control are produced and reinforced through the technology.

Authoritative Knowledge

In any given social situation, there are many different types of knowledge that exist, but not all ways of knowing achieve equal status or importance. Brigitte Jordan states that due to this

For a discussion of how political and economic interests influence scientific research and publications in obstetrics, see Vintzileos (2009).

¹⁴ APGAR stands for Appearance, Pulse, Grimace, Activity, Respiration, and it is a tool used to assess the newborn’s condition immediately after birth. The practitioner rates the newborn based on these five criteria on a scale from zero to two, and these ratings are added to create a total score from zero to ten. APGARs are assessed at one and five minutes after birth, and can be done again at ten minutes if the scores are low.

imbalance, “some kinds of knowledge become socially sanctioned, consequential, even ‘official,’ and are accepted as grounds for legitimate inference and action” (1997:60). The knowledge that is given more social power is referred to as authoritative knowledge. Jordan, who first coined the term, describes authoritative knowledge as:

...the knowledge that participants agree counts in a particular situation, that they see as consequential, on the basis of which they make decisions and provide justifications for courses of action. It is the knowledge that within a community is considered legitimate, consequential, official, worthy of discussion, and appropriate for justifying particular actions by people engaged in accomplishing the tasks at hand. [Jordan 1997:58]

It is essential to note that such knowledge is not absolute, nor more inherently correct than any other way of knowing; the power of authoritative knowledge lies in its social construction as the knowledge that matters most in a particular situation. Given this definition, authoritative knowledge is what guides, justifies, and regulates clinical decision-making in medicine; it is the knowledge that is considered relevant to assessing patient status, deciding what care is appropriate, and measuring the outcomes. Of particular interest to an analysis of the use of electronic fetal monitoring in American hospital obstetrics is how authoritative knowledge is used to justify the use of the technology and who is held accountable for the consequences.

Typically, anthropological discussions of authoritative knowledge in American childbirth have focused on how medical knowledge dominates the knowledge and intuition of birthing women. For example, Jordan states:

...there are other situations in which multiple kinds of authoritative knowledge do not come together, in which one kind of knowledge wins out and carries the day. This is typical for American hospital births, in which medical knowledge supersedes and delegitimizes other potentially relevant sources of knowledge such as the woman’s prior experience and the knowledge she has of the state of her body. [1997:61]

This assessment is certainly valid, and the previous chapter explored how electronic fetal monitoring enables physicians to supplant women's subjective knowledge about their birth experience with the authoritative knowledge generated by the medical establishment. However, an additional knowledge-producing system also exerts considerable influence in modern obstetric care and is especially relevant to decision-making regarding electronic fetal monitoring: the authoritative knowledge of the legal domain.

The Medico-Legal Arena

Since the 1980s, much attention has been paid to the practice of so-called defensive medicine and the alleged malpractice crisis in American healthcare. Though all medical specialties are subject to litigation, obstetrics is considered to be the field most affected by malpractice concerns (Tussing and Wojtowycz 1997). Citing a statistic that in 2004 one in seven obstetrician-gynecologists had quit practicing obstetrics due to high risk of malpractice claims, ACOG president Dr. Vivian Dickerson declared, "This crisis is getting more serious by the day. Its not only threatening today's OB/GYNs, but also the future of our specialty."¹⁵ As of 2005, half of all malpractice claims were brought against obstetricians, and according to the ACOG, 76 percent of practicing obstetricians had been sued¹⁶. According to the Medical Liability Monitor, in 2003, obstetricians in New York City paid malpractice insurance premiums that were on average 5.3 times higher than internists and 1.6 times higher than general surgeons, with many plans costing up to \$200,000 annually. Insurance costs vary widely by state, but obstetricians consistently have some of the highest premiums of all specialties (US General Accounting Office 2006). While the ACOG maintains that malpractice concerns are driving obstetricians out of

¹⁵ http://www.acog.org/from_home/publications/press_releases/nr07-16-04.cfm

¹⁶ http://www.acog.org/from_home/publications/press_releases/nr07-16-04.cfm

practice, the full extent, cost, and consequences of defensive medicine remains unclear and controversial (Bassett 2000, Katz 2005). Regardless of the figures used to quantify it, the complex interplay between the medical and legal systems is certainly real, and it has substantial implications for the construction of authoritative knowledge in medicine.

Defensive medicine is generally defined as medical care in which “the threat of medical malpractice may lead physicians to order medically unnecessary tests and procedures to protect themselves against a future lawsuit” (US Congress Department of Health and Human Services Office of Technology Assessment 1993). Such a definition appears to suggest that the relationship between law and medicine is unidirectional: law influences medicine, and fear of litigation causes physicians to practice defensively. However, this is in fact a superficial and incomplete representation of the situation. Equally important is the impact of medicine on law through technological innovation and the establishment of clinical care standards. As Bassett and colleagues explain, medicine and law exist in “a dialectical relationship that mutually defines, substantiates, and expands both disciplines over time” (2000:524). Medicine influences law by developing clinical practices seen as causally related to patient injury, and by reinforcing the legitimacy of associated documentary practices that offer the means to reconstruct relevant clinical events. Lawyers and judges are not medical professionals, and they are not independently qualified to assess what constitutes proper medical care. In a malpractice trial, both the prosecution and defense rely on expert witnesses, usually physicians who specialize in the type of care in question, to testify about their interpretations of the clinical situation. The legal system depends on medical research and authorities to provide information about standards of care upon which medical practice can be judged.

Dr. Melvin Konner, a noted anthropologist who completed medical school and published a

detailed account of his experiences as a third-year medical student, provides an interesting snapshot of the beginning of the malpractice crisis in his book *Becoming a Doctor*. He reflects upon a conversation with an attending obstetrician:

McCormick was giving me a lesson in the new defensive medicine that had grown up because of relentless, often frivolous malpractice litigation, directed against obstetricians as much as any other group and more than most. Seven out of ten obstetricians had been sued, and many doctors were giving up delivering babies. [1988:356]

Konner blames a unidirectional relationship of law influencing medicine for the rise in defensive practices. What is missing is an awareness of how the legal system is able to pursue litigation against obstetricians and what constitutes the medical evidence that renders legal action possible.

Additionally, while Konner provides insight into the physician perspective on why defensive medicine occurred on the labor and delivery ward, he does not address why it was a new phenomenon. The dissemination of electronic fetal monitoring coincided with a substantial increase in obstetric-related litigation, and not merely by chance. As Konner states, by the 1980's, the American obstetric community faced sharp increases in malpractice litigation, and this phenomenon can be largely attributed to the implications of obstetricians assuming the role of "fetal champions" armed with the technology to know the fetus and intervene on its behalf when necessary. The characterization of obstetricians as able to access objective knowledge about fetal condition through the use of the EFM altered cultural expectations and attributions of responsibility surrounding birth. The science, technology, and social meaning of the EFM mutually transformed the meaning of monitoring the fetus and enabled the legal pressures that led to the development of defensive obstetrics.

Just as Latour envisages, the use of electronic fetal monitoring has translated and betrayed society's most imperious- though well-intentioned- desires. The EFM, originally proposed to

visualize fetal condition, has evolved into a technology that builds expectations that omniscient obstetricians can unfailingly foresee potential problems. And, when their omniscience does fail, the EFM provides a means for legal recourse.

Why the EFM?

Several characteristics of the EFM are relevant to its relationship to defensive practice, including the fact that it produces absolute data in a uniformly quantified way. Every fetal heart rate tracing is recorded in the same unit of beats per minute, and this data is considered meaningful independently of other variables. Consequently, the EFM produces information as absolute data that can be ascribed standardized meaning. The ACOG and other researchers have devoted considerable effort to creating standardized guidelines for interpreting EFM tracings. The most recent proposal by the ACOG employs a three-tiered system that categorizes different heart rate patterns as “normal” “indeterminate” or “abnormal,” and each category is associated with different clinical guidelines (ACOG Practice Bulletin 106). Other researchers have recommended a color-coded system with five different colors that correspond to different risk levels, from “normal pattern” to “severe variant pattern” (Parer et al. 2007). Though these classification systems are intended to help physicians interpret the EFM tracings more accurately and effectively, they also restrict the physician’s subjective judgment. The fact that one of the three categories of interpretation as defined by ACOG involves “indeterminate” patterns indicates how difficult it is to classify the ambiguous outputs of the EFM, yet efforts to standardize their meaning continue. The idea that fetal heart rate patterns can be standardized suggests that there is one and only one correct interpretation of a given tracing. This notion is very compatible with the legal system, but can be very dissonant with complicated medical

realities.

Furthermore, the EFM creates a permanent record of a specific period of time; the graphic output temporally fixes events in a continuous, cumulative sequence. The tracings of the fetal heart rate provide a timeline onto which other clinical decisions or observations can be mapped, and by which the delivery can be “relived” and sequentially reconstructed after the fact. Finally, though the EFM records events that are fixed in time, the data itself is spatially and temporally mobile. An EFM recording can be examined by multiple people in different places at different times- an obstetrician sitting in her office can use her computer to read an EFM tracing that was produced hours before, or a lawyer can present to a court an EFM recording from a birth that happened years ago. Because of its cultural construction as objective and absolute, the data retains its intrinsic validity regardless of where or when it is interpreted. With an EFM, information that would otherwise be transient and private is made permanent and public, allowing for “direct atemporal access to the ‘facts’ of what went on during birth” (Bassett 2000:531).

As a result, an instantaneous decision made by a doctor during a delivery no longer constitutes the final word on a clinical situation. The data from the EFM can be used to reevaluate the decision that was made, even if it is far removed from its clinical and social context. The fact that an EFM tracing can be both decontextualized and standardized makes it ideal evidence for legal proceedings. Instead of relying on subjective human recollections or chart recordings completed after the fact, courts can use allegedly objective EFM data that is automatically recorded contemporarily with clinical events.

The characterization of EFM as a tool to allow physicians to definitively assess fetal condition, along with the legally-friendly nature of the data produced by the technology, creates

a situation in which the legal system is able to pass judgment on clinical decisions. The EFM grants the legal system the tools and evidence it needs to analyze clinical events and determine fault and responsibility outside of the social context and subjective characterization of a clinical situation. If a physician's management of a birth is called into question, the EFM tracings become the evidence of what "really happened" to the fetus during the delivery. The prosecution can have an expert witness (a physician who specializes in electronic fetal monitoring and high-risk deliveries) analyze the tracings and testify that they demonstrate malpractice by the physician; the defense can use the tracings as evidence that the physician acted appropriately based on the information available at the time.

A 2003 malpractice lawsuit involving a thirteen year-old girl with cerebral palsy alleged that the obstetrician who attended her birth neglected to intervene in a timely manner during her delivery, causing her permanent neurological damage. The plaintiff's attorney claimed that the EFM tracings showed fetal distress and a cesarean section should have been performed. The defendants argued that the strips showed no clear signs of abnormality and there was insufficient evidence to indicate surgical delivery. Just before the trial was scheduled to begin, the parties settled out of court.¹⁷ In another case involving a brain-damaged infant, a jury awarded a family \$10 million.¹⁸ The plaintiff's attorney, who is well known for pursuing lawsuits against obstetricians, alleged that the obstetrician had seen subtle signs of fetal distress on the EFM but did not attempt to accelerate the delivery, while the obstetrician maintained that he did not believe that the tracing indicated a need for intervention. Both sides had other physicians testify, and evidently the jury believed that the EFM showed convincing signs of fetal distress.

¹⁷ <http://www.feldmanshepherd.com/verdicts-settlements.php?action=view&id=6>

¹⁸ <http://www.olender.com/articles/this-man-makes-millions-suing-ob-gyns/>

These cases are only two examples of many lawsuits in which the EFM tracings have been the deciding evidence in determining whether malpractice occurred. From 1976 to 1986, almost two thirds of cases decided against obstetricians involved failure to properly interpret the EFM tracings, and failure to diagnose fetal distress remains the most often cited allegation in obstetric litigation (Lent 1999, Vintzileos 2009) The irony is that while many physicians feel that using the EFM provides “proof” to justify their clinical decisions, it is just as frequently used against them in courtrooms (Lent 1999). In such cases, multiple obstetricians examine the same fetal monitor data and swear under oath that it shows drastically different things. The original attending physician’s opinion is largely discounted while outside experts seek to convince a jury of non-medically trained individuals what conclusions they should reach about the EFM tracings. The ability- and responsibility- of deriving clinical meaning from the EFM no longer depends exclusively on the physician who is present at birth; instead, it can be passed from the original obstetrician to the expert witnesses to a civilian jury.

Defensive Medicine and Authoritative Knowledge

The relationship between the medical establishment and the legal arena that is enabled by technologies like EFM has profound implications for the construction of authoritative knowledge with respect to clinical care. As Jordan states, “The constitution of authoritative knowledge is an ongoing social process that both builds and reflects power relationships within a community of practice” (Jordan 1997:56). As the medical system increasingly emphasizes using objective, technological measures to dictate medical decisions, the legal system becomes increasingly able to pass judgment on medical events. The legal system, in turn, reinforces the legitimacy of these objective measures and contributes to further establishment of standardized precedents in clinical

care. The net result of this interaction is not only that physicians come to fear litigation, but more significantly, that so-called objective information is constantly reinforced as the dominant authoritative knowledge. The power balance in the medical decision-making is shifted towards knowledge that can be substantiated and corroborated with the kind of data that the medical and legal systems mutually define as objective and absolute.

In an interview, Dr. X described this reality:

I think that the legal issues have really dictated how we practice, and that's really unfortunate. If I see a baby's monitoring that doesn't look very good, and I don't act on it even though I think its going to be fine, and there's a bad outcome for whatever reason, then I'm at fault. And if there's a really good monitor, and the baby comes out and there's something wrong with the baby, then that helps me. So the legal system has really dictated this.

Even though Dr. X has never been sued, she is acutely aware of the fact that the EFM tracings are heavily weighed as evidence in malpractice lawsuits, and that if she does not act in accordance with the monitor information, she is more vulnerable to litigation. The ultimate authoritative knowledge here is ascribed to the tracings of the EFM; the obstetrician's clinical judgment is expected to be based entirely on the data from the monitor, regardless of whether or not she believes the information is an accurate representation of the situation. She expresses the feeling that she is forced to make decisions based on what information is relevant to litigation, and recognizes that the tracings of the EFM could either be used to condemn or defend her actions if the case were to be scrutinized in court. The amount of weight that EFM tracings are assigned in legal proceedings positions them as more important and more valid than the clinical knowledge and experience of the physician.

Consequently, medical authority as it is constructed in American culture is not only a question of physician versus patient or institution versus individual, but more importantly, it is a matter of objective science versus subjective experience and legal precedence versus clinical

judgment. Similar to the way in which the institution of biomedicine delegitimizes the knowledge a woman has of her physical experience, the rulings made in the legal sphere can undermine certain kinds of authoritative knowledge typically possessed by doctors and disrupt conventional power structures. Dr. Z recounted an experience that indicates how defensive medicine can impact the normal hierarchies of medical professionals. During our interview, Dr. Z described caring for a patient whose EFM tracing was slightly unusual but not enough for her to be alarmed or think that the fetus was experiencing distress. Based on the EFM data, an obstetric resident on Dr. Z's service became worried, but Dr. Z interpreted the tracing differently:

I was watching a strip¹⁹ and the resident called me and said 'I'm concerned', and I said 'I'm not'. And then another resident called me and said 'I'm concerned', and I said 'I'm not'. And then the nurse calls, and then suddenly there's about ten people telling me they're concerned and I'm not concerned. And everybody's whispering to each other 'Why isn't she concerned?' I'm like, 'I'm not'. And then finally I went to one of the high-risk doctors²⁰ and said 'Can you please pull up this strip because everyone keeps calling me and I just want to make sure I'm not missing something'. And [the high-risk doctor] says, 'Well its funny because the resident was just in here asking me about the strip.' So the resident went behind my back to ask her, and she told him the same thing I told him, 'Don't worry about it.' So there are a lot of people watching and when they have concerns then they bring it up to the next person. And as the attending I have the final say in what to do with something. So it's my decision and my judgment call. So, does that mean that some people might act on something that I wouldn't? Definitely. Because some people tolerate more risk than others.

While the idea of a nurse and resident questioning the assessment of the attending physician is certainly nothing new, the way in which they are portrayed to substantiate their concerns and the way the situation is resolved are revealing. Because the information contained

¹⁹ Before EFM tracings were computerized, they were printed out on a long strip of paper, so the tracing is often referred to as a "strip," even when what is being referred to is a digitized recording.

²⁰ A perinatologist, also known as a specialist in maternal-fetal medicine. Perinatologists complete a typical OB/GYN residency and then undergo additional years of specialization in high-risk pregnancy and birth.

in the EFM strip is quantified, it is equally accessible to each medical professional who can see the monitor screen, and each individual also feels capable of making a determination about its meaning.²¹ If the evidence involved was qualitative in nature, it is likely that the more conventional hierarchical controls of medicine would have allowed the authoritative knowledge associated with being an attending physician to more easily silence the protests of the nurse and resident. However, the fact that the data is perceived to have an absolute interpretation not only grants traction to the nurse and resident, but it also compels the attending physician to seek the advice of someone who is considered to have even more advanced ability to interpret the tracings- the perinatologist. Ultimately, the attending physician claims the authority to interpret the tracings as she sees fit and to proceed accordingly, but she acknowledges that by deciding not to intervene in a situation when others might believe intervention was indicated exposes her to a certain level of risk and possible legal repercussions. It is interesting that when Dr. Z concludes, “some people tolerate more risk than others,” she does not specify exactly who is at risk, and this ambiguity can encompass the risk to herself, the woman, and the fetus.

When the topic of practicing defensively and using EFM strips in lawsuits was pursued further, the Dr. Z commented, “I have not been sued, so I don’t know, but I know people definitely use [EFM tracings in lawsuits]. And that’s also why we get the cord pH, because the pH is much more accurate in terms of outcome than the strip on the baby, and as a routine we get them on everybody.” Though Dr. Z has never herself been the target of litigation, she acknowledges that the threat of litigation still influences her practice (or more exactly, the policies established by the hospital where she practices with which she is expected to comply).

²¹ As discussed in chapter 1, in the hospital where Dr. Z works, the monitoring system allows nurses, residents, and attending physicians to view tracings on the hospital computers or on the large central monitor screen in the labor and delivery unit. Nurses as well as obstetricians and residents are trained to interpret the EFM, though the nurses are not trained as extensively.

Most revealing is the technique used to mitigate this perceived threat: “Getting the cord pH” refers to testing the level of acidity in the blood flowing through the umbilical cord immediately after a baby is born. This test allows for a direct measurement of oxygen levels in the blood, and is considered to be a reliable indicator of fetal hypoxia at the time of birth. Here, Dr. Z explains testing the cord pH as a further piece of objective scientific data that can be used to judge what happened during a delivery and how it impacted the fetus. In order to protect against malpractice claims, an additional test is implemented to gather data that is regarded as even more legitimate based on the standards established by the medico-legal interaction.

Expect Perfection

As an examination of the relationship between EFM and malpractice litigation reveals, so-called “defensive medicine” is propelled not so much by fear of litigation as by the fact that the dynamic between the medical and legal systems continually establishes technological, objective data as the most legitimate source of authoritative knowledge. EFM use both facilitates this relationship between medicine and law and is perpetually rendered necessary by this interaction. The adoption of the technology has profoundly impacted the cultural context in which it is used, and the changing social meaning surrounding EFM has in turn altered the objectives that it is used to accomplish. The obstetric community has refuted the belief that EFM use can specifically prevent cerebral palsy. Instead, this purpose has been supplanted by a more ambiguous and problematic notion that proper monitoring can predict any bad outcome.

Once again, Dr. Melvin Konner provides insight into the changes that have occurred in practice ideologies. When reflecting on incidences of litigation against obstetricians, he explains, “It was not because they were worse than other doctors, but because in this situation people

expect perfection. They start out well and expect to end up well. When the inevitable occasional untoward event occurs, they sue” (1988:356). As Konner states, by the 1980’s, the American public in general expected positive birth outcomes, and when these expectations were not met, the assumption was that someone was to blame. However, these expectations were not formed without reason; the medical establishment bears substantial responsibility for creating and perpetuating the notion that obstetric “fetal champions,” armed with advance technologies and specialized knowledge, could guarantee healthy mothers and babies. Dr. X reflects on patient expectations produced through electronic fetal monitoring:

...it reassures [patients], and they feel like somebody is monitoring their baby all the time, and they’re less likely to have a bad outcome...I think the expectation from society is that if you can monitor me all the time, then I don’t want bad outcomes, because you can see when something bad goes wrong.

The latest edition of Williams Obstetrics outlines the conundrum that obstetricians face. They must simultaneously approach birth as a natural process that requires minimal intervention whilst foreseeing any complications and preventing them from causing permanent harm:

The ideal management of labor and delivery requires two potentially opposing viewpoints on the part of clinicians. First, birthing should be recognized as a normal physiological process that most women experience without complications. Second, intrapartum complications, often arising quickly and unexpectedly, should be anticipated. Thus, clinicians must simultaneously make every woman and her supporters feel comfortable, yet ensure safety for the mother and newborn should complications suddenly develop. [Cunningham et al. 2005:424]

Obstetric care requires navigating a precarious path between not over-intervening, yet always using medical technologies to their greatest potential to predict and prevent problems that might occur. Dr. Y describes the difficulty of trying to avoid unnecessary interventions while practicing in a climate of such high expectations:

...the consequence of having a bad outcome are so huge, nobody wants a bad outcome, and so what are the incentives of taking the risk and saying lets see how things go to avoid a c-section? There’s no incentive for that built into the system.

A system can have checks and balances for doing the right thing, but the system is designed now so that if something were to happen, there would be a million lawyers saying why didn't you do a c-section here, or here, or there? That's the problem.

As Dr. Y suggests that the greatest risk lies in not intervening when there is any indication of a problem with the fetus, he seems to reference a theoretical EFM strip. "Here, or here, or there" can be temporal and spatial locations represented on the fetal heart rate tracing; moments of potentially incriminating evidence of where intervention should have occurred. As he states, everyone certainly does want every delivery to end with a healthy mother and baby, and the consequences of performing an unnecessary cesarean section become more acceptable than the possibility of a vaginal delivery that ends in a damaged infant.

The idea of a cultural expectation for perfect birth outcomes is further elaborated by an obstetrician who specializes in high-risk pregnancies. In a paper published in *Human Nature*, Dr. Vernon Katz describes the "demand for the perfect baby" and the expectations American parents place on obstetricians to deliver abnormality-free infants (1993). Katz bases his observations on his own personal experiences and conversations with colleagues, and he expresses the belief that anxiety about being blamed for delivering a non-perfect baby significantly influences physicians' practice. Katz blames the extensive use of electronic fetal monitoring, fetal ultrasound, and amniocentesis for creating the expectation that obstetricians can predict and prevent bad outcomes much more effectively than they actually can, and this discrepancy between expectation and reality leads to blame and litigation against physicians. Though Dr. Katz does not offer direct quotes from patient interactions to substantiate his argument, he obviously feels that this phenomenon is real enough to warrant a journal article describing it. The very fact that Dr. Katz wrote this paper indicates how relevant the expectations of perfection were to his professional experiences.

Electronic fetal monitoring has encouraged the characterization of physicians as all-seeing and all-knowing fetal champions who can use technology to ensure that every birth produces a healthy baby. The fact that the information produced by the EFM is quantified, standardized, and temporally associated with events during birth make it ideal fodder for the legal system. The combination of these culturally-constructed realities makes electronic fetal monitoring an ideal bridge between the medical and legal domains and allows litigation to influence the authoritative knowledge of obstetrics. Through the complex interplay between the technology and the changing social context in which it is used, the EFM has contributed to dramatic changes in the way obstetricians make clinical decisions, how they are held accountable, and what patients and society expect from them.

CHAPTER 4

Evidence that Counts: Chasing Perfection in Obstetrics

As discussed in the previous chapter, socially relevant information about electronic fetal monitoring is not solely produced in the medical arena; legal concerns and litigation outcomes also influence precedents about the use of the technology. As part of efforts to improve the efficacy of clinical care and (theoretically) reduce malpractice lawsuits, the US medical establishment has increasingly emphasized the need to base medical care on practices that have been proven effective by scientific research. In the midst of this push towards so-called evidence-based medicine, the widespread use of electronic fetal monitoring is often portrayed as an anomaly in otherwise evidence-based obstetrics (Wendland 2006, Freeman 2002). Others characterize the use of the EFM as proof that most American obstetricians do not in fact ground their practice in scientific evidence, and thus believe that true evidence-based practice would lead to the elimination of this technology (Wagner 2006). Though it is tempting to think of evidence-based medicine as the perfect solution to the overuse of a technology, this supposition is problematic in many ways.

The term “evidence-based medicine” suggests a sense of objectivity, infallibility, and absolute correctness that belies the inherent biases of researchers and those who use the results. Science is not really as purely scientific as it is often presented to be, and evidence-based medicine is as vulnerable to partiality and cultural assumptions as any other medical paradigm. The influence of culture cannot be eliminated from medical practice, nor can it be eradicated from the development, generation, interpretation, and implementation of clinical research. The idea that scientific research will necessarily reveal the “truth” about a practice is misguided, and

it is also unreasonable to suggest that such research should be the only determinant of clinical care. As anthropologist and obstetrician Clare Wendland states, “There is no objectivity to be had, and the pretense that there is may be hazardous” (2007:227). When clinicians or researchers claim to possess objectivity, or when a study purports to have uncovered the definitive data on a technology, all parties are chasing an illusion. To adequately understand the relationship between evidence and practice, a variety of social structures and cultural biases must be considered. In the case of electronic fetal monitoring, analysis of the limitations of evidence-based medicine provides insight into why the use of this technology continues to defy the available evidence about its efficacy.

Evidence-Based Medicine

Evidence-based medicine, the idea that clinical practice should be based on rigorously evaluated scientific research, was declared a new paradigm in medical practice by the Evidence-Based Medicine Working Group at McMaster University in Ontario, Canada in 1992. In the paper outlining their vision of this new approach, the group designated evidence-based medicine as that which “deemphasizes intuition, unsystematic clinical experience, and pathophysiological rationale as sufficient grounds for clinical decision making and stresses the examination of evidence from clinical research” (1992:2420). Though this paper is generally credited with announcing the official “paradigm shift” to evidence-based medicine, it was certainly not the first time that scientifically supported practice had been proposed.

In 1972, British physician Archie Cochrane²² stated in his book *Effectiveness and Efficiency* that the majority of medical decisions were made based on opinion, anecdotal evidence, or the authority of experts. Instead, he argued, clinical care should be motivated by scientific research. Largely in response to Cochrane's analysis, the US Congressional Office of Technology Assessment created a new Health Program in 1975, with the overarching goal of defining methods and policies for evaluating the short and long term consequences of different medical technologies (Banta and Thacker 2001:708). This program funded Banta and Thacker's study on electronic fetal monitoring, which was the first comprehensive evidence-based assessment of a health technology (Rooks 1999).

When Banta and Thacker summarized the salient statistics on the predictive value, therapeutic effects, associated risks, and financial cost of routine use of EFM, they reached the conclusion that there was little evidence of any benefits provided by electronic monitoring and a convincing correlation between its use and increased cesarean deliveries. In the same year this paper was published, Dr. Cochrane publicly named obstetrics the least scientifically-grounded medical specialty. Compounded by increasingly vocal criticisms from the American home-birth movement, these developments generated much controversy and concern about fetal monitoring and other obstetrics interventions, and the perceived need for evidence-based obstetrics began to grow (Rooks 1999).

Evidence in Obstetrics

In the paradigm of evidence-based medicine, there is a hierarchy of medical knowledge that matches the tiered ranking of evidence proposed by the U.S. Preventive Services Task Force

²² The Cochrane Library, a highly respected electronic database that summarizes and synthesizes findings from randomized controlled trials (RCTs), is named for Dr. Cochrane.

in 1989. The “gold standard” of evidence is the randomized, double-blinded, controlled trial.²³

The supposition is that a randomized trial eliminates selection bias among research subjects, and a double-blinded study prevents the researchers from introducing their own biases into the experiment, therefore producing results that are value-neutral and empirically valid. Below this first tier come non-randomized controlled trials and cohort studies²⁴, and lower on the evidence totem pole are case descriptions, uncontrolled experiments, and expert opinions. Lower-ranking evidence, such as cohort studies and case reports, continues to comprise the majority of the available research, because randomized, double-blinded controlled trials are expensive, complicated, and sometimes even impossible to conduct (Rooks 1999).

Many of the practical difficulties of using scientific research to substantiate clinical practices have impeded efforts to implement evidence-based obstetrics. It is virtually impossible realize the “gold standard” of a randomized controlled trial (RCT) of a particular obstetric practice because doing so requires eliminating the rights of women to choose certain characteristics of their birth. For example, forcing a woman to have an epidural when she doesn't want one or denying anesthesia to a woman for the purposes of randomized grouping would be highly unethical. Additionally, even if researchers were able to randomly assign women to experience a certain type of birth, the psychological and emotional consequences of requiring a woman to give birth in a way she would not choose would undeniably impact the experience and outcome, and therefore invalidate the knowledge produced (Devries 2006).

²³ Randomized means that patients are assigned into different treatment groups by chance, regardless of their personal preferences or other criteria. Double-blinded means that both the subjects and the experimenters are unaware of who is assigned to which treatment group.

²⁴ Cohort studies are longitudinal, observational studies that follow a certain group of people (a cohort) with certain risk factors.

Furthermore, the relatively low levels of maternal and infant mortality and morbidity in this country make demonstrating statistically significant difference in practices very difficult. In the case of electronic fetal monitoring, the technology is intended to prevent events- fetal death or neurological damage due to severe hypoxia- that occur in approximately 1 in every 1,000 births. This makes it very difficult to gather sufficient data to make a statistically significant conclusion about the effectiveness of electronic monitoring. Moreover, the sheer number of factors believed to impact birth experiences and outcomes- prenatal care, location of birth, birthing position, nurse-to-patient ratio, fetal monitoring method used, anesthesia or pain-relief methods, mobility during labor, attitude of the birthing woman, previous birth experiences, etcetera- that are at play during any birth makes it incredibly difficult to distinguish the effects of one particular variable. Given the realities of obstetrics, researchers are often forced to rely on existing statistics or to devise alternative criteria in order to assess specific interventions and their consequences (De Vries 2006).

These challenges mean that there is virtually no way to perform a perfect randomized controlled trial of electronic fetal monitoring. Even in the most highly-regarded studies that have been done, there remain certain confounding variables or limitations that enable people to question the validity of the results (Parer 2003, Basset 2006). Whether the issue is small sample size, the effects of women's reactions to the EFM, or other events during that occur during the births, there is always an avenue to undermine the author's conclusions. The fact that the available research condemning electronic fetal monitoring does not unequivocally meet the "gold standard" may contribute to the resilience of this practice.

An additional complicating factor lies in how the research that is available reaches physicians. Obviously, every physician does not read every article that is possibly relevant to

their practice, so the ways in which they go about finding data can influence the kind of evidence they are exposed to. Dr. X states: “You know, as an academic OB/GYN, I use the resources from ACOG a lot, it’s a really nice reference for us...they do a nice job of synthesizing the evidence available. Our main academic journal is...affiliated with the ACOG.” This comment reflects one of the realities of evidence-based medicine: doctors can only read so many articles and analyze so much evidence while still practicing full-time, and many of them rely on a professional organization like the ACOG to review and interpret the evidence for them. A little gimmicky math suggests that a physician would have to spend approximately nineteen hours a day, every day of the year, reading journal articles in order to stay abreast of developments in obstetrics and gynecology (Rooks 1999).

Since this is clearly not realistic, organizations like the ACOG and the Cochrane Library become important tools, but they also necessarily introduce an additional level of subjective filtering into the process. Especially in the case of the ACOG, with its proclaimed dual objectives of advancing the professional interests of physicians and women’s health, biases are evident in terms of what research is given the most credence and attention by the organization. The ACOG has notoriously downplayed the research that is most critical of electronic fetal monitoring and the negative consequences associated with it (Wagner 2006). However, the organization has trumpeted studies that purport to show improvements in EFM tracing interpretation methods (ACOG Press Release July 26, 2010). For obstetricians who rely on the ACOG as the gatekeeper of evidence, such selectivity certainly has implications for the way they think about electronic fetal monitoring and what evidence they apply in practice.

Structural aspects of the US medical system also influence the kinds of evidence available and the primary variables that are studied in obstetrics. Obstetricians treat women

during pregnancy, delivery, and the immediate post-partum period. The baby is only their patient while it is a fetus; as soon as the fetus is delivered and renamed an infant, care passes to a pediatrician. The fact that the newborn infant is so immediately removed from the clinical domain of the obstetrician has a significant influence on the way obstetrical research is conceptualized. For the purposes of obstetric research, the main factors used to assess birth outcomes are the infant's blood pH and APGAR²⁵ scores- information is gathered within five minutes after delivery. In general, obstetrical researchers tend to ignore the maternal-newborn dyad²⁶ and the long-term implications of birth (Wendland 2007:222). The culturally prescribed rapid individuation of the infant leads most researchers to deemphasize analysis of longitudinal aspects of infant life in favor of immediate, quantifiable evaluative methods (Wendland 2007:222).

Similarly, because American women typically leave the hospital relatively soon after giving birth, most researchers focus only on short-term consequences that can be investigated during a one or two-day hospital stay. Longer-term factors, such as post-partum depression, lingering pain from delivery, and emotional responses to birth are often left unreported (Wendland 2007). Obstetricians generally agree that all of these factors are theoretically important, but because of the way American medical specialties are divided and patient care responsibilities are appropriated, they have little bearing on the everyday practice of obstetricians (Freeman 2002).

²⁵ APGAR stands for Appearance, Pulse, Grimace, Activity, Respiration, and it is a tool used to assess the newborn's condition immediately after birth. The practitioner rates the newborn based on these five criteria on a scale from zero to two, and these ratings are added to create a total score from zero to ten. APGARs are assessed at one and five minutes after birth, and can be done again at ten minutes if the scores are low.

²⁶ The maternal-infant dyad refers to the relationship between a woman and newborn and usually includes things like breastfeeding, bonding, and infant alterness.

These often-ignored long-term qualitative factors are tied to some of the most significant negative repercussions associated with electronic fetal monitoring. To someone who is attentive to the implications of a cesarean for the maternal-infant dyad (increased difficulties with breastfeeding, bonding, infant alertness, maternal depression, and more), the fact the use of the EFM drastically increases cesarean rates is extremely alarming. However, if only APGAR scores and mortality rates are considered, the EFM does not seem so threatening. Because quick, quantitative assessments dominate clinical evaluations, many of the harmful consequences of electronic fetal monitoring are downplayed and obscured in the scientific literature.

Certainly, a variety of social and structural features influence obstetrics, and the realities of practice necessarily influence the priorities of research. Many of the cultural values outlined in previous chapters, including belief in the advantages of more information, preference for technologically-produced information, and perceived need for the EFM “proof” of birth events are noticeable in new research that attempts to bring EFM use more in line with the evidence-based paradigm.

Though numerous studies have demonstrated that electronic fetal monitoring is not superior to auscultation, many people are conducting extensive research focused on refining EFM tracing interpretation in the hopes that this will improve its efficacy. The unfailing assumption behind such research is that electronic fetal monitoring is indeed superior, and it just needs more specific guidelines for interpretation in order to allow this superiority to manifest. A variety of researchers and organizations, including the ACOG and the National Institute of Child Health and Human Development, have published proposals for the standardization of tracing interpretations. Dr. J. T. Parer, a physician scientist who has been active in such research for over a decade, claims: “When FHR patterns are managed on the basis of standardized indicators of the

risk for acidemia, EFM will become a useful tool” (Parer et al. 2011:986). Dr. Parer seems convinced that as soon as tracing interpretation is made uniform and objective, the failings of electronic fetal monitoring will be solved.

In this vein, several different research teams have developed computer programs that recognize and classify different types of tracings. The authors of one such program state: “Computer analysis of cardiocographs has the theoretical advantage of providing a reproducible and objective interpretation of FHR tracings, quantifying parameters that are difficult to assess by the human eye, such as short- and long-term variability” (Ayres-de-Campos et al. 2005:53). They propose that the computer program is better able to recognize certain patterns and therefore derives more accurate meaning from the information. Authors of a similar program argue: “The strengths of this study reside in the capacity of computerization to analyze, without bias, more than 7416 hours of tracings...the computer will act consistently and measure precisely” (Elliot et al. 2010:258e6). Here, the authors credit the computerized analysis with improving the objectivity and precision of the interpretations. These programs are designed to standardize and automate EFM analysis with the hope of making tracing interpretation more accurate, objective, and evidence-based. Though existing research strongly indicates that obstetricians should abandon the EFM, cultural values instead compel researchers to continue attempting to justify electronic monitoring with scientific evidence.

Evidence that Counts

While researchers are seeking ways to substantiate the use of electronic fetal monitoring, obstetricians continue to negotiate exactly what it means to practice evidence-based medicine. Anthropologist Helen Lambert (2006) conducted a review of literature published within the

medical profession and examined the major criticisms physicians raised about this paradigm. She categorizes her findings into six main types of problems, including discrepancies between population evidence and individual patient needs, favoring of single interventions, exclusion of clinical skills, failure to consider patient views, production of formulaic guidelines, and difficulties in translating evidence into practice (Lambert 2006:2634). Lambert's research is relevant to understanding how physicians perceive evidence-based medicine to function- and fail- within their actual clinical practice.

It is essential to recognize that not only is evidence itself culturally shaped, but that the evidence that is most salient to a physician when they are caring for a patient is unequivocally influenced by a variety of social factors rarely reflected in a scientific journal article. Physicians practice in a fluid, complex environment, and the idea that they can disassociate their decision-making from this context and rely solely on scientific data is misguided. Each of the doctors I interviewed characterized him or herself as practicing evidence-based medicine, yet also readily volunteered that their use of electronic fetal monitoring is not necessarily consistent with the available evidence. The reasons they give to explain this apparent discrepancy highlight some of the additional factors that impact their clinical decisions, including past experiences, patient preferences, and questions of practicality. Consequently, analysis of the way these obstetricians explain their use of electronic fetal monitoring reveals that many different kinds of "evidence," including but not limited to published data, are significant in obstetrics.

While patient attitudes towards electronic fetal monitoring receive comparatively little attention in the scientific literature, each doctor offered patient preference as a significant factor influencing EFM use and subsequent obstetric interventions. Though these statements only represent the physicians' characterizations of patient feelings, the fact that the physicians have a

certain perception and offer it as an explanation for a clinical event is meaningful in itself.²⁷ For example, Dr. X directly confronts the discrepancy between the scientific data on the effectiveness of the EFM and her statement that she uses it with 100% of her patients:

The evidence shows that electronic fetal monitoring doesn't really improve outcomes and that intermittent auscultation is just as good, but I do think that the patients like it... And actually, I think a lot about this... We always practice evidence based medicine, but this is the one thing that evidence really hasn't shown but we still practice it... And I've started asking my patients sometimes, because I get to know them really well, so I'll say, 'you know that this really hasn't been shown to help,' [but they say] 'Oh but we really like to hear the baby's heart beat.' I think it has a lot of psychological meaning to patients. To actually hear it, even though it doesn't mean anything to them, they like to hear it... and the whole family gets involved.

Dr. X is acutely aware that the routine use of the EFM is not substantiated by research, and she identifies this as the one exception to her otherwise evidence-based practice. Interestingly, she not only expresses the belief that patients like the EFM, but she also characterizes birthing women as (at least partially) actively responsible for perpetuating its use. The scenario she creates is one of the evidence-oriented physician resisting the technology and the birthing woman clamoring for it. Dr. X believes that hearing the machine beeping in time with the fetal heart rate is reassuring to patients, even though most patients do not derive any medical meaning from it. Further discussion reveals that Dr. X does not believe that her patients would universally request electronic monitoring if intermittent auscultation was offered as an alternative, but she does feel that a significant portion of her patients would choose it. This explanation is particularly interesting because it portrays patient preferences acting as a barrier to implementing evidence-based care.

²⁷ The scope of this thesis did not allow for independent assessment of patient attitudes towards electronic fetal monitoring. For a additional commentary on patient attitudes towards the EFM, see Davis-Floyd (2003), and Georges (1996).

Notably, in this portion of the interview, Dr. X does not address any of the risks associated with the EFM. Though she acknowledged the negative consequences associated with the EFM earlier, here she treats it as a harmless thing that patients enjoy. This suggests that the risks tied to the EFM might seem rather remote in terms of individual patient interactions. An increased rate of cesarean section is a global measure that accrues over numerous births. In the context of one birth, such a risk factor seems rather abstract. Turning on the EFM does not automatically cause a surgical delivery, so it may be difficult to apply an intangible risk factor to a particular situation. However, a patient asking to be monitored electronically is concrete and immediately relevant to the birth, so such a request can easily supersede a theoretical risk correlation. This kind of reasoning speaks to Lambert's observation that one main difficulty of practicing evidence-based medicine is possible discrepancies between population-level evidence and individual patient needs (2006).

Dr. Z similarly asserts that patients like electronic fetal monitoring, and she emphasizes the positive impact that she believes it can have on a birth experience. As Dr. Z describes, the laboring woman and her family can watch the monitor to see the fetal heart rate as well as uterine pressures increases during contractions:

Its also interesting how [the EFM] involves other people in the room, if you think about it. If you go in a room when a patient is pushing, the whole family is involved. So I think there is this whole separate social and psychological gain that people aren't necessarily looking out. Because you can look at the results and the outcome and the c-section rate and all of this, but no one is looking at the outcome of the maternal psychological state of actually listening to her baby, knowing that her baby is OK all the time. That's really important.

Because the monitor shows contractions occurring, other people present at the birth often watch the monitor and encourage the laboring woman through her contractions. Dr. Z recognizes the social meaning of this involvement, in addition to emphasizing the perceived psychological

benefits of hearing and seeing the fetal heart beat throughout the delivery. Dr. Z acknowledges the actual “results and the outcome and the c-section rate and all of this,” but highlights other potential social, emotional, and psychological benefits related to the EFM that are not present in the typical evidence surrounding fetal monitoring.

While Dr. Z accentuates a potential alternative benefit, Dr. Y presents patient desires as hindering her efforts to use electronic fetal monitoring in a more evidence-based way. When I asked a question about the EFM limiting women’s mobility during labor, she responded:

I want them to walk. Some people want to walk. It’s actually better for them to walk during the first stage of labor.²⁸ But now patients come in and they want their epidural before they’re even hardly dilated, and that affects the whole labor. But, they just want to lie there and not feel anything. But then there are a lot of patients who feel very strongly about walking, going in the bathtub, waiting as long as possible. They don’t want to have anything to do with this continuous monitoring.

Dr. Y presents the question of whether or not the EFM is used as entirely a matter of patient preference. She assigns herself very little agency in determining how a birth is managed and which patients receive electronic monitoring. While she may want all women to wait to receive an epidural²⁹ and walk during the first stage of labor, the decision is not hers to make, and some women resist her recommendation and prefer to stay in bed hooked up to the monitor. This description again suggests the physician’s perspective that patient desires may actively prevent her from practicing as the scientific evidence indicates she ideally should.

²⁸ Several studies have shown that walking during labor reduces labor time and helps with pain management (Wagner 2006). It is also considered beneficial to wait until the second stage of labor to administer an epidural because early anesthesia has been show to impede labor progression.

²⁹ An epidural is a type of anesthesia that is administered via an injection into the lower spinal column. The epidural numbs the woman from the site of injection and below, so it is not possible for a woman to be out of bed once she has had an epidural. Additionally, hospital policy where Dr. Y practices states that once a woman has had an epidural, she must receive continuous EFM due to concerns about the effects of the anesthesia on fetal condition.

Beyond patient preferences at the level of the individual, several obstetricians expressed that “culture” and popular representations of childbirth interfere with their ability to practice evidence-based medicine. Dr. Y explained:

...a medicalized birth has become part of the social and cultural experience of what women expect. So, everybody who watches these stupid shows on TV, and by the time you're fifteen years old you know that you want an epidural for anesthetic. I mean, it's unbelievable. We can't get patients to go to childbirth classes, because they say I don't need to go to childbirth classes I can watch a video about it and read and see what's going on and then I want an epidural anyways, and it doesn't make any difference.

Dr. Y's obvious exasperation suggests that she feels unable to influence many elements of deliveries because she is fighting a losing battle against popular representations of childbirth. This quote also indicates that, to some extent, authoritative knowledge has been displaced from physicians and medicine to pop culture and patient preferences. As Dr. Y describes it, obstetricians have less control over which interventions are used as women turn to other sources – far removed from scientific evidence- to make decisions about their deliveries.

Furthermore, practical and logistical considerations influence the use of the electronic fetal monitoring. When asked why she never uses manual auscultation instead of the EFM, Dr. Z replied: “We don't auscultate. Because it's easier to just put the EFM on instead of listening. Its available everywhere, and its easier to just do that than to try to listen with your stethoscope.”

Additionally, Dr. X confirmed the importance of convenience:

The advantage of it too is that if you're doing auscultation, every so often you have to have someone go in the room and listen. Because you have central electronic monitoring, the patient could be in her room, and I could be watching the monitor from my office. And if the nurse calls me and she's concerned about something, I don't have to walk over there, I can just pull it up. And that's a big advantage.

While properly placing the internal or external monitor does require a certain amount of effort in comparison to using a stethoscope, Dr. Z emphasizes that the EFM is “easier”. As Dr. X elaborates, the ease and convenience are related to the fact that data from the EFM is constantly available and remotely accessible, without the obstetrician having to do anything other than pull up the tracings on a computer (or if she has AirStrip OB, on a cell phone). Though Drs. X and Z had both previously articulated the problems with electronic fetal monitoring, they do not mention them when discussing the convenience of EFM over auscultation. Scientific evidence fades to the background when practical considerations of fetal monitoring methods surface, and there is a clear disconnect between evidence and the realities of clinical practice.

There is a final element of the “evidence that counts” that seems to count the most of all: while it may be very rare, there are in fact births in which electronic fetal monitoring is a life-saving technology. Any instance in which electronic fetal monitoring detects a true life-threatening problem becomes a very powerful reason to use the EFM. Even if an obstetrician has never personally experienced such a situation, the very idea that this could happen is compelling. There is no scientific study documenting every birth in which signs of fetal distress led to an emergency cesarean that seemed to happen just in time to save the fetus. Nor is it possible to positively determine what would have happened if the EFM had not been used. Every time a concerning EFM tracing leads to a cesarean and the obstetrician pulls out a healthy, screaming infant, it can be interpreted in two ways: either the fetal distress was false and the cesarean was unnecessary, or the EFM worked perfectly and enabled intervention before damage occurred. From a scientific standpoint, it is impossible to determine which version is true; the truth depends entirely on perspective. To a woman who wanted to delivery vaginally or a homebirth advocate, this scenario is clear evidence of an inaccurate technology leading to gratuitous

intervention. To a woman who has suffered a previous stillbirth or the attending obstetrician, this may be proof of a life saved by the use of the EFM.

As Dr. X stated, “Its very, very subjective. Hindsight is twenty-twenty, its easy retrospectively when I know that I have [a good outcome] to say why did I do this or why didn’t I do that.” To an obstetrician who is ultimately responsible for the outcome of a birth, the consequences of a dead or damaged infant outweigh the costs of an unnecessary cesarean section. Obstetrician Amy Tuteur, who writes a blog called “The Skeptical OB,” expresses this perspective through a simplified mathematical model. Based on reasonably estimated values for the specificity and accuracy of electronic monitoring and intermittent auscultation in detecting true fetal distress in a sample size of 1 million births, she concludes:

Using intermittent auscultation resulted in more than 100,000 fewer C-sections, but an additional 100 babies died. You can make an argument (and many people do) that the life of 1 baby is not worth 1000 unnecessary C-sections, and hence, intermittent auscultation should be substituted for EFM. Of course, that means acknowledging that 100 babies would die who might otherwise be saved.³⁰

Dr. Tuteur uses these theoretical statistics to argue that for the physician who cares for large numbers of women, the priority is minimizing the number of fetal mortalities. While an individual woman may be more focused on ensuring that she is not subjected to an avoidable surgical delivery, the physician’s primary concern is ensuring that every baby is delivered healthy.

In this way, the idea that electronic fetal monitoring could potentially prevent a devastating outcome trumps every randomized controlled trial. Even though the scientific evidence does not support its use, the clinical need to avoid bad outcomes creates a perceived need for the EFM. Dr. Y acknowledges: “I think that labor and delivery is a very dangerous

³⁰ <http://skepticalob.blogspot.com/2010/12/is-electronic-fetal-monitoring-failure.html>

process for some people, for a very very small number of people, and we're not very good at predicting who those people are," but electronic fetal monitoring remains the most convincing predictive tool that is available. Dr. Tuteur echoes the same sentiment on her blog:

The bottom line is that obstetricians are well aware of the serious limitations of electronic fetal monitoring. For every neonatal life saved, for every case of brain damage averted, hundreds if not thousands of monitoring strips falsely predict fetal oxygen deprivation. The issue is not whether fetal monitoring is a good screening test; everyone knows that it is a bad screening test. The problem is that there is no screening test that's better.³¹

These obstetricians hold no illusions about the shortcomings of electronic fetal monitoring, but they express the imperative to at least attempt to predict who is likely to have a bad outcome. Any experience in which the EFM did successfully predict a real problem, or even just the notion that it potentially could do so, is sufficient reason to continue using it.

Clearly, there are many different considerations that are relevant to the way these obstetricians manage deliveries and monitor the fetus. While the term "evidence-based medicine" generally refers specifically to scientifically-produced data, these obstetricians reveal that there are in fact many different kinds of evidence salient to clinical practice that do not come from peer-reviewed journal articles. Things such as patient desires, logistical concerns, and a preoccupation with ultimate birth outcome influence the way physicians decide to use the electronic fetal monitor and how they interpret the information it produces. It is unproductive to think that value-neutral scientific evidence exists, or that it can somehow be used to eliminate subjectivity in obstetrics. It is far more useful to consider how cultural factors shape the relationship between electronic fetal monitoring, obstetrics research, and the evidence that counts in clinical practice.

³¹ <http://skepticalob.blogspot.com/2010/12/is-electronic-fetal-monitoring-failure.html>

CONCLUSION

The premise of electronic fetal monitoring is fairly straightforward: monitor fetal heart rate, and if everything seems fine, birth proceeds normally; if something is wrong, intervene and save the fetus. The idea of using a relatively non-invasive technology to prevent fetal injury and death during childbirth is undeniable appealing. There is a powerful cultural logic to gathering information about fetal heart rate in order to detect problems during childbirth, and the EFM does so in a way that, based on the values of biomedicine, appears inherently superior to any manual auscultation efforts. Ideally, the EFM allows fewer nurses to better monitor laboring women, and it enables busy obstetricians to directly observe the fetus even when they are not at the bedside. Most simply, electronic fetal monitoring provides convenient access to information that is considered accurate, meaningful, and consequential to successful childbirth.

Theoretically, electronic fetal monitoring seems like the perfect tool to address the challenge of identifying when medical intervention is needed in a delivery: with the machine, physicians can observe what medicine endorses as the “true” condition of the fetus, and therefore only interrupt the birth process when absolutely necessary. However, assessing fetal condition is not so clear-cut, and even with nearly a half a century of research on interpreting fetal heart rate tracings, there is still far more grey area than black and white. While a few tracing patterns are clear indicators of normality or distress, most remain ambiguous, open to numerous interpretations. It is in this hazy middle ground that controversy arises and risk, accountability, and authoritative knowledge are defined and disputed along the variable tracings of the EFM.

With electronic fetal monitoring, obstetricians reify the risks that the machine is intended to mitigate. As soon as the machine turns on, it renders visible changes in the fetal condition that

would otherwise remain unknown, and the variation in the fetal heart rate is translated as the perceived hazards of labor for the fetus. Obstetrical management then becomes oriented towards reducing the risk to the fetus, and every subsequent decision is constructed in these terms. With identification of risk necessarily comes responsibility; the obstetrician must assess the tracings, derive meaning from them, and decide how to proceed. The tracings cannot be ignored or erased; once the fetal condition is rendered visible, the obstetrician must be responsive to it.

Because of the nature of the data produced by the EFM, the interpretations of the fetal tracings are both highly subjective as well as definitive. Several physicians may draw drastically different conclusions from the same tracing, yet a judge or jury can still reach a singular ruling on how the information should have been used to inform clinical decision-making. While the obstetrician possesses the authoritative knowledge to interpret the EFM tracings, many other individuals do as well. Through the use of the EFM, authoritative knowledge surrounding a particular birth is no longer the exclusive domain of the attending physician; instead it can be enacted across time and space, within and beyond the medical realm.

This particular reality of electronic fetal monitoring introduces another dimension of risk: the risk to the obstetrician who uses the technology. In its social context, electronic fetal monitoring increases the level of accountability assigned to obstetricians. Because the obstetrician is privy to such seemingly valuable information about fetal status, they are expected to use the information to ensure positive outcomes. Along with the constant stream of data, the EFM is instrumental in producing expectations- on the part of obstetricians, families, and the legal system- for delivering perfect babies. The combination of legal rulings based on the EFM tracings and rising cultural expectations surrounding birth perpetuates and strengthens the perceived need to use the EFM to predict any possible complications.

In this context of measuring, evaluating, and minimizing risk, obstetrics is defined by weighing costs and benefits. Clinical realities and research biases minimize the consequences of injudicious intervention and exaggerate the perceived benefits of constant surveillance. With the medical establishment oriented towards the production of the fetus, any technology that advances this end is almost automatically constructed as beneficial; the associated costs may be understated or forgotten. There is, however, one cost that holds everyone's attention and drives the ubiquitous use of the EFM: the potential cost of *not* monitoring. Without the EFM, the physician is seen as less able to manage a variety of threatening risks: physiological risks to the fetus; physiological and psychological risks to the woman; professional, psychological, and financial risks to the obstetrician; and even financial and reputational risks to the hospital. Given even the slightest chance that using the EFM could lead to a life-saving intervention and provide concrete evidence of proper clinical care, not using it becomes more potentially costly than any of the other negative factors associated with it.

The great problem with electronic fetal monitoring is that it promotes a single-minded focus on preventing bad fetal outcomes. It goes without saying that everyone wants every birth to end with a healthy mother and a healthy baby. Unfortunately, the other certainty of childbirth is that no matter how infrequent or unlikely, some small number of deliveries will end badly for no perceptible, predictable, or preventable reason. Obstetricians and all other childbirth professionals rightfully strive to make this number as small as possible, and the many medical interventions available in US hospitals save maternal and fetal lives in many situations. However, this social, medical, and legal fixation on minimizing the risks of childbirth often leads to harmful interference with what otherwise would be naturally successful births. It is not a secret that electronic fetal monitoring has been clearly associated with high rates of surgical

interventions and little demonstrable benefit in terms of preventing fetal morbidity and mortality. Every obstetrician I spoke with- and I would venture to say nearly every practicing obstetrician in the US- is aware of the controversy. In my interviews, the obstetricians repeatedly emphasized their perceptions of birth as a natural process and their desires to reduce interventions. However, medical ideologies, hospital policies, legal pressures, and patient demands leave them feeling obligated to use the EFM.

In an era of ostensibly evidence-based medicine, electronic fetal monitoring exists in obvious defiance of numerous randomized controlled trial that have disproven its effectiveness. Where clinical statistics fail to explain this phenomenon, compelling cultural imperatives, complex medico-legal relationships, and socially-constructed forms of evidence emerge as powerful driving forces. As such, it is impossible to point in only one direction to explain the persistence of this demonstrably problematic technology: physician preferences, patient desires, legal precedents, economic considerations, and widespread cultural imperatives all coalesce to constantly render this technology necessary.

As electronic fetal monitoring continues to be scrutinized in obstetrics research and alternative birthing movements, it remains precariously balanced at the intersection of variety of disparate considerations. Some women and families embrace it, others hate it. Some analysts claim it reduces costs by allowing nurses to care for more than one laboring woman at a time, others cite the expense of purchasing and maintaining machines of dubious usefulness. And, as emphasized in this thesis, obstetricians especially regard this technology with ambivalence: they both rely on it to provide information that they believe is necessary and valuable, yet resent that it can be used to undermine their experiential knowledge or support claims of malpractice against them.

Despite substantial and convincing concerns about the consequences of its use, electronic fetal monitoring is embroiled in such a complex array of social forces that it is likely to remain a prominent fixture of American hospital births in the foreseeable future. Some potential for decoupling this technology from other unnecessary interventions lies in continuing to refine the way physicians interpret and respond to the heart rate tracings. But even more important is finding ways to solve the underlying problems- litigation fears, unrealistic expectations of preventing all bad outcomes, devaluation of women's birth experiences, invisibility of factors related to the maternal-infant dyad- that compel obstetricians to justify the use of a technology that they know is usually gratuitous and often harmful. If these larger issues are addressed, then hopefully this technology can become a valuable tool, used with discretion, to provide conscientious obstetric care.

APPENDIX

Interview questions for obstetricians:

- 1) About what portion of your patients receive EFM?
- 2) Why is EFM important to your practice?
- 3) Why doesn't the other portion of patients receive EFM?
- 4) Does EFM carry any significant risks?
- 5) Does not using EFM carry risks? (To the fetus? Mother? You as the doctor?)
- 6) How does EFM impact childbirth outcomes?
- 7) How does EFM impact a woman's birth experience?
- 8) Does EFM have a significant relationship with administration of pitocin or epidural?
- 9) Does EFM have a significant relationship with cesarean section?
- 10) How does using EFM impact the way you manage a birth?
- 11) Is EFM accurate in predicting dangerous fetal distress or hypoxia?
- 12) If there were enough nurses to guarantee a fetal heart rate check every 15 minutes, would EFM still be used?
- 13) How would not having access to EFM affect your practice?

WORKS CITED

- ACOG Practice Bulletin no. 106: Intrapartum Fetal Heart Rate Monitoring: Nomenclature, Interpretation, and General Management Principles. 2009 *Obstetrics and Gynecology* 114(1):192.
- ACOG Technical Bulletin. Fetal Heart Rate Patterns: Monitoring, Interpretation, and Management. Number 207--July 1995 (Replaces no. 132, September 1989). 1995 *International Journal of Gynaecology and Obstetrics* 51(1):65.
- Armstrong, David
2005 The Rise of Surveillance Medicine. *Sociology of Health and Illness* 17(3):393-404.
- Ayres-de-Campos, Diogo, Cristina Costa-Santos, and João Bernardes
2005 Prediction of Neonatal State by Computer Analysis of Fetal Heart Rate Tracings: The Antepartum Arm of the SisPorto® Multicentre Validation Study. *European Journal of Obstetrics & Gynecology and Reproductive Biology* 118(1):52-60.
- Ayres-de-Campos, Diego, with J. Bernardes, A. Costa-Pereira, and L. Pereira-Leite.
1999 Inconsistencies in classification by experts of cardiotocograms and subsequent clinical decision. *British Journal of Obstetrics and Gynecology*, 106: 1307–1310.
- Banta, D. H., and S. B. Thacker
2001 Historical Controversy in Health Technology Assessment: The Case of Electronic Fetal Monitoring. *Obstetrical Gynecological Survey* 56(11):707.
- Banta, H. D., and S. B. Thacker
1979 Assessing the Costs and Benefits of Electronic Fetal Monitoring. *Obstetrical Gynecological Survey* 34(8):627.
- Banta, H. D., and Stephen Thacker
2002 Electronic Fetal Monitoring. Lessons from a Formative Case of Health Technology Assessment. *International Journal of Technology Assessment in Health Care* 18(4):762.
- Beard, Richard
1977 Ultrasound and Measuring the Fetus. *British Journal of Obstetrics and Gynecology* 2:924-936.
- Bassett, Ken
1996 Anthropology, Clinical Pathology, and the Electronic Fetal Monitor: Lessons from the Heart. *Social Science and Medicine* 42(2):281-292.
- Bassett, Ken L., Nitya Iyer, and Arminee Kazanjian
2000 Defensive medicine during hospital obstetrical care: a by-product of the technological age. *Social Science and Medicine* 51(5):523-537.

- Beomsoo, Kim
2007 The Impact of Malpractice Risk on the use of Obstetrics Procedures. *The Journal of Legal Studies* 36:S79-S119.
- Borst, Charlotte G.
1997 The Training and Practice of Midwives: A Wisconsin Study. *In* *Sickness and Health in America*. Judith Walzer Leavitt and Ronald L. Numbers, eds. Pp. 237-252. Madison: University of Wisconsin Press.
- Burnham, John C.
1997 American Medicine's Golden Age: What Happened to it? *In* *Sickness and Health in America*. Judith Walzer Leavitt and Ronald L. Numbers, eds. Pp. 237-252. Madison: University of Wisconsin Press.
- Clark, Steven, and Gary D. V. Hankins
2003 Temporal and Demographic Trends in Cerebral Palsy--Fact and Fiction. *American Journal of Obstetrics and Gynecology* 188(3):628.
- Cochrane, Archibald Leman
1973; 1973, c1972 Effectiveness and Efficiency: Random Reflections on Health Services. [London]: Nuffield Provincial Hospitals Trust.
- Cohn, V.
1981 NIH task forces criticize some childbirth practices. *Washington Post*, March 8, A11.
- Costa, Maria, Diogo Ayres-de-Campos, Ana Machado, Cristina Santos, and Joao Bernardes
2010 Comparison of a Computer System Evaluation of Intrapartum Cardiotocographic Events and a Consensus of Clinicians. *Journal of Perinatal Medicine* 38(2):191.
- Cunningham, F. Gary, and J. Whitridge Williams
2005 *Williams Obstetrics*. New York: McGraw-Hill Medical Publishing Division.
- Davis-Floyd, Robbie
2003 *Birth as an American Rite of Passage*. Berkeley: University of California Press.
- Davis-Floyd, Robbie, and Carolyn Fishel Sargent
1997 *Childbirth and Authoritative Knowledge: Cross-Cultural Perspectives*. Berkeley: University of California Press.
- De Vries, Raymond, and Trudo Lemmens
2006 The Social and Cultural Shaping of Medical Evidence: Case Studies from Pharmaceutical Research and Obstetric Science. *Social Science Medicine* 62(11):2694.
- Elliott, Colm, Philip Warrick, Ernest Graham, and Emily Hamilton
2010 Graded Classification of Fetal Heart Rate Tracings: Association with Neonatal

Metabolic Acidosis and Neurologic Morbidity. *American Journal of Obstetrics and Gynecology* 202(3).

Freeman, Roger K., and Michael P. Nageotte

2010 Comments on American College of Obstetricians and Gynecologists Practice Bulletin no. 106. *American Journal of Obstetrics and Gynecology* 202(5):411-412.

Hon, E. H.

1973 Current Concepts of Fetal Monitoring. *California Medicine* 119(1):63.

Hon, E. H., and O. W. Hess

1957 Instrumentation of Fetal Electrocardiography. *Science* 125(3247):553.

Jordan, Brigitte, and Robbie Davis-Floyd

1993 *Birth in Four Cultures: A Crosscultural Investigation of Childbirth in Yucatan, Holland, Sweden, and the United States*. Prospect Heights, Ill.: Waveland Press.

Katz, Vernon

1993 Two Trends in Middle-Class Birth in the United States. *Human Nature*. 4(4):367-382.

Kay, Margarita Artschwager

1982 *Anthropology of Human Birth*. Philadelphia: F.A. Davis.

Konner, Melvin

1988; 1988, c1987 *Becoming a Doctor: A Journey of Initiation in Medical School*. New York, U.S.A.: Penguin Books.

Lambert, H.

2006 Accounting for EBM: Notions of Evidence in Medicine. *Social Science Medicine* 62(11):2633.

Latour, B., and C. Venn

2002 Morality and Technology: The End of the Means. *Theory, Culture Society* 19(5-6):247.

Leavitt, Judith Walzer

1997 "A Worrying Profession": The Domestic Environment of Medical Practice in Mid-19th-Century America. *In* *Sickness and Health in America*. Judith Walzer Leavitt and Ronald L. Numbers, eds. Pp. 237-252. Madison: University of Wisconsin Press.

Lent, Margaret

1999 *The Medical and Legal Risks of the Electronic Fetal Monitor*. Stanford Law School.

Mitford, Jessica

1992 *The American Way of Birth*. New York, N.Y., U.S.A.: Dutton.

- Numbers, Ronald L.
1997 The Rise and Fall of the Medical Profession. *In* *Sickness and Health in America*.
Judith Walzer Leavitt and Ronald L. Numbers, eds. Pp. 237-252. Madison: University of
Wisconsin Press.
- Oakley, Ann
1984 *The Captured Womb: A History of the Medical Care of Pregnant Women*. Oxford
[Oxfordshire] ;New York, N.Y.: B. Blackwell.
- Parer, J. T.
2003 Electronic Fetal Heart Rate Monitoring: A Story of Survival. *Obstetrical
Gynecological Survey* 58(9):561.
- Parer, Julian, and Tomoaki Ikeda
2007 A Framework for Standardized Management of Intrapartum Fetal Heart Rate Patterns.
American Journal of Obstetrics and Gynecology 197(1).
- Parer, Julian, and Tekoa King
2011 Electronic Fetal Monitoring as a Public Health Screening Program: The Arithmetic of
Failure to the Editor. *Obstetrics and Gynecology* 117(4):986.
- Pearson, J. F., and J. B. Weaver
1976 Fetal Activity and Fetal Wellbeing: An Evaluation. *British Medical Journal*
1(6021):1305.
- Rooks, J. P.
Evidence-Based Practice and its Application to Childbirth Care for Low-Risk Women.
Journal of Nurse-Midwifery 44(4):355.
- Sadovsky, E., Polishuk, W. Z., Mahler, Y., and Malkin, A.
1973 Correlation Between Electronmagnetic Recordings and Maternal Assessment of Fetal
Movement. *The Lancet* 301(7813):1141-1159.
- Sadovsky, E., and Yaffe, Y.
1973 Daily fetal movement recording and fetal prognosis. *Obstetrics and Gynecology*
41(6):845-850.
- Taylor, Janelle S.
2008 *The Public Life of the Fetal Sonogram Technology, Consumption, and the Politics of
Reproduction*. New Brunswick, N.J.: Rutgers University Press.
- Tussing, Dale, and A. W. Martha
1997 Malpractice, Defensive Medicine, and Obstetric Behavior. *Medical Care* 35(2):172-
191.

- US Congress Department of Health and Human Services.
1993 Office of Technological Assessment. Washington: Government Printing Office.
- US General Accounting Office.
2006 Malpractice Insurance Premiums. Washington: Government Printing Office.
- US Preventive Services Task Force.
1995 Guide to clinical preventive services, 2nd ed. Washington: Government Printing Office.
- Vintzileos, Anthony
2009 Evidence-Based Compared with Reality-Based Medicine in Obstetrics. *Obstetrics and Gynecology* 113(6):1335.
- Wagner, Marsden
2006 *Born in the USA: How a Broken Maternity System must be Fixed to Put Mothers and Infants First*. Berkeley: University of California Press.
- Wendland, Claire L.
2007 The Vanishing Mother: Cesarean Section and "Evidence-Based Obstetrics". *Medical Anthropology Quarterly* 21(2):218.
- Williams, J. Whitridge, Nicholson J. Eastman, and Louis M. Hellman
1961 *Obstetrics*. New York: Appleton-Century-Crofts.
- World Health Organization. *World Health Statistics* 2010.