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Comparisons of Care by Nurse-Midwives and Obstetricians:

Birth Outcomes for Moderate Risk Women

by

Leslie Cragin

DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

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in the

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of the

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By

Leslie Cragin

Acknowledgements

In memory of my mother, Dorothy T. Karnes

and

my father, James T. Karnes.

We must have a pure, honest,

and warm hearted motivation,

and on top of that,

determination, optimism, hope,

and the ability not to be discouraged.

The whole of humanity depends on this motivation.

H.H. Tenzin Gyatso, The 14th Dai Lama

Abstract

Comparisons of Care by Nurse-Midwives and Obstetricians:

Birth Outcomes for Moderate Risk Women

Leslie Cragin

In both historical and contemporary research investigating nurse-midwifery practice the recipients of care have generally been women who were considered to be at low risk for poor outcomes of pregnancy. The purpose of this research was to investigate and compare the processes and outcomes of care given by certified nurse-midwives and obstetricians to women at *moderate* risk for poor pregnancy outcomes.

In this retrospective cohort study chart data were collected for the total population of all patients (n = 1626) who enrolled for prenatal care with either obstetricians or nurse-midwives at two sites. Analytic statistics and regression analysis were used to examine associations between two or more variables.

This group of ethnically diverse women had an average of 7 risk factors for poor pregnancy outcome. After controlling for significant covariates, moderate risk women cared for by nurse-midwives were significantly more likely to have had fewer technological interventions, such as augmentation of labor and cesarean section ($p <$ .004); received personalized care AP and IP ($p < .03$); had more evidence of health education discussions with providers ($p < .001$); used comfort measures in labor ($p <$ .001); and breastfeed immediately after delivery and at 6 weeks pp ($p < .03$). There were no significant differences in rates of low birth weight.

From these results a profile of moderate risk women has been described for the first time. Further, the project demonstrates the positive and direct effect of midwifery care on processes and outcomes of care for moderate risk women.

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CHAPTER 1

Statement of the Problem

Both historical and contemporary research investigating nurse-midwifery care practices and outcomes have demonstrated safety and efficacy. However, the recipients of care in those studies generally have been women who were considered to be at low risk for poor outcomes of pregnancy. The purpose of this research was to investigate the processes of care used by certified nurse-midwives (CNMs) as well as the clinical outcomes of their maternity care among women at *moderate* risk for poor pregnancy outcomes.

Introduction to the Problem

As maternal and infant mortality statistics have improved in the United States, the focus of maternity care has become the promotion of optimal outcomes as well as the identification and reduction of risks that interfere with those outcomes. There are several stakeholders in this focus of care. Certainly pregnant women, their families and clinicians who provide care to them traditionally have been committed to optimal outcomes (Kennedy, 1999, 2000). Some of the newer stakeholders in perinatal outcomes are those who pay for maternity care. Payers are interested in finding innovative ways of supporting the provision of quality, cost effective care, particularly for women at risk for poor pregnancy outcomes. In the low risk populations previously studied, the outcomes of CNM care have been found to be equivalent to or better than those of physicians. Specifically, these outcomes have included higher average birth weight and lower rates of infant and neonatal mortality (Heins, Nance, McCarthy, & Efird, 1990; MacDorman & Singh, 1998; Visintainer et al., 2000). Nurse-midwifery care is also less costly than

medical/obstetric care (Lenaway et al., 1998, Oakley, 1996), primarily because of the decreased use of technology by midwives. Because of lower costs for care and excellent outcomes, some payers have come to view contemporary CNM practice as a viable solution to the care of childbearing women.

A prevalent assumption has been that the positive outcomes associated with nurse-midwifery care are due to "the likelihood that midwives are serving a low risk, self-selected population that would have positive outcomes regardless of the source of care" (Declercq, 1995, p.68). However the evidence in midwifery, medical, and public health literature contradicts this assumption. Women cared for by nurse-midwives include those who have both medical and sociodemographic risk factors (Declercq, 1995; Rooks, 1997). Specifically, CNMs care for women who are of a similar medical risk profile as the general population of childbearing women (Declercq, 1995). And, compared with the general population, women cared for by CNMs are more frequently from groups considered to be at risk for poor pregnancy outcomes because of sociodemographic variables, viz. "by virtue of their age, race/ethnicity, financial status, geographic location and migrant/immigrant status" (Scupholme, De Joseph, Strobino, & Paine, 1992, p. 343).

However, research about outcomes of both medical/obstetric and CNM care has traditionally been focused on women at either end of the "risk" continuum, i.e. women at low or those at high risk for poor perinatal outcomes. High risk is a term usually reserved for women with serious medical conditions. There are also sociodemographic factors associated with increased rates of poor pregnancy outcomes but causal links have not been proven. This makes assignment of the level of risk more difficult for women with these factors. But, when sociodemographic factors are added to medical risk factors, many more women in the general population would be classified somewhere *between* low and high

risk. These women could be characterized as being at *moderate* risk for poor perinatal outcomes. Many CNMs currently provide care for women who would be identified as those at moderate risk.

In research about outcomes of maternity care among women at all levels of risk, it is common to study low birth weight (LBW) as a significant variable, since an important indicator of the health of a population is the health status of infants and children in that population. LBW has been identified as "the strongest predictor of both infant mortality and infant and child morbidity" in the United States (Sable & Herman, 1997, p. 332). There is conflicting information about the outcomes of CNM care for women who have an increased risk of giving birth to LBW infants. While results of research using birth certificate data and observational methodology suggested that CNM care reduces the incidence of LBW, the results of intervention studies have not been conclusive (Clarke, Martin, & Taffel, 1997; Fiscella, 1995; MacDorman & Singh, 1998; Visintainer et al., 2000). In examining the outcomes of four of the more recent intervention studies, three studies (Fischler & Harvey, 1995; Heins et al., 1990; Rowley, Hensley, Brinsmead, & Wlodarczyk, 1995) found rates of LBW higher in the intervention group (nurse-midwifery care). Only one (Lenaway et al., 1998) showed a reduction in the odds of having a LBW baby when women were cared for by nurse-midwives. In this research, several outcome variables were measured, with a special focus on low birth weight (LBW).

Significance of the Study

Research about processes and outcomes of CNM care is important to families, clinicians, policy makers and payers. In the past most researchers have assumed that the women CNMs cared for were at low risk for poor outcomes. However, it is clear that many CNMs care for women at moderate risk for poor pregnancy outcomes. However

neither the processes nor the outcomes of CNM care have been studied among women at moderate risk for poor pregnancy outcome.

Low birth weight is a vital outcome variable in perinatal research because it contributes significantly to the infant mortality rate and the high cost of health care for children in the United States. In 1988, the estimated direct cost of the consequences of LBW in the United States was nearly $6 billion dollars (Lewitt, Baker, Corman, & Shino, 1995), accounting for 10% of all expenses related to health care for children (1998). Using a conservative estimate of a 3% inflation rate, the current direct cost of health care for children born at LBW can be estimated to be $8.5 billion dollars. Reducing the rate of low birth weight would result in cost savings to the health care system (Lewitt et al., 1995). This savings would be compounded if the reduction in LBW were accomplished using fewer technologic interventions than routine physician care of the same population. The relationship between CNM care and LBW is one goal of contemporary research about CNM practice.

To summarize, this research documented the processes and clinical outcomes of maternity care among women at moderate risk for poor pregnancy outcomes, with LBW as a special focus. Processes and outcomes were compared between equivalent groups of women cared for by CNMs and MDs. This project adds to contemporary knowledge by: (a) providing information about the practice of nurse-midwifery and medical/obstetrical care among women at moderate risk for poor pregnancy outcomes; and (b) demonstrating that among women at moderate risk, nurse-midwifery care resulted in outcomes equivalent to or better than those from medical/obstetric care.

CHAPTER 2

Introduction

This section of the research report reviews the theoretical bases for midwifery outcomes research, and then states the conceptual framework that guided the investigation. Salient literature will then be reviewed, including information about risk, and the outcomes of CNM care. Specific gaps in contemporary knowledge will be presented, followed by the study questions designed to fill some of those gaps.

A serious deficit in knowledge exists regarding the outcomes of care in women who are cared for by nurse-midwives. While the results of research conducted over three decades has been used to demonstrate that women who are cared for by nurse-midwives are not restricted by socio-demographic or medical risk factors (Declercq, 1995; Rooks, 1997), little is known about the outcomes of care to women who are not categorized as belonging to a low risk group.

As stated in Chapter 1, the positive outcomes associated with nurse-midwifery are assumed to be due to the low risk status of the women (Declercq, 1995). This opinion is difficult to disprove since much of the research conducted about outcomes of nurse-midwifery care used restricted samples of women in low risk categories (Declercq, 1995; Rooks, 1997). The practice of using of low-risk samples in nurse-midwifery research is rooted in two separate issues. First, by using "low risk" samples, researchers were able to more easily control for intervening variables without conducting randomized controlled trials. Second, the samples reflect how the practice was characterized in medical and popular literature. The resulting research did not accurately represent the characteristics of

women historically cared for by midwives[1] in the United States (immigrants, and rural women living in poverty) or for the subsequent changes in that group (Rooks, 1997).

For example, during the resurgence of nurse-midwifery in the 1960s, when States legalized nurse-midwifery practice, the scope of practice was often restricted to cases of "normal childbirth" as in California's nurse-midwifery practice act (BRN, 1997). This phrase represents the effort to define a scope of practice for nurse-midwives that was distinct from the practice of medicine and that fit within the philosophical framework and range of skills of nurse-midwives.

In actual practice, midwives have served a diverse population of women (Gabay & Wolfe, 1997; Scupholme et al., 1992). Often midwives have provided the only maternity services for women with restricted access to care (Rooks, 1997), a group believed to be at increased risk of poor pregnancy outcomes. However, studies continue to be conducted using women who are at "low risk" which reinforces the notion that the samples represent the true population of all women cared for by nurse-midwives.

This research project documented the outcomes of care, particularly rates of LBW, among moderate risk women who received care from nurse-midwives. The study addressed two gaps in knowledge affecting midwifery practice.

The first is that while the outcomes of midwifery care for women in low risk populations are excellent, the information about outcomes of care for women with

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[1] When the terms "midwives" or "midwifery" are used, they refer to the general category of the profession of midwifery, regardless of certification, educational preparation, or legal status. "Nurse-midwifery" refers to the profession of those who have received education in both nursing and midwifery, and who have been identified as nurse-midwives in the literature reviewed.

medical or social risk factors is limited. There have been few studies conducted among CNMs that included women with moderate medical risks or women from vulnerable populations. As women cared for by nurse-midwives are of a similar risk/vulnerability profile to those in the general population (Declercq, 1995; Parker, 1994), it is important to conduct research with samples that represent a similar diversity of risk or which, over time, build knowledge about all subgroups of that population.

The second gap in knowledge concerns the equivocal results of research examining the relationship between CNM care and rates of LBW among the women they care for. Nurse-midwifery care may be an effective, innovative strategy to decrease the rate of LBW among women from marginalized populations (Visintainer et al., 2000). However, past research was conducted using small study samples (Heins et al., 1990) and/or with women from primarily low risk populations (Slome et al., 1976) and the results of those studies are not consistent.

In the following section theoretical bases for CNM outcomes research will be discussed. Risk categories will be defined and a critique of risk scoring systems will be presented with a special focus on LBW. The next section will review descriptive research examining the outcomes of nurse-midwifery care, and includes a discussion of the credibility of the findings. The final section presents a critique of randomized controlled trials that investigated outcomes of midwifery care as compared to physician care. In the conclusion gaps in the knowledge about CNM care to women at risk of poor pregnancy outcomes will be reviewed and the main research questions will be presented.

Theoretical Basis for Midwifery Outcomes Research

Although midwifery has been practiced throughout recorded history, an intentional effort by the discipline to develop and communicate theoretical knowledge is relatively

new. Only three midwifery theories have been proposed in the United States, all within the past 15 years (Kennedy, 2000; Lehrman, 1988). Development of theoretical knowledge for nurse- midwifery has clinical practice as the focus, beginning with the foundational work of Ernestine Wiedenbach (Mc Kee et al., 1995, Meleis, 1997). Theoretical knowledge has been built from examination of the practice as is evidenced by "the writings of our clinicians, theorists and researchers" (Schultz & Meleis, 1988, p.218). Further, the ethical and philosophical commitments of midwifery contribute to the manner in which "theory and practice intertwine in a mutually supportive bootstrapping process..." (Dreyfus & Dreyfus, 1996, p. 30).

Interactionism

The historical roots of theoretical development in midwifery are interactionist and feminist. The theories developed about nurse-midwifery practice can be classified as interactionist because midwifery care is proposed to be a contextually influenced process of interaction between the midwife, the woman and her family and others (physician consultants, nurses) in their environment (Kennedy, 2000; Lehrman, 1988). The interactionist roots of nurse-midwifery theories can be traced to Ernestine Wiedenbach, a nurse-midwife and early nursing theorist. Wiedenbach, in collaboration with philosophers Dickoff and James, was instrumental in legitimizing practice-based theory development for nursing (Dickoff, James, & Wiedenbach, 1968). She is credited with a shift in emphasis from nursing's use of the medical model in research to use of a patient-centered nursing model (Mc Kee et al., 1995, Meleis, 1997). Wiedenbach's theory asserts that in order to assist patients in meeting their needs, nurses must first identify a "need for help" in the patient, and validate this perception of a need for help with the patient before initiating any nursing actions. While common today, the concepts of patient-centered care,

exploring the patient's perceptions and experiences of their condition, and eliciting validation of the nurse's assessment and plans for care can be traced to work done in the 1960s and 1970s at the Yale School of Nursing. Each of these concepts or approaches stems from the interactionist perspective and has been incorporated into nurse-midwifery philosophy and practice.

In 1961, the American College of Nurse-Midwives (ACNM) developed and adopted an expanded version of Wiedenbach's personal philosophy of nursing (Nickel, Gesse, & MacLaren, 1992) specifically for nurse-midwifery. Wiedenbach chaired the committee charged with this work. The ACNM's Statement of Philosophy has heavily influenced nurse-midwifery practice and subsequent theoretical development.

Feminism

Nurse-midwifery theory and practice are rooted in the core principles of feminism. These principles include the valuing of women and an activist approach to improving the lives of women and all people. The profession of nurse-midwifery "values women and confronts systematic injustices based on gender" (Chinn & Wheeler, 1985). Powell-Kennedy explicitly included principles of feminism in the development of her theory of exemplary midwifery practice.

The broad principles common to feminism are expressed in the professional practice of nurse-midwifery. The valuing of women and women's experiences are demonstrated in the history literature and practice of the profession. Nurse-midwifery care seeks to improve the health of women and their families in partnership with women, in the context of their lived experiences. For example, Mary Breckenridge founded the first nurse-midwifery training school in the United States in 1925. In order fully understand the health problems of women in rural Kentucky she spent a summer traveling by horse and

mule to isolated communities, staying with the families she interviewed (Rooks, 1997). Four nurse-midwifery schools were founded in the same period in response to midwives' work with specific underserved populations, demonstrating the activist stance of the profession of nurse-midwifery.

Another example of the activist position of many midwives occurred in the 1970's. Centuries of physician directed care had reinforced the gendered roles of American women (Vosler & Burst, 1993). Medical care for women was based upon the contradictory views that "women were ...exalted as natural and universal mothers by virtue of their reproductive abilities...(yet) those very reproductive abilities were viewed as increased risks for illness and women were seen to exist in a persistent pathologic state" (Vosler & Burst, 1993, p. 295). The Second Wave of feminism in the 1960's and 1970's, coupled with the activist stance of other social movements in that era, empowered women and families to seek alternatives to traditional women's health care: personalized, women-centered and natural. Many desired a home birth experience. A part of the women's health movement, nurse-midwives and "lay" midwives provided these services even when prosecuted for practicing medicine without a license (McCool & McCool, 1989).

In fact, the actual practice of midwifery embodies "confrontation of a systemic injustice based on gender" (Vosler & Burst, 1993). The history of midwifery illustrates this point. In western culture a striking example of the intentional suppression of women in their healing roles occurred in the Middle Ages. Witch hunts were conducted by the Roman Catholic Church and supported by governments during the 14th through the 17th centuries. While the accusations were brought against the poor in general, 85% of those executed were poor women. Women (as witches) were charged with: sexual behavior

"against men" (Ehrenreich & English, 1973, p. 8); of being organized; and having powers over health- either to cause illness or to heal. Peasant healers had no access to the universities where ruling class men were taught to be physicians. They were perceived as "a political, religious and sexual threat" (Bunting and Campbell, 1990, p.17) to the patriarchy. "No one does more harm to the Catholic Church than midwives." This statement, by priests Kramer and Springer, (Eherenrich & English, p. 11) is contained in the Malleus Maleficarum, a manual on how to conduct a witch hunt.

The usurpation of healing roles by male professionals was by no means limited to the middle ages. In the United States in the late 19th and early 20th centuries the emerging medical profession identified midwifery to be a problem. In 1910 approximately 50% of women, mostly those who were immigrants and poor, delivered their children at home. They were attended by midwives who were mainly of the same social class as the immigrants. Leaders in the medical and political arenas publicly referred to midwives as ignorant and dangerous. Most maternal and infant deaths, in and out of hospital, were attributed to sepsis. Rather than improving the education of midwives (as was done in Europe beginning in the late 18th century) existing schools of midwifery were closed (Rooks, 1997) in an attempt to reduce the number of practicing midwives. In fact, statistical evidence shows that where fewer midwives practiced, infant and maternal mortality rose (Dewitt, 1979 as cited in Rooks, 1997).

Feminist researchers have developed approaches to highlight gender-related themes of suppression of women. Lengermann and Niebrugge-Brantley (as cited in Campbell & Bunting, 1991) have identified three characteristics of theory and research built or conducted from a feminist perspective that informed the conceptual model for this project:

(a) women's experiences are the major object of investigation, (b) the goal of inquiry is to see the world from the vantage point of a particular group of women, and (c) it is critical and activist in its effort to improve the lot of women and all persons. (p. 6)

Additionally, one assumption underlying research conducted from a women's health perspective is that the focus is on health rather than illness (Timmerman, 1999). This assumption is consistent with a basic assumption underlying nurse-midwifery practice: birth is a normal life process. These assumptions are integral to the conceptual model guiding the research.

Development of theories related to nurse-midwifery has focused on the practice, which demonstrates certain feminist and interactionist attributes as discussed above. When feminist and interactionist approaches to theory development and research are used there is consistency between building knowledge for the profession and the practice of that profession. An example of this is found in the general theoretical framework of midwifery care described as the midwifery model of care (Arms, 1975; Rothman, 1982) which is discussed in a subsequent section.

Empiricism

While interactionist and feminist theories are consistent with the philosophy and practice of nurse-midwifery, is the same true for paradigms of scientific inquiry used to guide the methodology of research used to build knowledge for the profession? Empiricism is the dominant philosophy of science of western cultures. Much of the knowledge that has been used by the healing professions has been developed from the empirical standpoint (Duran, 1998). To understand empiricism it is necessary to consider the foundational influences on philosophies of science. Table 1 contains a brief overview of common paradigms of scientific inquiry and how those paradigms guide research

processes. The three paradigms considered most relative to this project are positivism, post-positivism and constructivism. Understanding the paradigms can be approached by asking two questions: What is the nature of reality? What is the relationship between the investigator and reality?

In positivism, it is held that things and phenomena are real and that it is possible to know *the truth* or how things really are. Working from this paradigm, one also holds the perspective that the investigator and object are independent and that the investigator can study the object without influencing it.

Table 1

Paradigms for Scientific Inquiry

Paradigm/Issue	Positivism	Post-positivism	Constructivism
Ontology-What is the nature of reality?	A "real" reality which can be known	A "real" reality which can be only imperfectly known	Relativism-local and specific constructed realities
Epistemology-What is the relationship between knower and what can be known?	Dualist/objectivist; Findings are true	Modified dualist/objectivist; Findings are probably true	Subjectivist
Aim of Inquiry	Explanation (ultimately resulting in) prediction and control		Understanding

This is a dualistic approach, a principle that informs not only the view of investigator and object of investigation, but is also used to create the possibility of causal relationships. That is, if the factors which are investigated are truly independent of other

influences, then it is possible to uncover which variable "causes" the wanted or unwanted outcome.

Conducted from a positivist paradigm, research investigating normal birth would be based on the belief that normal birth could or should be defined in concrete terms and objectively measured. Adopting the Freedman curve, developed by mathematically calculating and graphing the average length of thousands of labors, as the sole standard for evaluating "normal progress in labor" is an example of applying the results of research conducted within this paradigm. The underlying assumptions are that a "normal" length of labor exists and this length can be determined in an objective manner.

In post-positivism, there is a bit of hedging about our ability to know truth. The belief shifts slightly: there is a real reality but it can be known only imperfectly. It is not thought to be possible to maintain perfect objectivity but the more objectivity attained, the closer one gets to the truth. Using the Freedman curve as only one indicator of the progress labor would proceed from application of post-positivist inquiry. Freedman conducted his research with the intent to describe average length of labor. An objective standard absent of the many intervening factors that affect labor is not possible to attain. This situation is common to many areas of clinical research.

In constructivism, there is a major shift to belief in a reality that is socially constructed and specific in nature. The relationship between the investigator and the phenomena or subjects is believed to be interactive and the resulting truth, relative. Using a constructivist approach, when the length of normal labor is examined, a truth is constructed in that moment and time for a particular patient, or set of patients, which is fully informed by the experiences of the client(s), provider(s) and researcher(s). This truth also takes into account many factors of the environment surrounding the inquiry. While

less concerned with generalizability than positivist and post-positivist inquiry, in constructivism elements contributing to "the truth" can be shared among individuals and across groups. Therefore, others who share our experience/perspective may agree with the result.

Empiricism is the philosophy of science following the positivist or post-positivist paradigms. Meleis stated, "Empiricism...is based on sense data supported by a set of value free assumptions." Nelson (cited in Duran, 1998, p. 101) asserted that most of us function as empiricists and it does not make sense to deny this fact. A great deal of accurate and helpful knowledge used by health care professionals has been developed using this approach. Benner, Tanner and Chesla (1996) state "Both physicians and nurses alike would probably favor the use of objective clinical evidence...both would also favor practices based on sound scientific (*empirical*) theory and research...but expert practitioners in both disciplines must allow for nuanced interpretation of 'objective' evidence" (1996, p. 290).

While Benner and associates (1996) addressed the application of "objective" knowledge in practice, feminists critique of empiricism (Duran, 1998) and question whether it is even possible to develop knowledge which is at all objective. The basis of these critiques is that "the normative and detached view of the androcentric theorists purports to have a universality that it does not" (p. 105). Feminist critiques assert that knowledge is developed contextually and that subjectivity is inevitable. It is inevitable because these contextual issues influence the objects of inquiry as well as the methods used. Longino states: "The social character of scientific knowledge is made especially apparent by...the gatekeeping of peer review...gets published in journals...that is, what gets to count as knowledge" (cited in Duran, 1998, p. 109). Duran emphasizes the

importance of context: "(it) affects science at every step of the way and attempting to ferret out the way in which these effects are achieved helps to illuminate the structure of science itself, once again dismantling its pretensions of purity and uncontaminatedness." (p. 111) Acknowledging the contextual basis of the knowledge developed with empirical methods does not invalidate the knowledge but rather assists the practitioner using empirical knowledge to make more informed clinical judgments or "nuanced interpretations of 'objective' evidence"(Benner et al., 1996, p. 290).

This research project compared the outcomes of two distinctive approaches to health care. The following section discusses these two approaches from a theoretical perspective.

Midwifery Model

The midwifery model is based on a holistic philosophy, uses post–positivist and constructivist approaches to knowledge development, and operates on the assumption that many reproductive health issues are normal processes, which benefit from caring practices which address the woman in her lifeworld. Rooks (1997) succinctly described a major assumption of the midwifery model related to childbearing: "Midwives believe that pregnancy and birth are fundamentally healthy processes, which have many normal variations" (p. 448).

Midwives acknowledge the connections of mind and body, and of the person to their lifeworld.[2] Thompson, Oakley, Burke, Jay, & Conklin (1989) state, "We are grounded in the reality that the actual health status of any individual is more a result of his or her

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[2] This is defined as "the lived world as experienced in everyday situations and relations" (Van Manen, 1990, p.101).

environment, socioeconomic means and personal health habits than of any specific health teaching or professional intervention" (p. 121). In this way, health is not seen as the absence of illness (a state attained by curative actions) but as a result of a complex set of interactions between the person and her world, interactions that may include a health professional.

For nurse-midwifery, the practice domain includes applying empirical knowledge based on medical science but also is a "domain which shows forth clearly that in some human areas there is no place at all for abstract, objective, universal theory nor for any analytic rationality" (Dreyfus & Dreyfus, 1996, p. 47). Midwives strive to protect and nurture the normalcy of pregnancy and birth in a largely medicalized environment. This is defined not by scientific terminology but by the meaning of childbearing as a normal life process to women and families. It is in caring for women, acknowledging the *meaning* of normal life processes to the woman and her family, where there is no place for Cartesian-based abstract intervention. Dreyfus & Dreyfus (1996) wrote:

> In caring the nurse must be able to take on the perspective of the patient and make his or her peace with the situation and its suffering in order to be touched by the situation...Only by combining both technical and existential skills in their unique practice is the nurse able to heal both the body and the person. (p. 47)

While Dreyfus and Dreyfus (1996) refer to an illness requiring healing, their words could easily apply to childbearing which is a normal life process during which bodily changes may result in suffering. This suffering may be resolved during caring interactions where the skilled practice of a midwife enables her to take on the perspective of the patient, investigating the meaning and experience of the symptoms of pregnancy and birth and resulting in a plan of care developed by midwife and patient together.

Midwifery's protection and nurturance of the normal in processes related to women's health acknowledges and serves to "maintain human ties and concerns" (Benner and Wrubel, 1989 cited in Dreyfus & Dreyfus, 1996, p. 46). This approach also acknowledged midwives' anti-Cartesian view of mind and body as connected. The actions inherent to midwifery's caring practice can only take place when we have, in Dreyfus & Dreyfus's (1996) words, "taken up" the woman's situation. The authority for these therapeutic actions are rooted in the context of woman, family, and midwife, not stemming exclusively from the art of caring but including more of the context of a woman's situation than does the warrant for curative actions operating primarily from the biomedical point of view.

The defining characteristics of the midwifery model are proposed by this writer to be: (a) acknowledgement of the connections between the mind and body and the person to their lifeworld; (b) taking on the perspective of the woman, investigating the meaning and experience of symptoms or conditions, resulting in a plan of care developed by midwife and patient together, and (c) protection and nurturance of the "normal" in processes related to women's health, implying a judicious use of technology and intervention.

Medical Model

The "modern medical model...is based upon the ideology of technology...with its values of efficiency and rationality, practical organization, systematizing and controlling" (Rothman, 1982, p. 34). This paradigm is based upon the Cartesian view of the body as separate from the mind (i.e. dualism). While there is some shift away from a strict positivist approach in contemporary academic medicine, the medical paradigm is generally agreed to be based on a science with roots in Cartesian philosophy, using a positivist or post-positivist approach to knowledge development. This has resulted in the

medicalization of normal life processes and the setting of high value on technological approaches to cure.

Rothman (1982) noted that in the 1980 edition of *Williams Obstetrics*, normal pregnancy is viewed as a disease process, due to "the complexity of the functional and anatomic changes that accompany gestation" (p. 133). This view colors the medical approach in much of women's health. First, most knowledge and practice in women's health care have been devoted to reproductive issues. These issues are easily medicalized by a logical extension of the "the complexity of the [physiologic,] functional and anatomic changes" (1982, p. 133) that accompany many female reproductive processes.

Second, where more recent attention has been given to primary health care of women, attention is focused almost exclusively on illnesses or disease states (e.g., heart disease or cancer). Allen and Hall (1988) reported the effects of using the medical paradigm as the paradigm underlying *health* care (emphasis added):

> The diagnostic labeling of the medical model robs people of their control over their lives and of what they feel about their body. It leads to the medicalization of life processes such as pregnancy, grief, and menopause. It medicalizes the aged who have chronic illnesses but who otherwise regard themselves as healthy. (p. 25)

In addition to the separation of mind from body, the Cartesian-based medical paradigm also separates disease states and the causes of these diseases from the socioeconomic, personal, environmental, and ethical contextual factors surrounding them (Allen & Hall, 1988). Dehumanization of care and practice can arise from this separation. This approach leads to *treatment*, rather than *care*, since the intention of medical practitioners is to cure. In some cases, the intention to cure proceeds without regard for the social and medical iatrogenic consequences of the cure.

In the biomedical framework, the process of childbearing is seen as a state of potential danger to either the mother or fetus. Obstetricians are thus educated in pathology, the treatment of medical and obstetric complications, and surgery, which is the ultimate agent of "cure" when supportive or restorative treatments are not indicated or fail. The training and perspective of medicine results in the predomination of empirical medical definitions of what is "normal". Laboratory values, measurements of processes in time (weeks, days, hours, or minutes) or size (centimeters of dilatation) or weight (by grams ounces or pounds) are all plotted against the statistical mean. With this comparison to the normal curve, variation is renamed abnormality or deviation. Howell-White (1997) stated, "Physicians redefine normal as the prevention of the abnormal" (p. 925).

There is extensive literature containing comparisons or discussion of the midwifery and medical models, or both (Arms, 1975; Axten, 1995; Bash, 1995; Davis-Floyd & Sargent, 1996; Fullerton, Hollenbach, & Wingard, 1996; Gaskin, 1975; Howell-White, 1997; Keleher, 1998; Leppert, 1997). A central theme of this literature is the polarization of the two paradigms. Scoggin (1997) eloquently demonstrates this polarization from the midwifery perspective:

> Central and intrinsic to the nurse-midwife's professional schema is the conviction that the female body can handle most situations in a normal and natural way. If midwives do not cling to that belief they will be drawn into the whole medical model of birth, succumbing to the pressures of the health care system to perform more and more technological procedures...open[ing] it [midwifery] up to co-optation or absorption into medicine. As one CNM who runs her own birth center said, "One of the challenges of midwifery is to champion birth as a non-disease entity because if *we* (emphasis added) lose sight of that—it's just gone." (Scoggin, 1997, p.51)

The discussion of the biomedical and midwifery models presented thus far has been comparative, perhaps even dualistic in nature. Dualism may be appropriate when considering the *paradigms* underlying practice but not for discussions of practice itself. The midwifery and medical models presented here represent paradigms, "those aspects of a discipline which are shared by its scientific community" (Meleis, 1997, p. 11). The paradigms may appear to be "competing" for exclusive acceptance, however, midwifery cannot be and is not practiced without integration of the knowledge derived from both paradigms. It is not clear that completely discarding the medical paradigm would result in better theoretical knowledge for midwifery.

Paradigms are representative of philosophical and epistemological principles. What is represented in practice is more accurately "messy" and not able to be isolated from numerous contextual issues. Practice does include the interpretation and expression of paradigmatic principles, modified by an individual's or group's philosophy of practice, skill and knowledge set, and the context of the environment in which practice occurs.

Rooks (1997) has acknowledged the complementary attributes of the medical and midwifery models: "Each profession uses the other's knowledge to varying degrees, and builds unique expertise on knowledge from the clinical experience and research of its members and on knowledge from the basic and applied sciences..." (p. 127). Within their clinical practices, physicians and midwives share the difficulties inherent in reconciling the tensions between practice and theory, albeit from different philosophical perspectives.

Conceptual Framework

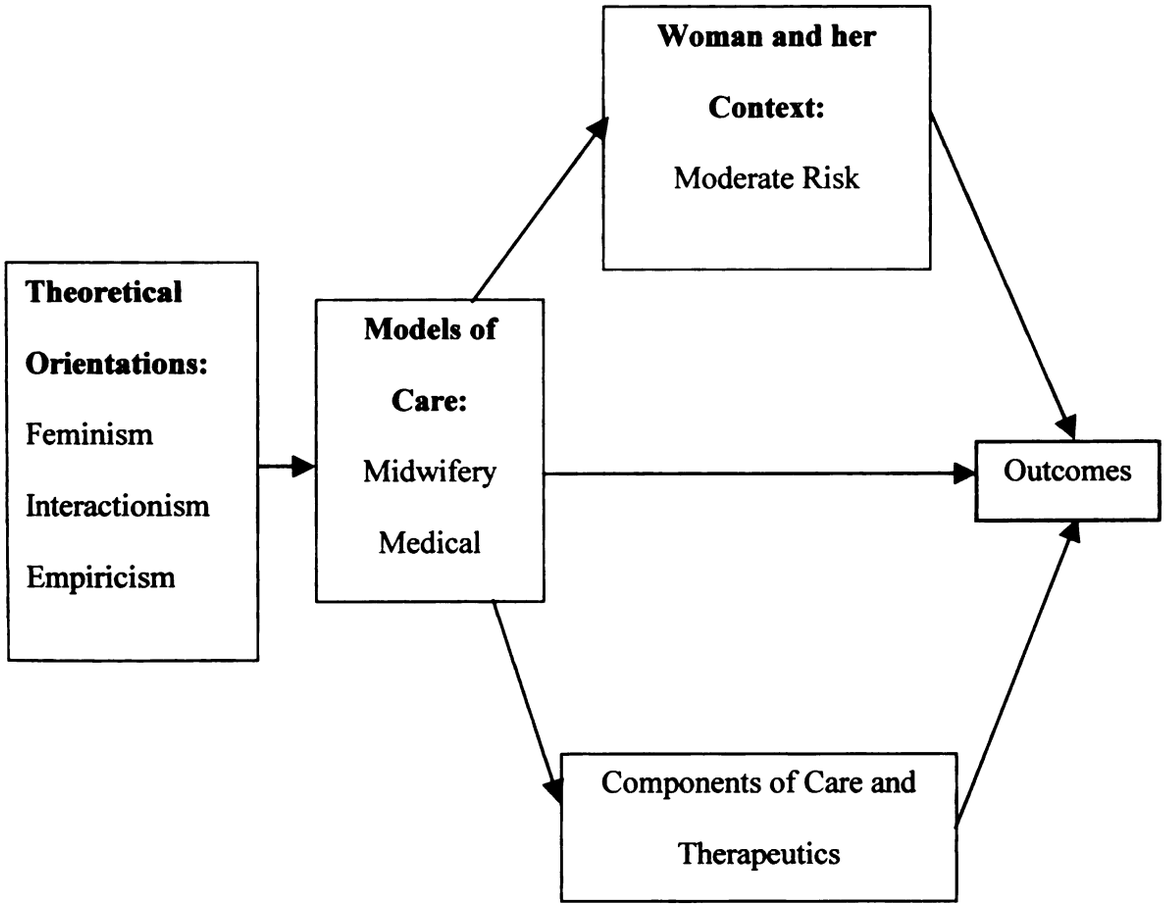
The conceptual framework presented in Figure 1 guided the project. This model proposes that specific theoretical orientations shape models of health care. These models, in turn, influence both the manner in which the recipient of care (the client) and the

context or environment of the client are viewed by practitioners of each profession and, in turn, which components of care and therapeutics are used when caring for the client. The outcomes of care are influenced by the models of care being used, by the interaction of the components of therapeutic and caring practices, and by the responses of client to those caring and therapeutic practices.

Using this framework, it is possible to clarify similarities and distinctions in the processes of care used by physicians and midwives when caring for moderate risk women. The similarities are consistent with clinical practices based on empirical theory and research. The differences in processes of care are proposed to stem from three influences: (a) the philosophical belief that childbearing is a normal process which focuses on health rather than illness; (b) defining the practice as a contextually influenced process of interaction leading to a "nuanced interpretation of 'objective' evidence."(Benner, et al., 1996, p. 290); and (c) when structuring care, giving equal authority to knowledge developed from women's experiences with that of technical-rational knowledge.

Figure 1

Conceptual Framework



Literature Review

In this section, methods for identifying women at risk for poor pregnancy outcomes will be presented with their limitations. Following that operational definitions of levels of risk that are used clinically will be described, with a special focus on risks for LBW. Finally research about the risk levels of the populations of women cared for by CNMs and outcomes of CNM care will be presented.

Level of Perinatal Risk

Risk Assessment Instruments

Lloyd (1983 in Chalmers, Enkin, & Keirse, 1989) states that the interest in determining which women or groups of women might be more likely to experience poor outcomes of pregnancy was apparent even in ancient Greece. There have been more recent attempts to organize a system of assessment beginning in the 1960s, contemporary with the advent of the regionalized perinatal system of health care. Two well-known and formally constructed risk assessment tools have been used and evaluated in research conducted with populations of women cared for by nurse-midwives (Chalmers et al., 1989; Rooks, 1997).

The first was developed by Papiernik and Kaminski (1974) and later modified by Creasy, Gummer and Liggins (1980). The Papiernik/Creasy system was originally constructed to predict women at increased risk of delivering an infant that is premature, has low birth weight, or both. Prematurity was defined as birth occurring at ≤ 37 completed weeks of pregnancy. Low birth weight was defined as being less than 2,500 grams.

Hobel, Hyvarinen, Okada, and Oh (1973) developed a risk assessment tool that has been incorporated into a commercially available risk assessment system, the Problem

Oriented Perinatal Risk Assessment System (POPRAS). The purpose of this assessment tool is to identify high risk pregnancy that may result in "neonates with morbidity and/or death" (1973, p. 1051).

Both assessment tools developed the lists of factors to be assessed based on comprehensive literature reviews related to low birth weight, preterm labor, or neonatal morbidity. Both include biologic/physiologic factors as well as social factors. Appendix A, Table A2 lists the factors included in the Papiernik and Creasy systems. Table A3 lists the factors included in the Hobel system. Both assigned empirically determined weights to the various risk markers. The weights are summed resulting in a single risk score from which the risk status is derived. The Hobel system assigned two levels of risk: low risk $\leq$ 9, high risk $\geq$ 10. The Papiernik/Creasy system included a moderate risk group: low risk = 0 to 5, moderate risk = 6 to 9, and high risk = $\geq$ 10.

To illustrate the differences in the systems, consider the following case: A 16-year-old with a history of two previous abortions, a pre-pregnant weight < 100 pounds, a weight gain < 20 pounds at 32 weeks, and uterine irritability at 30 weeks of her pregnancy would be considered high risk (score = 11) in the Papiernik/Creasy system, but low risk in the Hobel system (score = 5).

Neither the Papiernik/Creasy or Hobel's POPRAS system is consistently strong in predicting which women are at higher risk of delivering high risk neonates, low birth weight/preterm infants, or infants with both characteristics. Table 2 summarizes the sensitivity and specificity of the two risk assessment tools.

The tools have not been consistently used in clinical settings. In an era of evidence based medical practice, researchers are apparently reluctant to use these instruments as a basis for structuring caring absent stronger evidence that the use actually would improve

the clinical outcomes. Given the poor positive predictive value of the instruments, this analysis demonstrates the philosophical view held by nurse-midwives that most birth may be "risky but is safe" (Rooks, 1997, p. 280).

Table 2

Accuracy of Risk Scoring Systems

Study and Year	Sensitivity	Specificity	+PV	-PV
Kaminski et al., 1973	30	68	17	97
Hobel et al. 1973	76	67	7	99
Creasy et al., 1980	44*ϖ	93*ϖ	29*ϖ	97*ϖ
	77*#	90*#	33*#	99*#

Note. Adapted from Main (1987, p.791)

+PV, positive predictive value; -PV, negative predictive value

ϖ Single early screen only

Re-screened multigravidas only

Low Risk

Before proceeding with a review of what is known about the outcomes of midwifery care to women at moderate risk of poor pregnancy outcomes, operational definitions of risk[3] in nurse-midwifery and low birth weight literature were examined. The definitions of low risk are inexorably entwined with those of high risk as indicated in Appendix A Table A 1. Few of the studies reviewed refer to direct indicators of low risk status; rather they refer to the absence of high risk conditions. This provides evidence of a continuum of risk for the population of women giving birth. On one end is the ideal situation for

[3] For the purposes of this chapter risk will be defined within the traditional understanding of an "increased possibility of harm" without regard to the source (environmental or personal) of the potential for harm.

positive birth outcomes: women who do not have pre-existing medical conditions or life circumstances that may contribute to the development of conditions that would lead to poor pregnancy outcomes.

The definitions of low risk also are influenced by the research question that investigators seek to answer. For example, researchers investigating intrapartum (IP) events (for example, rates of Cesarean section) use operational definitions that explicitly include conditions affecting intrapartum outcomes (such as vertex presentation) when appropriate.

Some agreement is discernible within these studies. For example, the standard for low risk pregnancies at term appears to be women who have good baseline health status, are carrying only one fetus, and are not currently abusing drugs or alcohol; who begin labor spontaneously with the baby in a head-down position, and who do not develop obstetric complications during labor.

High Risk

High Risk. At the other end of the risk continuum are women who have serious medical conditions that predate pregnancy or who develop serious conditions during their pregnancies that require ongoing medical management. Researchers have validated this perspective and are pragmatic in their operationalization of risk status.

Women with complex medical or obstetric problems requiring medical or surgical interventions are labeled high risk and are outside the scope of nurse-midwifery practice. In these cases, while midwives may stay involved in the woman's care, physicians have the primary responsibility for decisions regarding her medical care. High risk factors fall into four categories: (a) those associated with life threatening conditions (e.g. brain death), (b) those associated with maternal or fetal perinatal related morbidities/mortality requiring

cialized medical treatment (e.g. Class B-R Diabetes, Rh isoimmunization), (c) those -existing medical conditions requiring treatment by medical specialist (e.g. cancer, us). The final high risk category includes conditions, that some nurse-midwives may nage, but that require specialized training or education before undertaking care of ients with the disease (e.g. HIV). Those conditions which, in the absence of advanced ining, require transfer of care from nurse-midwife to physician, can be considered a rking definition of high risk status. The 52 antepartum (AP) medical problems (ranging m abdominal mass to ulcerative colitis) in Butler, Abrams, Parker, Roberts, and Laros, 993) comprise nearly an exhaustive list of potential high risk conditions requiring ysician management.

Moderate Risk. It is much more difficult to define is a standard for moderate-risk egnancies. Researchers have not operationally defined the concept of moderate risk. The nge of medical, psychological, and obstetric problems that are independently managed co-managed with a medical consultant varies enormously from midwifery practice to idwifery practice. In order to more fully understand the issue from a national rather than local perspective, midwives and other researchers have begun to examine the data that escribe characteristics of the population of women cared for by nurse-midwives.

Risk Levels of Women cared for by CNMs

Caring for women who are considered to be at high risk for poor perinatal outcomes clearly beyond the scope of CNM practice, although midwives may continue to work ith physicians in a co-management situation with these women and their families. lowever, relatively recent research does show that CNMs care for women in both the low nd moderate risk categories.

Two survey-based studies conducted in the early 1990s (Gabay & Wolfe, 1997;

cupholme et al., 1992) confirmed that nurse-midwives cared for women who are from ılnerable populations. As noted above, the study "Nurse-Midwifery Care to Vulnerable opulations" (Scupholme et al., 1992) defined vulnerable populations as "populations that e likely to experience poorer than average outcomes of pregnancy by virtue of their age, ce/ethnicity, financial status, geographic location and migrant/immigrant status." This udy was a prospective survey designed to describe the women and babies cared for by ırse-midwives. Surveys were sent in May 1991 to 4,303 persons who had ever applied r certification by the American College of Nurse-Midwives (ACNM) or were associate embers of the ACNM.[4] While the original mailing included persons not qualifying for rticipation in the study, the sampling frame was constructed to capture as many rticipants as possible. The overall response rate was 62%. Of the 2,405 CNMs sponding, 78% were currently in clinical practice, and only data from those in practice ere included in the analysis (Scupholme et al., 1992). The results of the research emonstrate that 99% of the nurse-midwives responding were caring for women with at ast one characteristic of risk defining those in vulnerable populations in 1991. Table 3 ows the percentages of CNMs serving women in specific vulnerable populations.

This study has two limitations. First, the possibility of selection bias exists because e characteristics of the non-respondents are not known, nor are the characteristics of the omen they cared for. Second, the midwives were asked to retrospectively estimate the aracteristics of their clients, thus the accuracy of the data cannot be certain nor verified, reatening the reliability of the research.

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[4] Associate membership includes those midwives who have been active members but are engaged in issionary or volunteer work, or are students.

le 3

centages of CNMs Serving Vulnerable Populations

	Teen	Black	American-Indian	Asian/Pacific Islander	Hispanic	Poor	Immigrant	Uninsured
CNMs	95%	89%	36%	57%	79%	89%	51%	79%

e. From Scupholme, et al. (1992)

The second, prospective, phase of this study used a stratified random sample of the se one respondents. Two criteria were set for inclusion: spending 20% or more time in ical practice and willingness to participate in phase two (n = 1,438). In phase one only (n = 129) of CNMs reported that professional fees were their main source of income. e stratified sample for phase two included all midwives who cited their professional s as a main source of income and a 31% random sample of the salaried CNMs (n = 0). Data from the second phase of the study was used to estimate characteristics of the pulation of women cared for by nurse-midwives in 1991. It was calculated that proximately 3,000 nurse-midwives provided clinical care and that 71.1% of the women y cared for were from a population defined as vulnerable "to poor access or outcomes" aine et al., 1999).

A second type of research uses population-based (birth and death certificate) data to scribe characteristics of the population of women cared for by midwives. There are ee major limitations to this type of research. The first is the underreporting of births ended by nurse-midwives in data derived from birth certificates. The 1994 survey of the embership of the ACNM reported that 6% of nurse-midwives who attend births do not gn birth certificates. Contributing to the underreporting is lack of clarity regarding how erative vaginal deliveries are reported. It is not clear whether forceps or vacuum

eliveries are attributed to the CNM caring for the patient before delivery or to the hysician conducting the delivery. This is partly due to scope of practice issues (whether r not CNMs in a given state conduct operative vaginal deliveries) and partly due to the ack of standardization guiding the preparation of birth certificates. This lack of clarity on ne reporting of operative vaginal deliveries might result in underreporting of CNM-ttended vaginal births or—since physicians do the majority of vaginal operative eliveries for patients who are cared for in all other respects by a midwife—it might bias ne results in the direction of increased rates of poor outcomes for the physician group Albers, Sedler, & Gruelich, 1999).

Underreporting of medical complications is the second important limitation (Albers t al., 1999) of birth certificate data. Not all problems associated with poor pregnancy utcomes are listed. This impairs the validity of the conclusions drawn about the medical sk profile of patients cared for by midwives and physicians.

The third major limitation of the population-based research is that the data analyzed "delivery based." Birth certificates report only the attendant at birth. It is not possible to ack the characteristics or outcomes of the women for whom nurse-midwives may have ovided prenatal care, labor care, or both, and who are transferred to a physician either ntenatally or for Cesarean section or vacuum/forceps delivery. Likewise, no information n be obtained about the medical conditions for which a patient was transferred from idwifery care or for which co-management was maintained.

Within those limitations, describing the characteristics of the population of women aving a nurse-midwife attend their vaginal delivery has been an important contribution to e literature describing the scope, processes, and outcomes of care by nurse-midwives. or example, birth certificate data show the steady increase in the number and percentage

f births delivered by all midwives (nurse-midwives and "other midwives") nationally
ince 1975. Beginning in 1989, the Attendant field on the birth certificate was expanded,
eparating CNMs from "other midwives" (Clarke et al., 1997).

In 1975 midwives attended 19,686 births, representing less than 1% of all births in
e United States. In 2000 the number of births attended by nurse-midwives in hospitals
se to 297, 902 (Ventura, Martin, Curtin, & Mathews, 1999) or 7.8% of the total number
births in the United States. The women attended by nurse-midwives in hospital were
ore likely than those attended by physicians to be black, American Indian, or of
ispanic origin, < 20 years of age, unmarried, have less than a high school education, and
ve received less than adequate prenatal care as defined by the Kessner Index (Clarke et
, 1997). These are all factors believed to be associated, directly or indirectly, with the
creased risk of poor pregnancy outcome.

For midwife-attended births out of hospital, women were more likely to be White, of
spanic origin, > 30, have at least a college education and less likely to have received
equate prenatal care than women whose birth in hospital was attended by either a
dwife or doctor. These women were also less likely to have inadequate weight gain in
gnancy (Clarke et al., 1997). In this case, age and inadequate prenatal care are the
tors associated with poor pregnancy outcome.

Belonging to certain races or ethnic groups is also commonly classified as a risk
tor. Parker (1994) examined the relationship between maternal ethnicity and midwifery
endance at birth from 1982 through 1989. She intended to determine how much of the
sociation between midwifery attendance at birth and ethnicity is explained by other
ternal characteristics. A regression analysis was conducted in order to find alternative
planations for the increased odds for midwifery care at birth by maternal ethnicity. The

egression included maternal age, parity, education, first trimester prenatal care, place of elivery (in hospital vs. out of hospital), and marital status.

Parker (1994) found an increase in midwife-attended births from 1982 to 1989, arying by ethnicity. The rate of increase per year was greatest for American Indian, sian, and non-Hispanic White mothers. After adjustment for the characteristics listed ove, the increased odds of being delivered by a midwife rather than by a physician creased by one third for non-Hispanic White women and for a fourth group, Hispanic omen, but changed little for American Indian and Asian women.

The relative odds of being delivered by a midwife from 1982 through 1989, adjusted year of delivery, place of delivery, parity, age, education, first trimester prenatal care, d marital status are found in Table 4.

ble 4

lative Odds for Births by a Midwife, by Maternal Ethnicity 1982-1989

thnicity	*AOR*[a]	95% *CI*	*AOR*[b]	95% *CI*
on-Hispanic White	Reference		Reference	
Black	1.59	1.58, 1.60	1.39	1.38, 1.40
Native American	5.54	5.47, 5.58	5.12	5.04, 5.19
Hispanic	2.56	2.54, 2.58	2.35	2.33, 2.37
Asian	1.09	1.07, 1.11	1.09	1.09, 1.14

e. From Parker, 1994

djusted for year of delivery

djusted for maternal age, parity, education, first trimester prenatal care, place of delivery (in pital vs. out of hospital) and marital status

se findings lend further support to the work of Scupholme et al. (1992) by onstrating that women of color are more likely to have been attended by nurse-

midwives than are non-Hispanic White women.

Using birth certificate data, Declercq (1995) investigated the medical risk status of women attended by midwives (n = 147,293) in 1989. In this descriptive study, Declercq found that the women attended by midwives at home and in birth centers have prenatal medical risks lower than the national average (1995, p. 70). However, women who are attended by midwives in hospitals have rates of medical risks similar to the national average. Further, midwives serve a higher proportion of women with anemia, previous low birth weight or small for gestational age (SGA) babies, previous preterm delivery, renal disease, and genital herpes (Declercq, 1995), all of which are considered risk factors for poor pregnancy outcome.

These studies establish that the population of women cared for by nurse-midwives includes women who are members of vulnerable populations or who may have medical and obstetric conditions that place them at risk. Women from vulnerable populations are believed to be at increased risk of poor pregnancy outcomes relative to their restricted access to health care as well as the direct effect that marginalization of vulnerable populations within the larger social structure might have on health (Aday, 1993).

Given the limitations of the data sources, it is not possible to draw firm conclusions about the profile of *all* women cared for by midwives, specifically those who have medical complications or experience operative vaginal and cesarean section deliveries. However, women who deliver vaginally and are attended by nurse-midwives are not an exclusively low risk population. Rather, the population includes women with a range of medical and obstetric conditions associated with an increased risk of poor pregnancy outcomes. This population also includes women from vulnerable populations whose health status or pregnancy outcomes may be negatively affected by the interaction of

sical or psychosocial stresses and lack of access to health care.

ts Related to LBW

Low birth weight occurs more frequently among women who have been identified as rginalized and therefore vulnerable to health-related risk factors. Marginalization urs when persons are seen as different from the norm and pushed away from the ocietal center to its periphery" (Hall, Stevens, & Meleis, 1994, p. 25). Marginalization sults in women being physically, socially or economically vulnerable to sources of ness or environments that damage health (Hall et al., 1994). Vulnerable populations are ocial groups who experience limited resources...(and) have increased relative risk or isceptibility to adverse health outcomes" (Flaskerud & Winslow, 1998, p. 69). This ection discusses both social and personal level risk factors for birth weight.

Race and ethnicity. While low birth weight is more common among African-American, and some Hispanic and Asian ethnic groups, (Fuentes-Afflick & Hessol, 1998) race and ethnicity have not been proven as causal factors. Rather the terms define these groups as vulnerable populations (Leigh & Lindquist, 1998). Race, in and of itself, is not a hazard or exposure leading to poor pregnancy outcomes. Rather, race is a social construct. Those who are seen as belonging to a sub-group of that construct are vulnerable to the risk and perils of the environment, e.g. the perils associated with racism. The social construct is without scientific basis (Krieger, Rowley, Herman, Avery, & Phillips, 1993; Williams, Lavizzio-Mouney, & Warren, 1994). Additionally, the various categories of the construct have never been accurately or consistently defined (Hahn, 1992; Krieger et al., 1993; Williams, 1996). There are considerable problems of validity and reliability when using the concepts of race or ethnicity (a concept that suffers from similar methodological problems) as variables in health outcomes research (Williams, 1996). These problems

hamper the use of existent race/ethnicity data in determining which women are at risk of poor pregnancy outcomes and why those particular women are vulnerable to factors associated with poor outcomes.

As previously discussed, the relationship between LBW and race, class, and ethnicity is a complex one (Alexander & Kogan, 1998) and raises many questions about the causes and conditions leading to poor pregnancy outcomes. Williams (1997), a sociologist, provided a brief yet comprehensive description of the issues important to understanding the relationship between race and health:

> It [his theoretical framework] indicates that race is a complex, multidimensional construct reflecting the confluence of biological factors and geographic origins, culture, economic, political and legal factors as well as racism. All of these factors are interrelated and may combine both additively and interactively to affect health status and the utilization of health care. Race, an analytic variable of interest to many, is one of several social status categories created by societal forces and institutions. Social status categories reflect, in part, differential exposure to risk factors and resources that ultimately affect health through biological pathways. (1997, p. 327)

Other social factors. As discussed earlier, both feminist and midwifery theories assert researchers must study women in the context of their lived experience. In quantitative arch, data representing the social conditions in which women live and work serves purpose. The major categories of social factors associated with low birth weight are o-economic status, level of education, and access to health care (Hughes & Simpson,). The importance of including macro level social factors in research investigating is demonstrated in a study by O'Campo, Xue, Wang, & Caughy (1996). Their study

examined the effect of social factors on pregnancy outcomes of women living in Baltimore, Maryland, from 1985 to 1989.

The macro-level variables evaluated were obtained from census tract data. They are: ratio of homeowners to renters, number of community groups, unemployment rate, rate of housing violations per capita, crime rate, average wealth, and per capita income. The individual level factors, obtained from birth certificates, included birth weight, maternal age, maternal education, trimester of prenatal care initiation, and health insurance status.

The investigators found that all the individual level variables were significantly related to the risk of LBW. Of the macro level factors, per capita income less than $8,000 a year was directly and significantly (OR = 1.11; 95% CI = 1.02, 1.22) associated with an increase in the rate of LBW. Macro-level social factors modified the relationship between individual factors and LBW. For example, in "high risk neighborhoods" (as defined by high rates of unemployment, average wealth, or both), the protective effect of prenatal care on rates of LBW was lessened. While most of the high risk environmental characteristics *reduced* the protective effect of early initiation of prenatal care, there was one significant exception. For women living in neighborhoods with the highest level of housing violations, early prenatal care was associated with the greatest protective effect.

Johnson, Drisko, Gallagher, & Barela (1999) used multilevel modeling to examine interaction of neighborhood and individual characteristics in explaining neighborhood clustering of low birth with in Denver, Colorado. Because there was a high correlation among neighborhood factors such as high male/female unemployment, housing violations, crime, or few neighborhood resources, male unemployment was selected to represent neighborhood conditions. While the results indicate that both individual and neighborhood factors contribute to birth weight, the model explained only 8% of the

variance in birth weight for term births. However, the effect of male unemployment was five times as great as the effect of the maternal smoking, a modifiable risk factor of pregnancy in preterm deliveries.

Maternal characteristics. While there is extensive literature detailing the relationships between maternal characteristics and low birth weight, causal relationships have been difficult to uncover (Alexander & Kogan, 1998). The maternal characteristics most commonly associated with low birth weight are maternal age, parity, pregnancy interval, history of delivering a previous low birth weight infant, certain obstetric or medical conditions, pre-pregnant weight, and behavioral risks (Hughes & Simpson, 1995). Behavioral risks include drug and alcohol use, cigarette smoking, use of prenatal care and inadequate nutrition influencing weight gain during pregnancy (Alexander & Korenbrot, 995).

The three leading risk factors, accounting for 67% of low birth weight, are related to trauterine growth retardation. These are cigarette smoking, low maternal weight gain d low pre-pregnancy weight (Alexander & Korenbrot, 1995). Cigarette smoking and weight gain in pregnancy are considered modifiable risk factors and as such are phasized as key factors in reducing the high rates of low birth weight found in the ted States as compared to other economically advantaged nations.

mary

Many investigators (Chalmers et al., 1989) have identified the difficulties underlying ate prediction of pregnancies at risk of poor outcome. These problems range from ences in the prevalence of risk factors among various populations, to the differences significance of individual risk factors for specific populations. Additionally, some risk factors may actually be proxies for social class rather than proxies for the

unknown etiologic causes of any adverse outcome under investigation. Further complicating the problem is the potential that the factors may interact with one another. Researchers have thus far not been able to identify and measure either the interaction or the differential effects of such interactions (Flaskerud & Winslow, 1998).

As the literature reviewed demonstrates, little consistency or consensus has been agreed upon among experts in perinatal medicine regarding definitions for categories of risk in pregnant women. Researchers have tended to utilize pragmatic and contextual definitions. Attempts to develop instruments that identify women at risk of poor pregnancy outcomes have not been successful, since the instruments have poor positive predictive value.

Therefore, general and pragmatic definitions of risk status continue to be used in search and practice. For the purposes of this research, low risk status referred to women who did not have medical or obstetric conditions associated with poor pregnancy outcomes or who did not belong to a group whose characteristics would result in an increased probability of poor pregnancy outcomes. Moderate risk status was defined as having conditions contributing to poor pregnancy outcomes, excluding high risk conditions. As stated earlier, moderate risk also included vulnerable populations where health status, pregnancy outcome, or both may be negatively affected by the interaction of physical or psychosocial stresses and a lack of access to health care services. High risk was referred to women having serious medical or obstetric conditions. In most cases high risk status results in transfer of the patient to a physician for medical or surgical care, though nurse-midwives may continue to be involved in the care of these patients.

The conceptual framework or lens through which childbirth is viewed can direct both clinical practice and research. When childbearing is viewed from the biomedical

perspective, risk of reproductive danger is placed in the foreground with the normal processes of birth viewed as less important in determining the structure or processes of clinical care. Support of normal processes is easily sacrificed, since technology is believed to be capable of providing a better birth outcome. The perspective of nurse-midwives regarding risk is different: "Although the likelihood of bad outcomes is higher than normal under these circumstances [when moderate risk factors are present], the vast majority of these births have good outcomes; thus they can accurately be described as both 'risky' and 'safe' " (Rooks, 1997, p. 280).

Outcomes of Nurse-Midwifery Care

Background

In the 1920s two projects, one urban and the other rural, were initiated to address the high infant and maternal mortality rates found in the United States. Both projects used nurse-midwives to provide maternity care to women who lived in conditions of extreme poverty and material deprivation. The descriptive statistics drawn from the first 26 years of service at the first project, the Maternity Center Association in New York City were positive. The maternal mortality rate for the 7,099 deliveries during the period reported was 0.9 per 1,000 births compared to the national average of 10.4 per 1,000 births. (The current maternal mortality rate is approximately 1 per 10,000 births). The second project, Leslie County, Kentucky, was similarly successful. No maternal deaths occurred during the first 1,000 births (Tom as cited in Rooks, 1997, p. 37-39).

A demonstration project in Madera County, California, begun in the spring of 1960, showed that in a rural medically underserved county where women had inadequate maternity care, the prematurity rate in the county dropped from 11.0% in 1959 to 6.4% in 1961 after initiation of a nurse-midwifery program. The neonatal mortality rate decreased

from 23.9% to 10.3% per 1,000 births for the same period (Montgomery, 1969). When the program ended in 1962, physicians were recruited to care for the women of the county; within one year, the rate of prematurity then rose by 3.4% and the neonatal mortality rate rose by 21.8 per 1,000 births (Levy, Wilkinson, & Marine, 1971).

The early reports of nurse-midwifery care were retrospective designs with serious limitations. They often did not have a comparison group. Rather they used comparisons over time (before and after intervention) or as in (Levy et al., 1971; Montgomery, 1969)) used population-based vital statistics for their comparisons (Thompson, 1986). With the proliferation of studies examining nurse-midwifery practice, researchers have become more sophisticated. Now use of prospective cohort, quasi-experimental or experimental designs strengthen the validity of the research.

Two articles reviewing nurse-midwifery research, covering the years between 1925 and 1990, including comparison studies of outcomes of nurse-midwifery practice (Fullerton & Wingard, 1990; Thompson, 1986), demonstrate that care by midwives is qualitatively different from care by physicians. This difference consists of the greater amount of time midwives spend with patients, the inclusion of women and their families in the decision-making process, the lesser amount of technology used, the caring relationship between the woman and her midwife, the greater emphasis on information-giving by midwives, and the family- and woman-centered context of care. Additionally, research shows that nurse-midwives are safe practitioners for medically low risk women.

During the 65-year period covered by these articles, nurse-midwifery research consisted primarily of retrospective designs using samples restricted to low risk women who delivered in hospital. While the results were largely positive, methodological

concerns regarding the appropriateness of comparison groups, small sample sizes, failure to address both the structure and process of care in addition to the outcomes of care, and problems of data collection and interpretation (Fullerton & Wingard, 1990) have limited the credibility and generalizability of the conclusions.

Descriptive Research

Since 1990, more prospective cohort studies have been conducted (as compared to the period before 1990), as well as population-based studies and one meta-analysis. Table B1 in Appendix B provides an overview of this research. The studies reviewed included in this section are those that examine outcomes of midwifery care compared to physician care. Studies that investigated care provided on an episodic basis (antepartal only or intrapartal only) are not included.

The results of these studies confirm the general conclusions of the research conducted before 1990. Nurse-midwives have outcomes of care at least equivalent to physicians and use less technological processes of care than their physician colleagues. Support for these conclusions are demonstrated in the population-based analyses conducted by Declercq (1995) and Clarke and associates (1997).

Epidemiologic Studies. Clarke and colleagues (1997) found that some birth outcomes or women attended by midwives were better than for women attended by physicians. The wer rates of preterm delivery, low birth weight, and very low birth weight could be counted for by the transfer of women at higher risk of poor outcomes to physicians ore delivery. As noted above, these positive findings have been documented in studies g other designs (Brown & Grimes, 1993; MacDorman & Singh, 1998), one of which trolled for the medical risk status of the mothers (MacDorman & Singh, 1998). Although the rate of complications in births attended by nurse-midwives in hospital

was close to the national average of complications for all births, the rates of complications most likely to result in Cesarean sections were markedly lower (Declercq, 1995, p. 71). This is perhaps due to the fact that in the cases where women with those complications experienced Cesarean sections, the physician was listed as attendant at delivery. This again points to the serious limitation of using birth certificate data without being able to account for antenatal and intrapartum transfer of care.

Intrapartum complications occurred least frequently in women whose births were attended by midwives at home or in birth centers. Without further evidence regarding transfer of care, it is not possible to conclude whether this finding is a result of appropriate management of women at risk (i.e. transfer of those at higher risk to the hospital) or whether the population delivering out of hospital is, in fact, at lower risk of intrapartum complications.

Declercq (1995) reported lower rates of common obstetric interventions in women cared for by midwives compared with women cared for by physicians, as have other researchers (Brown & Grimes, 1993). Declercq's conclusion was that while CNMs attending births in hospitals do not serve a population at exceptionally low risk, they use fewer obstetric interventions and have outcomes that are "still distinctly better than average" (1995 p. 73).

Declercq's conclusion requires further investigation. No tests of association between the selected maternal risk factors and the outcomes were conducted. The comparison group of "all U.S. births" included both vaginal and operative deliveries. The strength of this comparison is that the referent risk profile is the total population of women giving birth. The weakness is the impossibility of accounting for the outcomes of patients who are transferred antenatally from midwives to physicians. Are they of even higher medical

risk status? Alternatively, are they of a similar mixed risk status to the women having vaginal deliveries attended by midwives?

Three descriptive studies will be discussed in more detail because their designs addressed some of the limitations of research conducted before 1990 (Fullerton & Wingard, 1990; Thompson, 1986). The designs included a prospective cohort, a retrospective chart review using a random sample of obstetric providers, and an epidemiologic study using regression analysis.

Prospective Cohort Design. Deborah Oakley and her colleagues have written a series of articles (Oakley et al., 1995) stemming from their extensive research project comparing the philosophy, process, and outcomes of care by physicians and nurse-midwives. This research project was an important contribution to the outcomes research literature for nurse-midwifery. The researchers investigated the structure and processes of care as well as the outcomes of care as suggested by Donabedian (1966). They also explored the influence of the characteristics of the women, beyond demographics or medical risk status, on the outcomes of care. While not a randomized clinical trial, the study produced results that are consistent with the findings of two smaller random assignment studies (Chambliss et al., 1992; Slome et al., 1976).

Oakley and her colleagues (1995) conducted their prospective cohort study in a large Midwestern tertiary care center, including the center's ambulatory care satellite and hospital-based clinics. The unit of analysis was "care provider teams" headed by either a CNM or an obstetrician. During the period of the research, care was given by 22 obstetricians, eight CNMs, ambulatory care nurses, and labor and delivery nurses. Patients self-selected their provider group at the time of the first prenatal visit.

Self-selection of provider type raises the possibility of selection bias. Oakley and her

associates (1995) addressed this by using two strategies. First, only women who qualified for nurse-midwifery care were invited to participate in the study, eliminating women from the physician care group who did not qualify for midwifery care. This had the effect of creating two groups who were equivalent in terms of known risk status at the time of entry into care. Second, data analysis included comparisons of as many factors (women's characteristics) potentially contributing to selection bias as could be identified and measured by the research team.

Of the 1,464 patients enrolled, 1,181 women remained in the study and gave birth by the completion of the study in February 1993. Losses after enrollment did not differ by provider group, demographic characteristics, reproductive history, psychosocial descriptors, or desire for breastfeeding (BF). Patients who enrolled in the project gave written consent for review of their hospital records and agreed to complete questionnaires at the first prenatal visit, at 32 weeks gestational age (GA), after the birth in the hospital, and at six weeks postpartum. Data from the postpartum questionnaire were not included in this report.

Most maternity outcomes research focuses on medically based processes of care (Oakley et al., 1995). An important contribution made by the researchers of this study is that processes from both midwifery and biomedical frameworks were examined. The authors developed and used proxy measures to assess physical care and psychosocial/educational practices. The educational and psychosocial care practices were combined (named psychosocial/educational) because it is difficult to know whether any specific care indicator is a measure of education, counseling, or counseling-based treatments (Oakley, 1995). For the intrapartum period, the psychosocial/educational category was operationalized as the number of non-technology-based comfort measures

the woman used, such as hydrotherapy for painful contractions. All proxy measures were found to have validity and reliability.

To illustrate: a nurse-midwifery approach to management of pain in labor might include prenatal education in non-pharmacologic pain relief measures, exploration of the woman's beliefs about labor pain, and a plan for managing a painful labor. During the labor itself midwifery management might include suggestions that she walk, shower, or use epidural anesthesia. This approach includes two educational and psychosocial measures, two non-technological physical care measures and one technology-based physical care method. The psychosocial/educational and non-technological physical care measures were identified as important indicators of the midwifery philosophy of care.

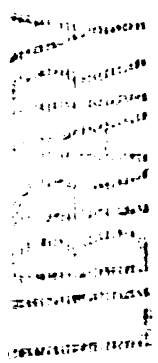
The intrapartum physical care scale was weighted to reflected technology-based care procedures. As anticipated by the different philosophical frameworks of the respective professions, physicians scored significantly higher on this scale ($p < .001$), a fact that the authors used as support for construct validity.

A weighted scale was constructed by the research team to assess actual or potential risk as "no existing scales have demonstrated replicated predictive validity" (Oakley et al., 1995, p. 401). The authors report that construct validity for the risk scale was demonstrated by low scores, as expected of patients meeting the eligibility for nurse-midwifery management, and the predicted non-significant difference between the two groups. They conclude that the scores are "adequate proxies for reproductive risk" (p. 402), a variable of critical interest when attempting to explain differences in outcomes or care processes by provider group where selection bias may be present.

Moritz (1995) cautioned against "too specific an approach to claiming outcomes by any single provider group" (p.119) because it is clear that the individuals receiving care

contribute to the outcomes documented. Often this connection is only expressed as the demographics or biomedical risk status of the woman. The approach used in Oakley's research (Oakley et al., 1995) acknowledged the connection between the individual, the process of care, and the outcome by examining both "women's characteristics"[5] and "women's preferences" (p. 406) in addition to demographics and risk status.

The women's preference scale was constructed by listing six labor and delivery procedures: labor started with medication, pain medicine in labor, IV fluids in labor, electronic fetal monitoring (EFM) by machine, stirrups for delivery, and episiotomy. KR-20 reliability for this scale was .74, demonstrating that the six items all measured various aspects of the same concept. The "empathy with main provider" scale was used as a measure of evidence of psychosocial/educational support and could be said to reflect part of the patient's contribution to process and outcomes.



The analysis of the data used intent to treat comparison. That is, the data were analyzed as belonging to the provider group with which they initiated their care, whether or not they transferred care to the other provider group. Bivariate analysis was done for each provider group on each variable, then linear regression and multiple logistic regression were used to test the hypothesis that provider group accounted for the difference in care received after all other explanations were taken into account (Oakley et al., 1995, p. 402).

The results of the bivariate analysis showed that a number of prenatal and intrapartum care processes were statistically different by provider group. These are listed

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[5] Such as occupation, income, parity, selected historical risk factors, locus of control, anxiety, and reasons for choosing specific provider type.

in Tables 5 and 6.

Table 5

Group Differences in Prenatal Care Measures

Care Measure	Nurse-Midwife Group (n = 471)	Obstetrician Group (n = 710)	p
Number of Sonograms	0.9	1.7	< .001
Other physiological tests [a]	37%	28%	< .005
Nutritional counseling	98%	81%	< .001
Discussions about Sexuality	75%	57%	< .001
Smoking Cessation Counseling	65%	38%	< .006

Note. From Oakley et al., 1995

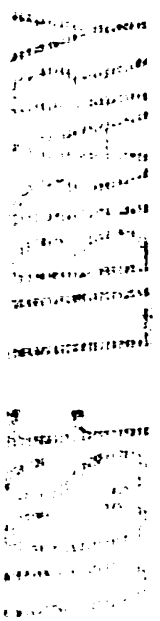
[a] e.g. X-rays, L/S ratio

During the prenatal period nurse-midwives were found to have used fewer sonograms (p < .001), engaged in more nutritional counseling (p < .0001), and had more discussions about sexuality (p < .001) and smoking cessation (p < .006) than physicians. Nurse-midwives were also found to have used more types of other physiological tests (p < .005) than physicians, such as testing for urinary tract infections (UTI). During the intrapartum period, physicians were found to use a statistically significantly larger number of technologically based physical care measures and fewer psychosocial/educational measures (range of significance for each measure p <. 05 to p < .001).

Table 6

Group Differences in Intrapartum Care Measures

Care Measure	Nurse-Midwife Group (n = 471)	Obstetrician Group (n = 710)	p
IV fluids	51.8%	87.3%	< .001
Continuous EFM	36.9%	70.4%	< .001
Internal FSE or IUPC	31.0%	47.9%	< .001
AROM	42.5%	53.2%	< .001
Labor analgesia	31.0%	41.5%	< .001
Labor epidural	14.6%	39.6%	< .001
Delivery in DR	27.4%	40.8%	< .001
No delivery anesthesia	18.5%	4.8%	< .001
Delivery epidural	19.7%	44.5%	< .001
Forceps delivery	4.0%	10.7%	< .001
Episiotomy	30.1%	56.6%	< .001
Cesarean Section	13.0%	19.3%	< .01
Oral fluids or food in labor	85.0%	74%	< .001
Self Care Comfort Measures in Labor			
Changed position	64.8%	53.1%	< .001
Relaxation Techniques	42.4%	35.8%	< .05
Massage	37.0%	30.0%	< .05
Walked	37.4%	29.1%	< .05
Showered	29.0%	11.0%	< .001
Listened to music	15.5%	8.8%	< .001



However, studies finding differences between provider groups have been criticized for not taking alternative explanations into account (Oakley et al., 1995). For this reason multiple regression was used to examine the dependent variables for which significant differences were found in bivariate analysis. This analysis of four independent variables examined the contribution of the woman's evolving medical risk status, length of labor, and the woman's personal characteristics and preferences.

The extensive examination of care processes and outcomes (Oakley et al., 1995), the bivariate analysis substantiated previous study findings that midwives' processes of care differ from physicians and achieve equally positive outcomes when caring for low risk women. Type of provider explained only a small amount of the variance in many of the dependent variables after controlling for other influences on the outcome variables using logistic and linear regression. For example, provider group explained 7.6% of the variance in amount of technology-based care used and 3.4% of the variance in degree of empathy with main provider (a proxy measure for psychosocial/educational care practices). "Women's characteristics" was a significant contributing element in all nine of the dependent variables examined by multiple regression ($p < .01$; r^2 not reported for all variables).

In summary, the research team used a comprehensive approach to study a complex measurement problem. The sample size and design allowed for reasonable confidence that the influence of confounding variables had been controlled (Oakley et al., 1996). The generalizability of this research is limited to similar practice settings (academic teaching centers). The characteristics of the women, whose pregnancies and births provided the data analyzed, also limit the generalizability to White women in their mid-20s to early 30s who are married, college educated, and working outside the home. It will be important to

replicate this study with a sample that includes women who are ethnically diverse, younger, and poor in order to develop knowledge about a group more representative of the women cared for by nurse-midwives.

Using data from the same study, Oakley also reported the results in terms of cost effectiveness and outcomes (Oakley et al., 1996). In this case, the same methodology was used to account for the contribution of provider group to the dependent variables of infant and maternal mortality, gestational age, hematocrit, Apgar scores, eight specific infant complications, birth weight, breastfeeding at delivery, infant separation from mother after delivery, 13 specific maternal complications, mother's satisfaction with care, and monetary charges for care.

Using bivariate analysis, provider group accounted for a statistically significant difference in only three clinically significant infant outcomes: abrasions of the infant (physician > nurse-midwife, $p < .04$), breastfed at delivery (nurse-midwife > physician, $p < .001$), and infant separation from mother after birth (physician > nurse-midwife, $p < .001$). The abrasions were found to be most common in infants who were delivered by forceps, associated with either episiotomy or Cesarean section. While both groups had low rates of maternal complications, a higher proportion of women in the physician group experienced third or fourth degree perineal lacerations ($p < .001$), and postpartum hemorrhage ($p < .001$). The total number of complications ($p < .001$) was higher in the physician group as well, though in both groups the average number of complications per woman was less than one. While satisfaction with care was greater for women in the midwife group ($p < .01$), in both groups the women were "satisfied" according to the scale. For two cost outcomes—average hospital charges for the mother ($p < .001$) and average professional fee charges for the mother ($p < .003$)—the expenses of the women

cared for by nurse-midwives were less than those cared for by physicians.

In multiple regression, provider group uniquely contributed to explained variance for fewer outcome measures than in the study of processes of care. Provider group accounted for a statistically significant effect on only four outcomes: whether the neonate stayed with the mother after delivery, major perineal lacerations, the number of maternal complications, and satisfaction with care ($p < .05$). R^2 was not reported for these four results. Subject selection, the woman's medical problems, and preferences for medical intervention explained the hospital charges.

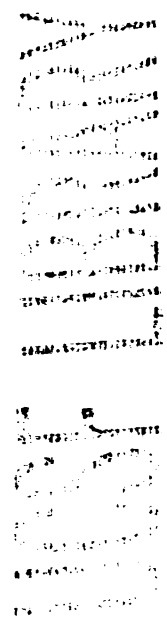
This analysis is important because it refined previous findings related to differences in outcomes of patients cared for by nurse-midwives and physicians. Examining the potential for an interaction between women's preferences for care and provider group, while not found to have an effect on the outcomes, strengthened the findings that provider group itself was a significant contributor to variance in the four outcomes reported. Additionally, none of the results pointed to any deficit in the quality of care experienced by women in the midwifery group. In fact, the outcomes of care were equivalent or better, even though the nurse-midwives used a less technologically based approach in the process of caring for women having a similar health and risk status as those in the physician group.

Retrospective Chart Review. Rosenblatt et al. (1997) examined the differences in processes of care used by nurse-midwives, family practice physicians, and obstetricians by using a stratified random sample of providers of obstetric care in the state of Washington. The hypothesis tested was that "systematic differences exist in the style and resource intensity of care provided to similar groups of women" (Rosenblatt et al., 1997, p. 344). It was expected that obstetricians would have the most intensive practice style and nurse-

midwives the least intensive style. The unit of analysis was individual provider. Data for the patients of providers enrolled in the study were obtained by retrospective chart abstraction and the data analysis used intent to treat comparison.

A random sample of all urban obstetric providers in the state of Washington, each of who cared for more than 10 low risk patients (delivered in hospital) during 1988 were approached to participate. From a sampling frame of 1,680 providers, 177 randomly selected providers were approached. Of these, 156 agreed to participate in the study.

The power analysis, based on detecting a $500.00 decrease in the cost of obstetrical care required a sample of 60 providers in each of three arms of the study. However, fewer than 60 CNMs were practicing in Washington State at the time of the study, though all were in urban areas. The final sample consisted of 151 providers who allowed information to be abstracted from their charts: 54 obstetricians, 54 family practice physicians, and 43 nurse-midwives, a smaller sample than indicated by the power analysis.



A total of 9,470 charts were reviewed for eligibility in the study and 46.8% were found eligible. The most common reasons for ineligibility were related to obstetric history and risk factors developing during the current pregnancy. A table of random numbers was used to select 11 charts per participating provider for abstraction. Providers with fewer than 11 charts available had all their charts included. A total of 1,513 charts were randomly selected; after incomplete charts were removed, the patient sample included 1322 pregnancies.

The provider groups differed in several important and statistically significant ways. Both CNMs and family practice physicians were younger than obstetricians by approximately five years ($p < .001$). All of the CNMs were female, while approximately 80% of the physicians were male ($p < .001$). The CNMs worked primarily in clinic or

HMO settings, while the physicians worked predominantly in private practice ($p < .001$). The study patients of these providers did not differ demographically or by pregnancy outcome measures. It should be noted that the sample size was too small to detect small, but clinically important, differences in outcome measures or in maternal and neonatal morbidity.

The results of the study are summarized in Table 7. As hypothesized, the largest differences were found between CNMs and obstetricians. Only 55.8% to 58.0% of physician-attended patients began labor spontaneously versus 72% of CNM-attended patients ($p < .001$). Approximately 26% of the CNMs' patients experienced induction or augmentation of labor, while approximately 40% to 42% of the physicians' patients underwent these interventions ($p < .001$). Episiotomy rates of the CNMs' patients (30%) were approximately half that of the physician's patients (57.6% to 59.6%, $p < .001$). Delivery techniques were also different. Nearly 84% of the CNMs' patients delivered vaginally and without the use of vacuum or forceps, while only65% of obstetricians' patients and 70% of family physicians' patients did so ($p < .001$).

The cesarean section rate also differed significantly: 8.8% for CNMs, 13.6% for family physicians, and 15.1% for obstetricians ($p < .02$) (Rosenblatt et al., 1997). The authors used an estimate of cost by provider, by method of delivery, and by length of stay to operationalize the dependant variable, cost. The procedure and methods of cost approximation are not defined. The result reported for this variable was that "the obstetricians used 12.2% more resources than nurse-midwives, a difference that is statistically significant." (p. 348).

Table 7.

Significant Findings from Pairwise Comparisons of Provider Groups

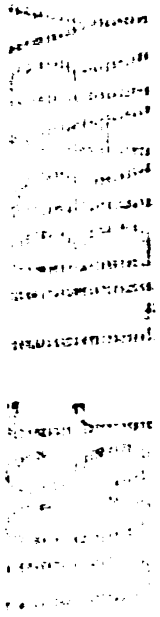
	Significance of Pairwise Comparisons			
Variable	Overall Significance (*p*)	Obstetricians vs. Family Physicians	Obstetricians vs. CNMs	Family Physicians vs. CNMs
Spontaneous Labor	.000	NS	.000	.001
Induced or Augmented Labor	.000	NS	.000	.001
Continuous EFM	.02	NS	.004	NS
Intermittent EFM	.006	NS	.008	.01
Epidural Anesthesia	.000	.04	.000	.01
No Anesthesia	.000	.03	.000	.001
Episiotomy rates	.000	NS	.000	.000
C-Section	not reported	NS	.02	.02
Forceps	not reported	NS	.000	.001
NSVD	not reported	NS	.000	.000

Note. From Rosenblatt, et al. 1997

The researchers did not explicitly define the dependent variable "practice style and resource intensity." In comparison, Oakley et al. (1993, 1995) listed all measures of interest and explained their inclusion related to the midwifery model of care. Rosenblatt and associates (1997) listed type of delivery, labor characteristics, EFM, and anesthesia and episiotomy rates as outcomes, all of which are measures of what Oakley and others (1995) called physical process of care. It is interesting to note that resource intensity is inferred to be increased reliance on technological assessment and intervention. CNMs, who rely on appropriate use of technology, patient education, and psychosocial support,

and who stay with patients throughout labor and delivery, may feel their practice style is *more intense*, albeit using a different definition of "intensity."

A strength of the Rosenblatt study (1977) was the exploration of alternative explanations for the differences found in bivariate analysis, using multiple regression. For example, the model did not demonstrate a significant contribution of race or gender of the provider or for selected patient variables. Specialty of the provider continued to explain the greatest portion of variance after all other factors were held constant. The findings confirm those of other studies (Butler, Abrams, Parker, Roberts, & Laros, 1993; Davis, Reidman, Sapiro, Minogue, & Kazer, 1994). The authors concluded that the practice philosophy of CNMs, and the training and orientation of the physician providers were the probable explanations for the differences found.



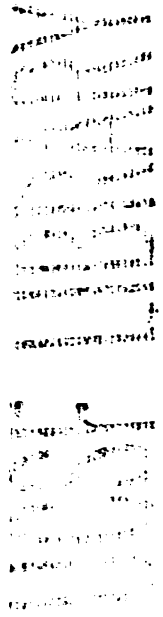
Epidemiologic Design. MacDorman and Singh (1998) conducted the first study with a sufficiently large sample size to allow for analysis of differences between provider groups in neonatal, postnatal, and infant mortality. These outcome measures are sufficiently uncommon as to require very large sample sizes to uncover statistically significant findings.

MacDorman and Singh (1998) analyzed singleton vaginal births delivered by either CNMs or physicians in the United States in 1991. For this research they used the United States Department of Vital Statistics' linked birth/death data set. The sample was drawn from the total population of births in the United States in 1991. All singleton vaginal births at 35-43 weeks gestational age delivered by CNMs (n = 153,194) were compared to a 25% random sample (n = 686,644) of all singleton vaginal births at 35-43 weeks gestation delivered by physicians. The restriction of gestational age was used in order to

minimize the potential bias of expected high transfer rates in extremely preterm or post dates pregnancies.

The data were analyzed and three regression models were developed. The first model represented the unadjusted odds ratio for the predictors. The second showed the effect of attendant when the socio-demographic variables were included, and the third model added complications of birth to the socio-demographic and medical risk factors of the second regression model.

The sample for each provider group varied in several important ways. CNMs cared for a higher proportion of ethnically diverse women than did physicians (48% versus 35%, statistical significance not reported). Additionally, the women attended by CNMs were younger, less educated, more often single, and more frequently began prenatal care in the second or third trimester. In the authors' view, "a greater percentage of CNM than physician deliveries involve mothers at risk for poor pregnancy outcome." (MacDorman & Singh, 1998, p. 314) These differences were controlled in the regression analysis of models two and three.



As demonstrated by the results, this increased *risk* of poor outcomes in the women cared for by midwives was not translated into actual poor outcomes. "For singleton vaginal births at 35-43 weeks of gestation, the adjusted risk of infant mortality was 19% lower for CNM than for physician attended deliveries, the risk of neonatal mortality was 33% lower and the risk of delivering a low birth weight infant was 31% lower" (MacDorman & Singh, 1998, p. 315).

Using three models, the analysis of results was seen to develop in interesting ways. For example, in the first model, the unadjusted risk of infant mortality for babies delivered by CNMs was 13% lower than for those delivered by physicians. When the socio-

demographic characteristics were included in model two, this rose to a 20% decrease in risk, representing the increased risk status of the mothers. However, including the medical risk factors and complications in the third model reduced this very slightly to a 19% decrease in risk for infant mortality in the group of mothers delivered by CNMs.

This research supported the findings of Scupholme and colleagues(1992) and Declercq (1995), who reported that midwives do not care exclusively for a low risk population. In MacDorman and Singh (1998), the medical risk factors used in the regression models were those having a statistically significant effect on birth outcomes. The positive outcomes—lower risk of infant and neonatal death as well as lower risk for low birth weight—support Declercq's assertion that nurse-midwives' positive outcomes are not due to their caring for an exclusively low risk population (Declercq, 1995).

In this study, as in Oakley's (1995,1996) and Rosenblatt's (1997) use of multiple regression techniques to explore alternative explanations for the findings is a strength of the work. The large sample size of this project enabled the researchers to make an important contribution to the outcomes literature for nurse-midwifery care. This contribution is related to the ability to select and draw conclusions about dependent variables (neonatal, postnatal, and infant mortality, and low birth weight) not previously accessible due to the smaller sample size used in most prospective research.

Limitations of the study are inherent in the data set, derived from vital records: the under reporting of medical conditions and of CNM deliveries, the lack of clarity regarding operative vaginal deliveries, the inability to use intent to treat comparisons for the analysis of all births of women initially cared for by CNMs but transferred to physician care, and the inability to separate the effects of various practice models (e.g. CNM only or CNM/physician teams) on the outcomes. Albers, Sedler, and Gruelich (1999) contended

that the findings support the conclusion that "If nurse-midwifery care in labor does not confer a clear mortality advantage for term or near term infants, nurse-midwifery care is at least equivalent to the care of physicians" (p. 54).

Visintainer and associates (2000) reported a 41% reduction in risk of low birth weight (*RR* = 0.59 95% *CI* 0.46 to 0.73, $p < .001$) among a cohort of indigent women cared for by nurse-midwives compared to all women cared for in the county of study during 1992-1994. This historical prospective cohort study used intent to treat comparison. The researchers included all indigent women (n =1443) who contacted the midwifery program in the intervention group whether they were transferred to the medical center for high risk conditions (e.g. drug abuse, insulin dependent diabetes, gestational hypertension) or received all care, including delivery, from the nurse-midwives. It was estimated that approximately 7% of mothers transferred care to the medical center. The comparison group (n = 39,749) consisted of all live births in the county during the study period. Cases with missing data on race or age were dropped from the regression analysis.

The authors did not report nor control for specific risk factors in either group with the exception of race and age. A limitation of the research is that the authors could not account for the effects of confounding variables and the potential selection and self-selection bias. Due to the paucity of descriptive data for each group, important risk factors for LBW could not be identified and included in the analysis, e.g. adequacy of prenatal care, rates of smoking, and pre-pregnant weight. However, when the group receiving nurse-midwifery care (indigent women, 90% of who were covered by Medicaid) was compared to the county group receiving Medicaid, there was 56% reduction in risk of LBW (*RR* = 0.44, 95% *CI* 0.34 to 0.57, $p < .001$), indicating that the reduced risk held

and, in fact increased, when the two groups were comparable in terms of insurance status and thus by inference, socio-economic status.

Credibility of Descriptive Research

Methodological problems prevent unequivocal acceptance of the positive findings of studies examining the outcomes of nurse-midwifery care as compared to physician care (Fullerton & Wingard, 1990; Lydon-Rochelle, 1995). In the studies published prior to the mid-1990s, the most common problems were: selection bias, retrospective data collection, non-equivalent comparison groups (risk status, delivery site, episodic versus comprehensive care, teaching staff versus CNMs), inadequate sample size, and variations in the definitions of structure, process, and outcomes of care provided.

Few studies departed from the assumption that midwives care only for low risk women and, because of this, the positive outcomes of the therapeutic intervention (midwifery care) directly reflected the low medical risk status of the population. The most notable exceptions to use of the concept of low risk in defining samples for nurse-midwifery research are MacDorman and Singh (1998) and Oakley and her colleagues (1996, 1995), who controlled for medical risk factors rather than selecting the sample based on risk status.

While statistical analysis cannot solve problems inherent to design, the use of multiple regression analysis as used by Oakley et al. (1996), Lenaway (1998), and MacDorman and Singh (1998) addressed some of the methodological concerns listed above. Taken together, the strategies of appropriate sample sizes, use of multiple regression to address potential selection bias, appropriate comparison groups, and prospective designs have improved the credibility of findings in descriptive research.

The consistency of the results point to the conclusion that nurse-midwifery care—for the population of women currently cared for by midwives—is indeed as safe as medical care and that excellent outcomes are attained with fewer technologic interventions (Rooks, 1997).

However, the "gold standard" in outcomes research investigating a treatment or intervention, such as midwifery care, remains the randomized controlled trial (RCT) (Kane, 1997). Without randomization, concerns that the two groups (patients in midwifery care versus physician care) are in some way different—and that these unknown factors account for any significant differences in the outcomes measured—will continue to be raised. Many of the methodological problems of descriptive research can be resolved with the use of RCTs.

Randomized Controlled Trials

Using a Medline literature search and the reference lists of published papers, seven randomized controlled studies comparing midwifery care to physician care, published between 1976 and 1999, were found (Chambliss et al., 1992; Harvey, Jarrell, Brant, Stainton, & Rach, 1996; Heins et al., 1990; MacVicar et al., 1993; Rowley et al., 1995; Slome et al., 1976; Turnbull et al., 1996). Only three of the studies were conducted in the United States[6] (Chambliss et al., 1992; Heins et al., 1990; Slome et al., 1976). These

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6 While the structure of care in Great Britain, Australia, and Canada may vary from that of the United States, these studies are included because the purpose of this section is to provide insight into how the use of RCTs improves the credibility of the findings of research investigating midwifery care as compared with physician care. The generalization of the results of the individual studies is limited to situations where the structure of care and the population are similar to those included in the research.

studies are summarized in Appendix B Table B2.

The statistical tests and results of the RCTs are described in Table B3. In general, the results show that the clinical outcomes of care by nurse-midwives are equal to or better than those of the control groups.

Results of non-randomized samples (Kaufman & McDonald, 1988; MacDorman & Singh, 1998) have been subject to the criticism that self selection of midwifery care might bias the study results due to undefined and unexamined characteristics in women who chose nurse-midwifery care rather than physician care.

In the RCT conducted by Slome and colleagues (1976) patients were excluded who requested either nurse-midwifery or physician care. The remaining women who were randomized could be said to be largely absent of the confounding variables found in those who self select either midwifery or physician care. The results of the trial reported statistically significant differences in only two outcomes of care, perhaps as the result of the relatively small sample size ($n = 438$). Women in the group cared for by nurse-midwives were more likely to have had more prenatal visits ($p < .0005$) and were less likely to have experienced forceps deliveries ($p < .05$).

The RCTs varied considerably in the reporting of estimations of sample size and power. For instance, Slome and colleagues (1976) did not discuss effect size or calculations of sample size. They reported using a "computer generated random sequence" to create the random assignments (p. 179). No reason was given for doubling (approximately) the number of women allocated to nurse-midwifery care as were allocated to care by the house staff.

The comparison of CNMs to house staff is not an equivalent comparison. House-staff are in various stages of training, while CNMs have completed their education. This

discrepancy is emphasized by the fact that in many academic centers, nurse-midwives are the faculty responsible for resident education in the management of "normal birth". Clinical judgment varies with stages of accomplishment and expertise (Dreyfus & Dreyfus, 1996) and is a key component that influences both the process and outcomes of care. For example, in large perinatal centers staffed by a residency program, Cesarean section rates are often lower than in surrounding community hospitals without residency services, while rates of operative vaginal deliveries are higher.

Heins and colleagues (1990) examined the low birth weight rates for women cared for by CNMs or physicians antepartally with all women in both groups delivered by obstetricians. In this case the attendant at delivery did not influence the dependent variable, low birth weight, and thus the comparisons are valid.

The hypothesis that rates of low birth weight could be decreased in women cared for by nurse-midwives in the Heins' study (1990) was not generally supported. However, among African American women who scored highest for risk of preterm delivery, those cared for by nurse-midwives had a clinically significant decreased rate of very low birth weight (VLBW): 2.6% compared with 6.7% in the physician group (*OR* 0.35; *CI* 0.1-0.9) The outcome variable VLBW is a critically important outcome as it is associated with greater neonatal mortality and infant morbidity in the United States than any other factor. Rates of VLBW are disproportionately higher for African American women.

Heins and associates (1990) calculated the low birth weight rate among the high risk patients at their site (13%) and hypothesized that the low birth weight rate for the intervention group (cared for by nurse-midwives) would reach the average rate for the state (5%). They determined that they had the resources to recruit a large enough sample (n = 1,500) to detect this statistically significant change at 90% power ($p < .05$). A

replication of this study using larger sample sizes and limiting participants to those at highest risk might demonstrate a statistically significant reduction in VLBW in women cared for by nurse-midwives.

The study by Chambliss and colleagues (1992) demonstrated that the residency service of a large women and children's hospital in Los Angles could achieve the same low rate of Cesarean section as the midwifery service at the same institution. One explanation for this was found in the significantly higher rate of operative vaginal deliveries conducted by the residents ($p < .006$), a method of delivery performed only by physicians, often to avoid Cesarean sections. Additionally—and as could be expected with higher rates of operative vaginal deliveries—higher rates of episiotomies and third- and fourth-degree lacerations were found for women in the physician group ($p < .005$ and $p < .003$ respectively). In general, interventions were higher in the physician group, demonstrating that with less use of technology, women cared for by nurse-midwives can experience excellent perinatal outcomes.

Chambliss and associates (1992) studied care given by nurse-midwives and resident or attending physicians during labor and delivery. Chambliss and colleagues stated that in the physician service, a senior resident is responsible for management decisions in consultation with the attending physician. The responsibility for management decisions in patients cared for by the nurse-midwifery service is not described. Did the nurse-midwives consult with the attending physicians directly or go through the senior or less senior resident? In any case, this study, like Slome and colleagues (1976), compared nurse-midwifery management to management by house staff and therefore used a non-equivalent group for comparison.

The sample size ($n = 386$) was calculated to show a statistically significant difference

in the Cesarean section rate between the residency service and the nurse-midwifery service. The final sample size reflects over sampling (n = 492) due to anticipated difficulty in obtaining the medical records for data collection. They did not specifically state effect size or power anticipated for the outcome measures being investigated.

Chambliss and colleagues (1992), were able to use a blinded design. Either the resident physician or nurse-midwife staffing the screening/admitting area evaluated patients for eligibility. The screening area was physically distant from the inpatient care units. If a patient was eligible, the provider would open a sealed envelope that determined the service to which she would be admitted. The providers in the inpatient care units did not know which patients were study participants as neither the patient nor the chart were identified as such. Because this was an extremely busy service, many patients not part of the study were cared for concurrently with study patients by the same providers. Patients in this hospital were not routinely given a choice of provider, so informed consent was not required by the research committee.

In the United Kingdom, the perinatal delivery system has undergone a significant transformation. One intention of this change was to increase women's satisfaction with maternity care services by increasing the number of women receiving continuity of care from midwives and reducing the institutional nature of hospital-based intrapartum care. (MacVicar et al., 1993) conducted an RCT investigating the outcomes of the new care system compared to those of the customary care system. The results of this large-scale trial (n = 3,510) confirmed the results of previous studies. Nurse-midwives used less technologically based care measures and achieved outcomes equivalent to other providers of obstetric care. In this case, 8% fewer women in continuity care had sonograms during the antenatal period ($p < .0001$), 9% more women had spontaneous onset of labor

compared with the control group ($p < .001$), 39% fewer experienced continuous electronic EFM ($p < .0001$), and 8% fewer had an episiotomy ($p < .001$). Five percent more patients cared for by the midwives had lacerations, perhaps due to the lower rate of episiotomies in the midwifery patients. While both groups scored in the "satisfied" range of the evaluation instrument, more continuity patients were "highly satisfied" with both prenatal and intrapartum care ($p < .0001$).

In Mac Vicar's group (1993), disproportionate randomization was used following the rationale that half the mothers would transfer from the Home to Home intervention group (midwifery care) either prenatally or in labor. Their estimates proved accurate, with 45% transferring to specialist care, half of those during the antenatal period. MacVicar et al. (1993) was also the only study to use a prospective or pre-randomization design. Consent and explanation about the study was given only after randomization to the Home from Home group. Consent was not obtained from the control group as they were receiving the usual type of care available to all women in the community.

In Australia, (Rowley et al., 1995) an RCT was conducted testing the hypothesis that a population of high risk women could also benefit from nurse-midwifery services without an increase in perinatal morbidity. Rowley and colleagues (1995) randomized women who presented to a hospital-based clinic but excluded women who specifically sought shared care from their obstetrician. The term shared care refers of a team of midwives, nurses, and family practice physicians directed by an obstetrician who is the "team leader." Using logistic regression models to test whether the effect of treatment (continuity care provided by nurse-midwives compared with customary care by a variety of providers) was "homogenous across risk and parity strata," (Rowley et al., 1995, p.290) confirmed the hypothesis. In addition, satisfaction scores were found to be significantly

higher for the mothers cared for by the midwifery teams (95% *CI*, *p* not reported) and cost of care was 4.5% lower.

Another trial conducted in the United Kingdom (Turnbull et al., 1996) confirmed the results of the larger trial done by MacVicar and colleagues (1993). Turnbull and associates (1996) controlled for self-selection by randomizing women who sought care in consultant-led clinics. A statistically significant greater proportion of women cared for by physicians experienced induction of labor (95% *CI* 4.4 to 14.5), were given continuous electronic EFM ($p < .005$), and had episiotomies ($p < .02$). Women cared for by midwives were more likely to be satisfied with their care as compared with women cared for by a variety of providers across all four areas of care measured (antenatal, intrapartum, hospital-based post partum and home-based postpartum.

Turnbull and associates (1996) clearly discussed data collection methods, including training to improve intrarater reliability and crossover coding (each member of the team coded equal numbers of each study group) to prevent bias. One of the sources of data for the prenatal period, the shared care card, was available for 82% of the midwifery group but only 59% of the shared care group ($p < .0001$). The number of prenatal visits was analyzed only for those women with complete data. Differences between the two groups were discussed in a limited manner and indicated that the groups did not differ in number of hospital admissions, type of delivery, and length of postnatal stay.

The studies conducted in the United Kingdom and Australia compared nurse-midwifery care with either "consultant led" or "shared care." In each of these cases, the patients may have been cared for by any combination of family practice physicians, obstetricians, or midwives during their antepartum care. Nurse-midwives are used extensively to staff maternity units in Great Britain and Australia, so it is probable that

most women delivering in the shared care or consultant led groups had significant parts of their labors and deliveries managed by nurse-midwives. While the results of these trials demonstrate some differences between the two groups, it is difficult to draw firm conclusions about the efficacy of midwifery care in these studies because the structure of care includes nurse-midwives in both the treatment and control groups.

The most recent RCT to be published was conducted in Canada. Canada has only recently incorporated nurse-midwifery care into the health care system. Harvey, Jarrell, Brant, Stainton, and Rach (1996) reported the results of a small (n = 194) pilot project evaluating the implementation of nurse-midwifery care in a major western Canadian city in 1990. Selection bias was controlled for by random assignment to provider group of women who sought midwifery care (Harvey et al., 1996). As in the other RCTs, women cared for by nurse-midwives in this RCT experienced fewer technology-based care practices without any increase in maternal or neonatal morbidity when compared to women cared for by physicians. The length of hospital stay for women in the midwifery care group (29.04 hours) was about half that of women in the physician group (59.47 hours, $p < .001$). This calculation was made after the data on women who had Cesarean sections were removed from the analysis. In the nurse-midwifery group, 4% had Cesarean sections compared with 15.1% in the physician group ($p < .007$).

In summary, the results of these RCTs consistently demonstrated that women cared for by nurse-midwives experienced proportionately fewer technology-based care measures yet achieved outcomes of care at least equivalent to the outcomes achieved by the customary standard of care available in the populations studied. Examination of these articles reveals methodological improvement over earlier cohort studies.

Credibility of RCTs

As stated earlier, the results of non-randomized designs in midwifery outcomes research (Kaufman & McDonald, 1988; MacDorman & Singh, 1998) have been limited by the concern that self selection of midwifery care might bias the study results. Designs that use randomly selected samples or randomize patients to type of provider reduce the potential for error related to selection bias.

One of the challenges of studying outcomes of nurse-midwifery care in the United States has been the difficulty of randomization. The common belief is that most women highly value the ability to choose at least the type of obstetric provider they will use or the site of their care, if not the specific person who will care for them. Within the limitations of a managed care environment, middle- to upper-class women have the ability to make this choice or to choose their insurance plan in order to obtain their preferred type of care. It is assumed that they would be reluctant to accept randomization. Even if women were to consent to randomization, it would be difficult to convince private physicians and midwives, whose clinical income is dependent upon patients in their care, to participate in the studies. Reimbursing providers for participation would result in prohibitively high costs for the research.

Those without access to private insurance, such as the working poor, may obtain maternity care from publicly supported clinics. They may have the same preferences as more affluent women but are without the resources to access the kind of care they prefer. It is not surprising, then, to find that in the RCTs in the United States (Heins et al., 1990; Slome et al., 1976) used samples of women who attended publicly funded clinics or hospitals.

Most studies reviewed in this chapter described their process for randomization. In all

studies describing the process, a person not involved in the initial assessment or clinical care of the patient did random assignment. Blinding subjects to the researchers or providers further improved the internal validity of the findings. Two of the studies in this review (Chambliss et al., 1992; MacVicar et al., 1993) were able to use a blinded design.

Both Fullerton and Wingard (1990) and Lydon-Rochelle (1995) point out the importance of equivalent comparison groups. Chambliss and colleagues (1992), Slome and associates (1976), and Harvey and others (1996) compared CNM-care with physician-only care, however they included resident physicians. Two of the RCTs examined comprehensive care (antenatal, intrapartum, and postpartum care being managed by either nurse-midwives or physicians) (Harvey et al., 1996; Slome et al., 1976) and one examined episodic care (Chambliss et al., 1992). Only Harvey's group used truly equivalent comparison groups with care by nurse-midwives being compared with care by attending physicians.

Sample size and limitations of the sampling design can result in errors in both internal and external validity (Hulley & Cummings, 1998). Only Heins and colleagues (1990) and Chambliss (1992) related the power analysis specifically to their hypothesis as recommended by Hulley and Cummings (1998). Rowley and others (1995) set the sample size by determining the optimum number of women to be cared for by the existing continuity midwife team. They later stated, "The study had sufficient power to detect clinically important differences in obstetric interventions" (1995, pg. 290).

In all studies reviewed, the patients to be randomized were drawn from women receiving care in a defined geographic area. Most studies recruited participants from women who registered for care at medical centers or clinics. In the United States during the time these studies were conducted, women of low socioeconomic status (SES) used

hospital-based or community clinics. The samples of Slome and colleagues (1976), Chambliss and associates (1992), and Heins and others (1990) reflected this bias. Only the Harvey and associates' (1996) trial, conducted in Canada, advertised for research subjects; their sample reflected women with higher educational levels than samples in the United States-based studies. Tables B4 and B5 in Appendix B show the demographic characteristics of the studies reviewed.

As would be expected in RCTs most studies found the comparison groups and intervention groups did not have statistically significant variation in socio-demographic characteristics. Harvey and colleagues (1996) reported a statistically significant ($p < .03$) difference in level of education. However, as the mean number of years of education for women in the nurse-midwifery group compared with the physician group differed by less than one year, (16 years vs. 15.23 years) it is not a clinically significant finding. In the MacVicar and others' (1993) trial, significantly more women in the control group smoked (30% versus 26%, $p < .015$), which could influence the birth weight outcome.

All the studies except Heins and associates (1990) and Rowley and colleagues (1995) restricted the sample to medically low risk women, thus limiting the generalizability of the findings to a population of low risk women. In Heins et al. the population of interest was women at high risk for preterm delivery. Using a preterm labor risk scoring tool, the authors recruited participants from the population of women attending state-funded prenatal care clinics in South Carolina. If a woman had medical or pregnancy-related complications at the time of entry into the program, she was referred to the state-funded medical high risk clinic and excluded from the trial. If she developed complications during the pregnancy, she was kept in the study while receiving appropriate treatment for her condition. In the case of women in the intervention group (nurse-midwifery care), this

treatment included co-management by physicians.

One of the proposed objectives of the Rowley and associates study (1995), conducted in the United Kingdom, was to determine whether the benefits of continuity care by nurse-midwives observed in low risk women would also be found in high risk women. The only excluded group were women with substance abuse problems. Otherwise, women were divided into four groups: low risk primiparas, high risk primiparas, low risk multiparas, and high risk multiparas.

Medical risk was not consistently defined among the studies. This makes comparison of the results across studies difficult. Table B6 in Appendix B describes excluded medical risk factors. Rowley et al. (1995) used the criteria for assessing eligibility to enter care at the hospital birth center to define low risk; all other women were assigned to the high risk group. The eligibility criteria were not explicitly defined in the article.

A strength of the RCTs reviewed is that they used intent to treat analysis. Once enrolled in the studies, all outcome variables of the participants were attributed to the study group to which they were originally assigned. As demonstrated in the earlier review of population-based studies, nurse-midwives cared for women with a range of medical and socioeconomic risks. While the policies or guidelines for consultation and transfer of care differ, in every practice there will be some women who transfer to physician care. If an intent to treat comparison is not used in the analysis, confounding variables of those who change study groups (crossovers)—rather than the treatment itself—may be responsible for the outcomes measured (Hulley & Cummings, 1998).

In the MacVicar and associates trial (1993), consent and explanation about the study was given post-randomization. Only those randomized to the Home from Home group, which was the name given to the intervention of care by nurse-midwives received

explanation about the study. If they refused midwifery care (resulting in de facto assignment to the control group) or were transferred to consultant care during the trial, their data were included in the intervention group for purpose of analysis. This approach increased the number of subjects whose data were analyzed, since those randomized to the control group did not have the opportunity to refuse to participate based on their anxiety or uncertainty about group assignment (Hulley & Cummings, 1998). The study team's intention for choosing this design was to protect against high levels of dissatisfaction in the control group. The potential for dissatisfaction can occur when subjects receive a full explanation of the proposed intervention, viz. nurse-midwifery care, but are randomized to the control group.

However, the power to detect differences may have been reduced (Hulley & Cummings, 1998) had a large proportion of women refused to be in the Home to Home group. In this case, only 189 of the 2,364 randomized refused to participate and it is unlikely that this small percentage (8%) would affect the power. This was, in the words of the authors, a pragmatic trial "aimed at comparing the two methods under practical conditions" (Mac Vicar, et al., 1993, p.317), including the results of the 189 women who never received the intervention (midwifery-led care). An inadvertent result of this approach might have led to the minimization of differences in the outcomes observed. Presenting the analysis both with and without the 8% who refused Home to Home care would have assisted in determining the effect of the inclusion of their results with the group who actually received the intervention.

Conclusion

The research reviewed for this paper provides limited information regarding the outcomes of nurse-midwifery care to women at increased risk of poor pregnancy

outcomes. The results of those few research studies not restricting participation to patients of low risk status, indicates that for women delivering vaginally, nurse-midwifery care results in medical outcomes and levels of satisfaction which are at least equivalent to physician care while using lower levels of technologically based processes of care.

Gaps in Knowledge

The gaps in knowledge about nurse-midwifery care to women of moderate risk status are indicated by the following questions:

1. What are the medical, social and demographic characteristics of the population of women at moderate risk of poor pregnancy outcomes?
2. What are the characteristics, including medical or obstetric conditions, of the population of women transferred to physician care for management of medical or obstetric problems in pregnancy?
3. What are the characteristics of the population of women who remain in midwifery care but have operative vaginal or Cesarean section deliveries?
4. How are the processes of care and maternal or infant outcomes of care, for the groups noted in questions 1- 3, different from those who are managed by physicians throughout their pregnancies and deliveries?
5. Are certain medical or obstetric conditions in moderate risk women managed by nurse-midwives associated with increased infant or maternal morbidity as compared with the same conditions in the population of women managed by physicians?

CHAPTER 3

Introduction

The intent of the research was to expand what is known about the outcomes of care to moderate risk women who were cared for by nurse-midwives. The research design was intended improve upon the design limitations of previous midwifery outcomes research.

Research Questions

The main questions to be answered were:

A. What are the characteristics of and outcomes of care in a population of moderate risk women cared for by nurse-midwives?

B. Will women of moderate risk care for by nurse-midwives have a lower incidence of low birth weight than women of similar medical risk cared for by physicians?

C. Will the women cared for by nurse-midwives experience fewer technological processes of care, i.e. sonograms, induction of labor, epidural anesthesia, and operative deliveries than those cared for by physicians?

D. Will a higher proportion of the women cared for by nurse-midwives experience non-technological processes of care?

E. Will higher proportion of the women cared for by nurse-midwives breastfeed than those cared for by physicians?

F. Will moderate risk women cared for by nurse-midwives have fewer contacts with the health care system in the first year postpartum?

Design

The literature review revealed several important methodological considerations for design of studies investigating nurse-midwifery care to women at risk of poor pregnancy

outcomes. The following were considerations in the planning of this research. Studies must be conducted that include the entire population of women given comprehensive (prenatal through postpartum) care by nurse-midwives. Alternatively, samples should be used in which medical or socioeconomic risk is specifically defined and connected to the outcome under investigation. Sample sizes should be calculated based on the hypotheses of the experiment.

Comparison groups should be carefully selected. Use of sites with residency programs need not be a problem if the midwifery services also include student midwives who provide care to patients under the supervision of nurse-midwives. Studies should be conducted at multiple sites in order to capture variations in practice, including regional differences and disparities in policies governing transfer of patients to physician care.

All data should be analyzed using intent to treat comparison. Statistical analysis should include regression methods to control for variations in the socioeconomic or medical risk status between groups. Whenever possible, in prospective studies, the characteristics of and preferences of the women for specific processes of care in the sample should be included to assess their contribution to the outcomes under investigation.

While RCTs are commonly agreed to be the best design for investigation of interventions, it is unlikely that in the United States a sufficient number of patients would consent to be randomized to provider group. However, multi-site quasi-experiments of prospective design, using convenience samples from selected nurse-midwifery practices where an appropriate control group also exists, are feasible.

Alternatively, a multi-site retrospective cohort design investigating the outcomes of moderate-risk patients who received care from physicians or nurse-midwives is an initial

step toward building knowledge about the processes used and the outcomes of care for women of moderate risk status cared for by nurse-midwives. This was the design used for this research project.

Methodology

The specific aim of this retrospective medical record review was to compare the rates of low birth weight and processes of care in women at moderate risk cared for by nurse-midwives with those cared for by obstetricians. This methodology was chosen in order to address the major limitations of previous nurse-midwifery outcomes research discussed in Chapter 2.

Chart data were collected for the total population of all patients who enrolled for prenatal care with either obstetricians or nurse-midwives and who subsequently delivered at either of the two hospitals used by the provider groups. The time frame for the variables of interest ranged from the time of enrollment in prenatal care through 8 weeks postpartum. Transfer of care at any time during this period was noted. This enabled the linkage of outcomes to the provider group with whom the patients originally enrolled and received at least 60% of their care.

The independent variable had two levels: physician care and nurse-midwifery care. The main dependent variables of interest were LBW and technologic processes of care. Confounding variables such as medical risk status, parity, age and education were examined using statistical regression techniques.

Setting

Two nurse-midwifery practices with parallel physician practices were selected as sites for the research. The San Francisco site is an inner city practice affiliated with the county public hospital. The Vallejo site is located in an urban suburb in the northern San

Francisco Bay area and is owned by a large non-for profit health care organization.

The purpose of using two sites was to increase the diversity of patient characteristics, thus increasing the generalizability of the results. Commitment to participate in the study was received from the director of the nurse-midwifery service at Great Beginnings Perinatal Service, Vallejo, CA., the two obstetricians in the parallel medical practice and the director of Maternal Child Services at Sutter Solano Medical Center (the parent organization for the Vallejo practice). The faculty of The Nurse-Midwives of San Francisco at SFGH, Chief of the Department of Ob/Gyn at SFGH, and the Director of Perinatal Services at SFGH also gave consent for the project. IRB approval was received prior to data collection at both sites.

Each practice employs from 5 to 15 nurse-midwives who provide prenatal care and attend the deliveries of 350 to 500 patients per year. The practice at San Francisco General Hospital is quite stable, with the faculty midwives having joined the practice 3-22 years before the study period. This has resulted in a consistent practice pattern based on written clinical practice guidelines. The physician practice has had more turnover, however, several attending physicians have long tenure in the practice (up to 20 years).

The lecturers and clinical faculty of the UCSF/SFGH Interdepartmental Nurse-Midwifery Education Program (INMEP) are all members of the nurse-midwifery service. Several of the nurse-midwives practicing at the suburban site are graduates of INMEP, including the director of the midwifery service. While the midwives at Sutter Solano have not practiced together for as long as the CNMs at SFGH, the clinical practice guidelines are similar.

Each practice cares for women from marginalized populations: women in their teens or women over 35, immigrants, women living at ≤ 200% of the federal poverty level,

women living in federally designated heath shortage areas, women of Hispanic, American Indian, Black or African-American, Asian or Pacific Islander heritage. Both nurse-midwifery practices have a collaborative relationship with the parallel obstetric practices serving a demographically similar caseload of women. The physicians attend the deliveries of approximately 200 women per year per practice.

One difference in the two practices was noted at the time of data collection. The vast majority of privately insured women in the study (95%, n = 98) are seen by physicians in the Vallejo practice. While some privately insured women began care with the midwives, it is the policy of that practice to transfer them to the physician group.

In this study, both self-selection and assignment to care based on provider availability were the expected modes of enrollment for prenatal care. Patients enrolled into care, were seen by the main provider every month until 28 weeks gestational age, every two weeks until 36 weeks gestational age, once a week until 41 weeks and twice weekly until delivery (usually not longer than 42.5 weeks gestational age). In cases where a patient's condition warranted medical examination, appointments were made with physician consultants or specialists and a care plan was developed for co-management or transfer of the patient to medical care as appropriate.

At SFGH nurse-midwifery students care for some patients with a CNM closely supervising the provision of care. In the SFGH obstetric practice, patients are seen by attending physicians, residents and, in some cases, medical students, with the level of physician supervision tailored to the experience of the resident/medical student. That is, medical students are closely supervised and 4th year residents practice with supervision mainly for complicated and high risk cases. At Great Beginnings, care is given by attending physicians or CNMs. Although the practices were not exactly equivalent,

clinical practice guidelines used for care were consistent within sites. The use of two different sites was a strength of the study since the wider range of patient characteristics increased generalizability of the results.

Sample

Protection of Subjects

Approval for this research project was obtained from the Committee on Human Research at the University of California at San Francisco H 879-17121-02, Expiration 12-21-02. IRB approval was obtained at San Francisco General Hospital (SFGH). A single project assurance was filed by Sutter Solano Hospital with the Office of Human Research Protections of the Federal Department of Health and Human Services. This small community hospital did not have a standing IRB, therefore an IRB Authorization Agreement was filed, permitting Sutter Solano Hospital to rely upon the IRB process at UCSF.

Privacy and Confidentiality. As eligible cases were identified, they were assigned a unique identification code. Following data collection, all data were entered into the computer and analyzed under that code. A hard copy master list of the medical record numbers and identification codes were kept in a locked file drawer in the office of the principal investigator (PI), Leslie Cragin. The hard copy was accessible to only to the PI. The master list will be destroyed after completion of the research. The computerized list was kept in a password protected file. Only the PI knew the password.

Copies of the Data Collection Sheet (DCS) which have the patient record number recorded on them were kept in a locked file drawer in the office of the investigator. This drawer was accessible to only the PI. Following publication of the research project, the paper DCSs will be also be destroyed.

Risks and Benefits. The only potential risk to subjects was loss of confidentiality. As stated above, data were entered under a unique identification code and only one hard copy of a list linking the specific medical record numbers to those codes existed. The list was kept in a locked cabinet and will be destroyed after data analysis is completed.

There were no direct benefits to subjects in this study. The potential benefits occur at the macro level. The proposed study would expand nursing knowledge about the effectiveness of advanced practice nurses caring for at risk, marginalized populations. These findings should also be of interest to policy makers concerned with creating effective programs of care aimed at the reduction of low birth weight in the United States.

Consent. The researcher requested and received waiver of consent, as the research is a retrospective chart review where no patient contact is involved. As stated above, no patients will be identified in publications or reports of the findings of this research.

Nature and Size of Sample

Power Analysis. Low birth weight is the primary outcome variable of the research. The national average rate of low birth weight for 1995 was 7.3% (March of Dimes, 1998). The *Healthy People 2000* target rate for LBW is 5%, which is a 31% decrease in the average rate. Mac Dorman and associates (1998) showed a 31% reduction in the risk of delivering a LBW baby for patients at 35-43 weeks gestational age when having a vaginal delivery attended by a nurse-midwife. San Francisco County data show that in the three racial/ethnic groups most commonly identified as vulnerable (Asian, Hispanic, Black) rates of LBW vary from 6.2 (all Hispanic) to 11.6 (Filipino) for an average of 8%. Lowering this rate to the county wide average of 5.6% would be a decrease of 30%.

Based on previous research, the estimated effect size for this proposed study was -0.371. Using nQuery Advisor (Elashoff, 1997) it was determined that when the sample

size is 1242, the logistic regression test of ß=0 (α=.05, two sided) will have 80% power to detect a ß of -.371. This assumes that one normally distributed covariate, provider type, is being entered into the model after adjustment for prior covariates, that its multiple correlation with covariates already in the model is .25 and that the odds ratio for low birth weight in patients cared for by CNMs is approximately .70.

The estimation of the odds ratio for low birth weight in patients cared for by CNMs was drawn from a review of the literature and quality assurance statistics at SFGH. The analysis of data for the study found an *OR* of .80. The study population of moderate risk women demonstrated differences in rates of LBW of only 18% rather than the anticipated 37%. Recalculation of the power analysis demonstrated that in order to detect a statistically significant difference between the provider groups with an odds ratio of .80, the sample size would need to be slightly more than 4000.

The proposed total sample population size for the project was 1500 moderate risk patients. This took into consideration an expected 6% loss of paper charts and 4% missing data in existing charts. The proposed sample size would be sufficient to detect significant differences in all outcome variables as the effect sizes for the other dependent variables, based on previous research, are less than -.37 (Butler et al., 1993; Harvey et al., 1996).

Sample Size. The final study population was 1173. The total population from which the eligible records were drawn consisted of all women delivering at each site with either the nurse-midwifery or parallel obstetric practices from April 1, 1999 through March 31, 2000 ($N = 1626$).

A total of 453 records were eliminated. Cases were eliminated from data collection for the following reasons: late transfer into the midwifery or physician practices ($n = 184$, 11%); missing portions of the medical records preventing assessment of risk ($n = 28$, 2%);

duplicate entries in the case list (n = 13, 1%) and charts missing from the medical records departments (n = 18, 1.5%). Analysis for risk status was conducted on the remaining 1383 records. The results indicated that 130 (8%) women were found to have high risk conditions and 80 (5%) were low risk. The remaining 1173 women had at least three moderate risk conditions and comprised the final study population.

Demographics. The demographic characteristics of women in the study are listed in Table 9 on page 109. The study population can be generally characterized as poor (only 8% were privately insured) and ethnically diverse (90% were either Asian, African American, or Hispanic). They had an average of 10 years education and a mean age of 27 years at the time of delivery. Sixty percent (60%) were single and 57% had at least one other child.

Risk Profile. The mean number of risk factors in the population was 7.5 (*SD* 2.7) with a range of 3 to 20 risk factors. The mean number of medical and social risks was similar, 3.3 (*SD* 1.9) and 4.2 (*SD* 1.7) respectively. Over half (62%) the women in the study population had three or more moderate risk medical conditions and 78% had three or more demographic or psychosocial risk factors.

Criteria for Inclusion in the Study Population

Provider Groups. Eight hundred and twenty two (822) women began care in the nurse-midwifery practices and 351 women began their care in the physician practices. Of those, 140 transferred care from one group to another, mainly from CNM to obstetric care. Ninety-six (96) of these transfers were during the intrapartum period. These were retained in the original provider group for the purposes of analysis (i.e. intent to treat analysis).

A total of 44 women transferred care at some point during the antenatal period. After determining the proportion of visits a woman received with her original provider group

compared to the transfer group, assignment to main provider groups was made. If a woman received ≥ 60% of her care in her original group, she was retained in that group for the purposes of analysis. Twenty-one (21) of the 44 women who transferred care were assigned to obstetric care for the purposes of analysis, and 22 were retained in the midwifery care group. One woman transferred from obstetric to midwifery care and was retained in the obstetric care group. Eight hundred and one women (801) had nurse-midwives as main providers of care and 372 women had obstetricians as main providers of care.

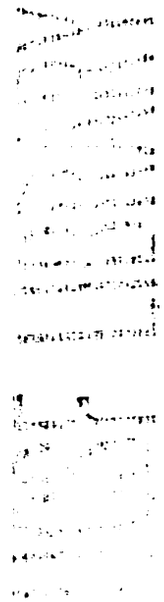
Risk Status. Following collection, entry and cleaning of data, cases were assigned to one of three groups: low, high and moderate risk. The low risk group was defined by failing to meet the criteria for high or moderate risk status.

Factors used in selection of moderate-risk cases are listed in Appendix C. Inclusion criteria for moderate risk status were set at least three risk factors, two of which could be psychosocial factors. The risks included: (a) factors of the maternal environment (e.g. living in public housing; or two or more families in one unit, homelessness, domestic violence); (b) factors representing social adversity (low socioeconomic status, non-white race); (c) medical conditions associated with LBW which were managed or co-managed (with a physician) by a nurse-midwife (e.g. pre-eclampsia, evaluation for intrauterine growth retardation, preterm labor at 32-36 weeks gestational age); and (d) modifiable risk factors of LBW including genital tract infections, smoking, maternal under-nutrition, psychological stress or drug/alcohol use in pregnancy.

Appendix D contains a list of definitions for these factors. The medical definitions followed clinical definitions used by the sites. Where discrepancies occurred between sites, the clinical guidelines of the American College of Obstetrics and Gynecology were

used to construct a final definition. The definitions of the psychosocial risk factors were based upon the definitions used by the Comprehensive Perinatal Service Program (CPSP) of the California Maternal Child Health Division. Both sites participated in that program and used psychosocial assessment forms based upon the CPSP guidelines.

Appendix E lists high risk factors. Inclusion criteria for this group were any one of the 48 factors listed. High risk factors are categorized as: (a) those associated with life threatening conditions (e.g. brain death), (b) those associated with maternal or fetal perinatal related morbidities/mortality requiring specialized medical treatment (e.g. Class B-R Diabetes, Rh isoimmunization), (c) those pre-existing medical conditions requiring treatment by medical specialist (e.g. cancer, lupus). Also included as high risk are conditions that nurse-midwives may manage but require specialized training or education before undertaking care of patients with the disease (e.g. HIV).



"No prenatal care" was included as a high risk factor for two reasons: (a) Assessment of prenatal risk is often not possible for women without PNC as they enter care in labor or in a medical crisis. (b) The experience of the providers at both sites was that women without prenatal care are frequently poly-substance abusers with complex underlying medical problems, including a high percentage who are later found to be HIV positive.

Data Collection Methods.

The primary method of data collection was review of paper medical records. Paper record abstraction has been used successfully by previous researchers (Lenaway et al., 1998). The second method was analysis of computerized data (Butler et al., 1993; Davis et al., 1994). A concern when using paper record review is missing data. In the Lenaway (1998) study 12.6% of 1513 records were found to be incomplete.

A review of medical records at one of the sites during a previous research study

showed that only 4% of the records contained missing data for the dependent variables examined. As stated earlier, only 2 % of the records in the current study were deleted from the study due to missing data.

It was estimated that a sufficient number of moderate risk cases would be obtained from the records of deliveries occurring within 12 months (April 1, 1999 to March 31, 2000). It was projected that collecting data on births occurring over 12 consecutive months would result in 258 cases above the necessary sample size calculated by the power analysis (n = 1242). This calculation insured that a sufficient number of cases would remain after those with missing data were excluded.

Each site kept a computerized data file with patient characteristics and clinical information about each patient who has delivered with them. Both sites use Microsoft Access Software (MS Access) for the data files. The computerized obstetric databases are utilized mainly for risk management purposes. The quality of these databases was not consistent across sites.

An assistant who was trained to abstract the information from paper medical forms enters the intrapartum data at SFGH and the hospital computerized medical record. In both cases the providers enter the information into the medical records. Reports are generated weekly from the computerized data and checked for accuracy by providers. For the purposes of this study, several variables were manually collected from the paper charts, entered in the study spreadsheet and checked against the computerized data. Greater than 99% agreement was observed for the variables date of delivery, previous cesarean section, ethnicity and age.

At the suburban site, a receptionist enters in data to the computerized system. Serious inaccuracies were found in the data entered for the study period by the Principal

Investigator. Following a process similar to the one used at SFGH and described above, it was determined that over 80% of the computerized data for IP variables were inaccurate. In order to correct the inaccuracies, a data collection sheet for intrapartum variables was generated for each record at the Vallejo site. The IP information for each record was cross-checked and corrected during the chart review.

The information for the dependent variable "number of visits in the first year postpartum" were obtained from the Lifetime Clinical Record database kept by the San Francisco Community Health Network. These data were not in a format that allowed importation and analysis in the SPSS program. It will be translated into a compatible format and analyzed in a subsequent project.

During initial contact with the suburban site, information for the dependent variable "number of visits in the first year postpartum" was thought to be collected within the Sutter Health System for each patient. However, the data were not available to the researcher.

Data Collection Instrument

The basis for data collection was the Data Collection Instrument (DCI) (Appendix F). This was constructed and pilot tested during the training of the research assistants. After approximately 20 charts were reviewed, the DCI was revised and finalized. The definitions of variables were discussed, corrected where necessary and finalized at that time.

Procedure for Data Collection and Analysis

Data were drawn from two types of sources: existing computerized databases and paper patient charts. The data drawn from electronic sources was formatted into the DCI.

Existing Data Bases

A copy of each site's data files for the deliveries occurring during the study period was made for the exclusive use of the researcher. While the two practices did gather information on precisely the same factors there was a great deal of overlap. The first step in the process of data collection was to compare the variables and variable definitions used at each site. Only those variables whose operational definitions matched across sites were to be downloaded. It was anticipated that many of the demographic and general clinical variables would be obtained in this way. Due to the inaccuracy of the information in the Vallejo database, only the variables ethnicity and sex of the infant could be downloaded and used without extensive correction.

The second step was to create a spreadsheet in SPSS of the study variables (columns) and patient identifiers (rows) of all patients delivering during the study period. A codebook was constructed at this point to guide data entry and for assistance in cleaning the data before analysis. SPSS allows printing of a code book organized by variable number, then name, permitted responses (e.g. for dichotomous variables, Yes = 1, No = 0, 9 = missing). Definitions for the variables in the codebook were keyed to the list of definitions in Appendix D.

Existing data on the study variables were downloaded into the study spreadsheet for each case. A cross check of 20 cases chosen using a table of random numbers was conducted to insure that the download had been properly conducted. The download was found to be complete and accurate. A unique identifying number was assigned for each patient (1-1626).

This became the "original" data file to be used for data analysis. After the download was completed, a data collection sheet (DCS) was generated for each case using the MS

Access file. The first page was printed with the patient's medical record number and the study unique identifying number. The case DCS differed from the DCI by inclusion of selected variables downloaded from the sites' databases. Each DCS used at Vallejo included the IP data report generated for each patient. Using the individualized DCS, the researcher and research assistants (RAs) completed the data collection process with a paper chart review.

Chart Review

The doctoral candidate and seven RAs conducted the chart review. Three RAs were students in the nurse-midwifery education program at UCSF/SFGH. Therefore, they have familiarity with the basic obstetric terms and language used to describe clinical activities. They were recruited by an e-mail sent to all midwifery students currently enrolled announcing the need for research assistants for the project. They were paid $10.00 per hour of data collection. The RAs were not students during the period of time for which data were being collected so they will not be familiar with the cases being reviewed. Two of the RAs were nurses (one a retired professor of nursing and midwifery), and two others were applying to medical school.

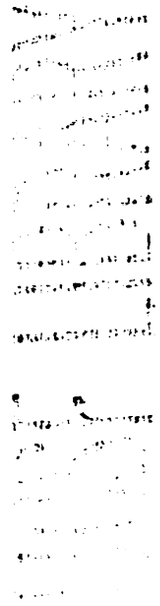
The Principal Investigator and the RAs were trained and prepared for chart review by simultaneously reviewing the same five charts following the protocol found in Appendix G. After each person reviewed three charts, the team compared the results for each case and discussed inconsistencies in scoring. The initial inter rater reliability for the three charts reviewed was 88%. Variable definitions were changed or clarified during this process.

Reliability

Once the protocol was finalized, another five charts were pulled, each to be reviewed

by each member of the data collection team. Inter rater reliability was determined for a sample of 25 variables. The variables selected were those requiring the most interpretation. For example, recording the actual birth weight in grams (if missing from the downloaded data) requires no interpretation. However, the moderate risk variables may be recorded by different clinicians using different language: urinary tract infections may be referred to as cystitis, UTI, or bladder infections, requiring interpretation on the part of the data collectors. The second IRR score was 93% with an error rate of 7.3%.

There were two other opportunities for checking the accuracy of the data collected. If the RAs had questions about the interpretation of any variables, the PI reviewed the chart and discussed her conclusions with the RA. Additionally she reviewed the entire chart for accuracy. In the majority of the cases reviewed, (approximately 5% of the total) the PI's conclusions about variables in question agreed with the RA's.



In cases where there was disagreement, this involved no more than one variable per chart. These discrepancies, if not corrected, would have resulted in an under count of moderate risk cases. Specifically, the RAs occasionally missed identifying a moderate risk variable. The orientation process had included a discussion of the ethical issues of chart review and the potential for bias in the interpretation of data during chart review. The RAs were asked to adhere strictly to the definitions of variables and not to make assumptions about care not documented.

The second accuracy check occurred at the time of data entry. Cases with missing data were identified as the data were entered on the spreadsheet. One hundred thirty-three files (133, 11%) were re-pulled at SFGH due to missing data. Charts with missing data were completely reviewed by the PI, and any discrepancies noted and corrected. In a few cases, the sections about IP and PP outcomes had not been completed. With this as the

exception, the same pattern of undercounting moderate risk variables was noted. The estimated error rate is below 1% and all known errors were corrected.

The data file was backed up each time the data were entered by making a copy to a Zip disk. This process was also used during analysis. The original data file and all updates were kept on a server, which was part of the UCSF Department of Ob/Gyn network. This system was backed up daily. Additional copies of the data files were kept on the hard drive of another PC.

Data Analysis

Data were analyzed using SPSS 10.01. Steven Paul, PhD, Senior Statistician for the School of Nursing at UCSF, provided consultation services for the data analysis. The level of significance for all tests was set at .05.

Exploratory analysis using descriptive statistics was conducted. The examination of descriptive statistics allowed evaluation of the data for outliers, missing values for each variable, and frequency distributions for each variable (Hulley & Cummings, 1998).

Evaluating the descriptive statistics assisted in completion of editing the data. Outliers indicate errors in data entry, as do missing values. The descriptive statistics were used to characterize the study population. After review of the descriptive statistics, any cases with missing values or outliers were re-pulled and checked. If errors were found, they were corrected.

Appendix H describes the research variables by type and descriptive statistical test used in the exploratory analysis. In this project, the following variables are quantitative or interval level data: (a) maternal age, (b) number of living children, (c) gravity and parity, (d) height (in inches), (e) pre-pregnancy weight, (f) weight at first prenatal care visit, (g) total number of PNC visits, (h) weight at last PNC visit, (i) gestational age at entry to care

(in weeks), (j) gestational age at delivery (in weeks), (k) total number of sonograms in pregnancy, (l) birth weight, and (m) number of contacts with health care system in the first 8 weeks postpartum. These variables were evaluated by calculating the mean, median standard deviation and standard error.

For some variables, a histogram was constructed with a normal curve superimposed in order to visually examine the distribution of the values for continuous variables. Frequency counts, with cumulative percentages was run for the categorical nominal and dichotomous variables listed in Appendix H.

Analytic statistics were used to examine associations between two or more variables. This analysis followed the three-step process suggested by (Hulley & Cummings, 1998):

> (1) inspection of the pattern of association in the sample, (2) computation of the magnitude of the association in the sample, and (3) estimation of the likelihood that the association observed in the sample also exists in the population from which the sample is drawn (p. 168).

If statistically significant differences were found between the groups, the variables (e.g. age) were entered into the regression analysis.

Variables and Their Measurement

The independent variable was provider group with two levels: nurse-midwifery care or obstetric care. Patients were identified as belonging to the provider group with which they initiated care and received at least 60% of their antenatal visits. Patients who transferred from one provider group to the other group were assigned to the group from whom they received > 60% of their care. Forty-four (44) patients transferred from CNM to obstetric care. Twenty one of these received > 60% of their care from the obstetric practice and were assigned to that group for the purposes of analysis. Only one patient

transferred from the obstetricians to CNMs and that patient received > 60% of her care from the obstetricians and remained in the obstetric group for analysis. The data were analyzed using intent to treat comparison with the exception of the 21 women who received > 60% of care from obstetricians.

The conceptual model (as seen in Figure 1) guided the decision to make this exception to the intent to treat analysis. The intent of the research was to determine whether differences exist between types of care. The cases selected in this manner reflected a sufficient "dose" of the intervention (nurse-midwifery care). This enabled the outcomes of care to be assigned to the provider group from which the patient received the majority of prenatal care. The effect of provider group on the outcome variables was examined by entering provider group as the last step in the regression analyses.

Cases of transfers of care from an outside clinic or provider were handled in a similar manner. If a patient transferred after 20 weeks gestational age received less than 75% of her care at either study site, her record was eliminated from the study. Including cases where a majority of care was received in an "unknown" model of care would introduce serious confounding.

Table 8 presents the relationship of the hypotheses, variables and the analysis of variables. The dichotomous dependent variables were: low birth weight (< 2500 g), induction of labor, epidural anesthesia, cesarean section, vacuum delivery, forceps delivery, evidence of psychosocial/educational care measures, evidence of non-technologic care measures, evidence of personalized care and breastfeeding (BF) at 6 weeks postpartum. The relationship between these variables and the independent variable was analyzed using chi square ($p = .05$).

Table 8

Statistical Tests by Hypotheses

Hypothesis	Variables	Analysis
Hypothesis 1.	Provider type	Chi square
Birth weight	Race/ethnicity	Chi square
< 2500 g	Best estimate gestational age ≤ 36 weeks	Chi square
	Smoking	Chi square
	Level of prenatal care	Chi square
	Underweight at entry to care	Chi square
	Total weight gain in pregnancy	Students t-test
	Parity (TPAL)	Students t-test
	Age	Students t-test
	All moderate medical and psycho-social risk	Students t-test
	factors	Chi square/Student t-test
		Logistic regression
Hypothesis 2.	Number of sonograms,	Students t-test
Technologic	induction or augmentation of labor,	Chi square
interventions	epidural anesthesia,	Chi square
	operative deliveries,	Chi square
	Provider type	Chi square
	All moderate medical and psychosocial risk	Chi square
	factors	

Table 8 (*continued*)

Hypothesis	Variables	Analysis
Hypothesis 3.		
Non-technologic care measures:	Provider type	Chi square
	All moderate medical and psychosocial risk factors	Chi square/Student t-test Logistic regression
Hypothesis 4. Breastfeeding	Breastfeeding	Chi square
Breastfeeding	Provider type	Chi square
	Type of delivery	Chi square
	Type of anesthesia	Chi square
	Best estimate gestational age $\leq$ 36 weeks	Chi square
	Race/ethnicity	Chi square
	Parity (TPAL)	Students t-test
	Age	Students t-test
	WIC	Chi square
	Evidence of personalized care AP/IP	Chi square
	Evidence of provider discussions (diet, psychosocial stressors etc.)	Chi square Chi square
	All moderate medical and psycho-social risk factors	Chi square/Student t-test Logistic regression
Hypothesis 5. Number of visits in first 8 weeks post-partum	# visits	Student t-test
	Provider type	Correlation coefficient or
	All moderate medical and psycho-social risk factors	Student t-test Multiple regression

Number of ultrasound exams in pregnancy and number of contacts with the health care system in the first year postpartum were the continuous dependant variables and were analyzed using two sided student's t test ($p = .05$). If the data for these variables proved to be extremely skewed, then Mann Whitney U test was used for the bivariate analysis. The Mann Whitney U test was used to analyze number of sonograms.

The potential confounding variables of this study included factors that have been shown to influence the outcomes under investigation. The continuous confounding variables include: gestational age at time of delivery, total documented weight gain in pregnancy, pre-pregnant weight, parity, and age at time of delivery. These were analyzed using two-sided student's t test ($p = .05$).

Two other potential confounding variables were women's medical risk status, and adequacy of prenatal care measured by the Adequacy of Prenatal Care Use Index (APNCU) (Fischler & Harvey, 1995; Kotelchuck, 1994; Oakley et al., 1995). The APNCU (1994) addresses both the timing of the initiation of PNC and the total number of visits received, adjusted for gestational age at initiation of prenatal care and at delivery. Using this index to examine rates of LBW from1980 birth certificate data, Kotelchuck (1994) found that rates of LBW were higher both for women who received inadequate levels of PNC and for those who received more intensive levels of PNC. The latter reflected the necessity of more intensive services for higher risk women (Kotelchuck, 1994). Each of the three levels of the APNCU (Inadequate, Adequate and Adequate Plus) was treated as a dichotomous variable and examined for significance using chi square ($p = .05$).

Medical risk status has not been consistently defined or measured in previous midwifery outcomes research. Using a process similar to Mac Dorman and associates

(1998), all prior and existing moderate medical risk factors listed in Appendix A were included in the data collected for each case. These data were analyzed for relationships between specific risk factors and the dependant variables using $\chi 2$ analysis or t-test to determine whether specific risk factors could be considered have an association with the outcomes.

Hypotheses and Regression Analyses

The hypotheses and types of regression analyses used were:

Hypothesis 1. After controlling for medical risk status, nurse-midwifery care of women at moderate risk for poor pregnancy outcome will result in rates of low birth weight (< 2500 g) equivalent to or lower than rates in women cared for by obstetricians.

Multivariate analysis using logistic regression was used to assess the risk of low birth weight in a moderate risk population of women cared for by either obstetricians or nurse-midwives. The results of the analysis will demonstrate whether type of provider predicted rates of low birth weight after controlling for confounding variables.

Hypothesis 2. After controlling for medical risk status, nurse-midwifery care of women at moderate risk for poor pregnancy outcome will result in lower rates of the following technologic interventions: sonograms, induction or augmentation of labor, epidural anesthesia, and operative deliveries i.e. cesarean section, vacuum and forceps deliveries than rates in women cared for by obstetricians.

For induction and augmentation of labor, epidural anesthesia, and operative births, logistic regression was used to assess the effect of provider type on risk of experiencing technologic processes of care after controlling for confounding variables. For sonograms in pregnancy, a quantitative dependant variable, multiple linear regression was used to determine the percentage of variance in number of sonograms in pregnancy which can be

explained by provider type after controlling for confounding variables.

Hypothesis 3. After controlling for medical risk status, nurse-midwifery care of women at moderate risk for poor pregnancy outcome will result in higher rates of non-technologic care measures: personalized care, psychosocial/educational care measures, and non-technologic comfort measures in prenatal care or in labor than rates in women cared for by obstetricians.

Multivariate analysis using logistic regression was used to assess the risk of experiencing non-technologic processes of care in a moderate risk population of women cared for by either obstetricians or nurse-midwives. The results of the analysis will demonstrate whether type of provider predicts rates of experiencing personalized care, psychosocial/educational care measures, or non-technologic comfort measures in labor after controlling for confounding variables.

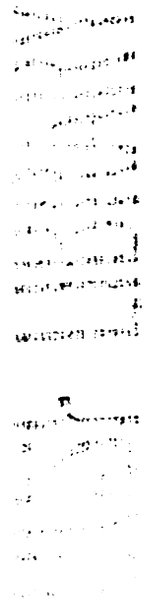
Hypothesis 4. After controlling for medical risk status, nurse-midwifery care of women at moderate risk for poor pregnancy outcome will result in higher rates of women breastfeeding at 6 weeks post partum than rates in women cared for by obstetricians. Logistic regression was used to assess the effect of provider type on rates of breastfeeding at 6 weeks postpartum after controlling for confounding variables.

Hypothesis 5. After controlling for medical risk status, there will be no significant differences in the number of contacts with the health care system for problems related to the mother's health between discharge and 8 weeks postpartum for women receiving nurse-midwifery outcome compared to women cared for by obstetricians.

For contacts with the health care system, a quantitative dependant variable, multiple regression was used to determine the percentage of variance in number of contacts with the health care system which can be explained by provider type after controlling for

confounding variables.

Confounding variables were defined as those risk factors showing a statistically significant effect on outcomes in the bivariate analysis as well as being unevenly distributed in the independent variable groups. Any variables (e.g. age), which were a risk factor for the outcome and demonstrated a statistically significant difference between the provider groups, were entered into the models, to insure that the potential for selection bias examined.



CHAPTER 4

Results

Description of the Study Population

The demographic and risk profile of the study population were presented in Chapter 3. They are repeated here to provide easier access for the reader to a complete description of the study population.

Demographics. The demographic characteristics of women in the study are listed in Table 9. The study population can be generally characterized as poor (only 8% are privately insured) and ethnically diverse (90% are either Asian, African American, or Hispanic). They have an average of 10 years education and a mean age of 27 at the time of delivery. Sixty percent (60%) were single and 57% had at least one other child.

Risk Profile. The mean number of risk factors in the population was 7.5 (*SD* 2.7) with a range of 3 to 20 risk factors. The mean number of medical and social risks was similar, 3.3 (*SD* 1.9) and 4.2 (*SD* 1.7) respectively. Over half (62%) the women in the study population had three or more moderate risk medical conditions and 78% had three or more demographic or psychosocial risk factors.

The women had a mean of 11 prenatal visits yet 38% (n = 433) received an inadequate amount of PNC on the APNCU Index. Over 25% (n = 297) had an adequate amount of PNC and 28% (n = 317) scored in the adequate plus category of the APCNCU Index (1994).

Table 10 presents results related to weight and weight gain in pregnancy. Only 9% (n =97) of women were underweight at the beginning of pregnancy, however 42% (n = 491) failed to gain adequate weight during pregnancy.

Table 9

Provider Group Differences for Demographic Characteristics

Characteristics	Nurse-Midwifery Group	Obstetric Group	Total
	M, SD, n	*M, SD, n*	*M, SD, n*
Age in Years**	25.6 (*SD* 6.0) 801	27.5 (*SD* 6.1) 372	25.8 (*SD* 6.2) 1173
Years Education**	9.6 (*SD* 3.6) 787	11.0 (*SD* 3.8) 355	10.1 (*SD* 3.7) 1142
	n (%)	*n* (%)	*n* (%)
Marital Status*			
Single	497 (62.4)	201 (54.5)	698 (59.9)
Married	300 (37.6)	168 (45.5)	468 (40.1)
Ethnicity**			
African-American	114 (14.3)	67 (18.6)	181 (15.6)
Asian/Pacific Islander	65 (8.1)	98 (27.2)	163 (14.1)
Hispanic	542 (67.8)	139 (38.6)	681 (58.8)
Non-Hispanic White	72 (9.0)	49 (13.6)	121 (10.4)
Other	6 (.8)	7 (1.9)	13 (1.1)
Parity			
Nulliparous (G1)*	2259 (32.3)	97 (26.1)	356 (30.3)
Multiparas	458 (57.2)	213 (57.3)	671 (57.2)
(Viable Births)			

Table 9 (*continued*)

Characteristics	Nurse-Midwifery Group	Obstetric Group	Total
	n (%)	n (%)	n (%)
Insurance			
Medi-Cal**	786(98.5)	263 (71.1)	1049(89.8)
Private**	5(0.6)	93 (25.1)	98 (8.4)
Self Pay/Package*	6 (.8)	11 (3.0)	17 (1.5)
Jail Services*	0 (0)	2 (.2)	2 (.6)
< 11 Years of education	386 (49.0)	107 (30.1)	493 (43.2)

* $p < .05$. ** $p \leq .003$.

Table 10

Medical Risk Factors Related to Weight by Provider Group

Characteristics	Nurse-Midwifery Group	Obstetric Group	Total
Mean Weight Gain	28.3 (*SD* 15.0)	29.0 (*SD* 17.0)	28.5 (*SD* 15.6)
	n (%)	*n* (%)	*n* (%)
Inadequate Weight Gain	332 (41.4)	159 (42.7)	491 (41.9)
Underweight-entry to care	62 (8.2)	35 (9.6)	97 (8.6)
Overweight-entry to care	313 (41.8)	159 (43.7)	472 (42.4)

An additional 42% (n = 492) were classified as obese at the beginning of pregnancy (> 120% desirable body weight [DBW] for height).

For risks related to obstetric history, 7% (n = 85) had previously delivered a preterm infant (< 36 weeks gestational age) or an infant at low birth weight (< 2500 g). Twenty-four women (2%) had a fetal demise in a previous pregnancy and 13% (n = 151) had previously experienced a cesarean delivery. Approximately 9% (n = 100) had become pregnant < 1 year after completing a previous pregnancy.

Two variables describing recent or current substance abuse plus one describing current alcohol abuse were combined into one "Alcohol or substance abuse." The study population had low rates of substance use: 7% (n = 86) had a history of alcohol or drug use within 6 months of pregnancy, 8% (n = 90) were abusing drugs or alcohol during the pregnancy, and 5% (n = 54) were smoking pot. The rate of cigarette smoking was higher at 14% (n = 164).

Each of the substance abuse issues differed by ethnicity. For example, of the 90 women currently abusing drugs and alcohol, the highest proportion were African American (n = 41, 46%) followed by non-Hispanic White women (n = 24, 27%). Asian/Pacific Islander (n = 11, 12%) and Hispanic women (n = 12, 13%) had the lowest proportion of current substance abuse.

Forty-one percent (41%, n = 476) of women in the study had at least one infectious disease during pregnancy. Many women had infections in more than one category. The separate variables related to infectious diseases were combined into two variables. One represents all sexually transmitted diseases and the other, all other infections requiring antibiotic treatment.

Of the 471 women having at least one infection, 78% (n = 370) had either an STD or

other infection of the genital tract. One hundred seventeen (117) or 11% had other types of infections requiring antibiotic treatment such as pyleonephritis or pneumonia.

Mild and severe pre-eclampsia, diet controlled and insulin dependent gestational diabetes were combined into one variable entitled diseases of pregnancy. One hundred forty-seven (147) women (12.5%), had diseases of pregnancy, nine had more than one condition. Only 9 (< 1%) women had severe pre-eclampsia diagnosed in the antepartum setting. Twenty-two (22) women or 2% of the study population had insulin dependent gestational diabetes.

Pre-term labor requiring hospitalization occurred in 4% (n = 46) of the women and IUGR was diagnosed in slightly more than 1% (n = 15) pregnancies. The rates for most other medical risks including anemia (Hgb. < 10.0), asthma, cholestasis, fibroids, clinical depression, sickle cell trait, and hypothyroidism ranged from 1% to 9%. These were combined into one variable named "other medical conditions" (n = 286, 24%).

Problems related to violence occurred at rates ranging from less than 1% (pregnancy as a result of rape) to 13% (exposed to violence). Forty-eight (48) women had experienced domestic violence during pregnancy and 110 women described prior history of domestic violence representing a total of 14% of women in the study population.

Undesirable housing conditions affected 11% of the study population. Thirty-three of moderate risk women (n = 33, 3%) were homeless or living in "welfare hotels" during their pregnancies.

Only six percent (6%)of the women reported problems with nutrition, either running out of food (n = 20) or being eligible for but not enrolled in the WIC program (n = 44). Over 15% (n = 171) of women identified problems with social support, i.e. being single and without friends or family in the area, or without the support of the father of the baby

or her life partner. Three percent of women (3%, $n = 38$) stated their partner abused drugs or alcohol.

A large percentage of women (37%, $n = 411$) self–identified as monolingual in a language other than English. Ten percent (10 %, $n = 122$) had immigrated to the U.S. within 12 months of last menstrual period (LMP). Six percent of women ($n = 69$) had children living in another country and 2% of the women ($n = 20$) reported having children either living in foster care or adopted out.

Differences between Provider Groups

Demographics

Significant differences between provider groups for the women's demographic profiles are also shown in Table 9. Women receiving the midwifery care ($n = 801$) were significantly younger (25.6 years vs. 28.5 years, $p < .001$), had less education ($p < .001$), and a greater proportion of them were women of color ($p = .018$).

There were significant differences between provider groups by ethnicity ($p < .001$). In the nurse-midwifery group, approximately 68% reported Hispanic ethnicity, while in the physician group only 39% were Hispanic. The physician group had larger proportions of women in Asian/Pacific Islander, African American and other ethnic groups.

Approximately 11% of the midwifery patients were under 18 years of age at last menstrual period compared with 4% of women cared for by the obstetricians ($p < .001$). Obstetricians cared for greater than twice the proportion of women over 35 years of age (14% vs. 6%, $p < .001$). A greater proportion of women in the midwifery group were primigravidas (32 % vs. 26%, $p = .03$).

A higher proportion of women in the nurse-midwifery group reported < 11 years of education (49% vs. 30%, $p < .001$). This may be due to the greater proportion of women

of Hispanic ethnicity in the midwifery group as there was a strong association between Hispanic ethnicity and < 11 years of education ($\chi^2 = 233.45$, $df = 1$, $n = 416$, $p < .001$).

Nearly 100% of women cared for by nurse-midwives were covered by public insurance ($p < .001$). Only 4 of 798 (0.5%) midwifery patients had private insurance. This contrasts the physician's caseload where 93 of 370 (25%) women were covered by private insurance. Women with private insurance had significantly fewer risk factors (M = 4.6, *SD* 1.5) compared with women covered by public insurance ($M = 7.8$, $SD = 2.6$, $p < .001$).

Moderate Risk Status

To review, for this study moderate risk status was generally defined as the presence of conditions contributing to poor pregnancy outcomes, excluding high risk conditions. Moderate risk status included demographic factors, medical conditions, and psychosocial factors. Inclusion criteria for moderate risk status was defined as the presence of least three risk factors for poor pregnancy outcome, two of which could be demographic or psychosocial factors. The mean number of total risk factors by provider group was not significantly different: 7.5 for women cared for by nurse-midwives and 7.3 for women cared for by obstetricians ($p = .315$).

Medical Risk Factors. The 41 medical risk factors are listed in Appendix C. Women cared for by obstetricians had an average of 3.6 medical risk factors while women cared for by nurse-midwives were found to have 3.2 medical risk factors ($p = .002$).

As indicated in Table 10 no significant differences between provider groups in risk factors related to maternal weight were found. Approximately 40 % of each group experienced inadequate weight gain during pregnancy and 9% of each group were underweight at entry to care.

Differences by provider type were found for 14 medical risk factors and conditions.

The categories of these differences were drug or alcohol abuse, obstetric risks, diseases of pregnancy and other medical conditions. These results are presented in Table 11.

Obstetricians cared for a higher proportion of women with substance and alcohol abuse problems ($p < .05$). They also cared for a higher proportion of women with pregnancy related conditions including admission for preterm labor, previous cesarean section, uterine fibroids, and hypertension of pregnancy. Nurse-midwives cared for higher proportions of women with a close interval pregnancy, bacterial vaginosis or group beta strep and greater than one urinary tract infection during pregnancy ($p < .05$).

Psychosocial Risk Factors. Appendix C lists the 21 psychosocial risk factors. Adequacy of prenatal care has been found to be an important predictor of LBW (Alexander & Korenbrot, 1995). No significant between group differences in the Kotelchuck Adequacy of Prenatal Care Index exist, as shown in Table 12.

Women who had midwives as their main providers of care had an average of 4.3 psychosocial risk factors while those cared for by obstetricians had an average of 3.8 ($p < .001$). Significant differences between provider groups were found for 6 psychosocial factors: living in public housing, homeless or living in a hotel, eligible for but not enrolled in WIC, children in foster care or adopted out, monolingual in a language other than English, and unwanted pregnancies. The differences and significance levels are listed in Table 13.

In the next section, results will be presented by hypothesis. Within the report of each hypothesis, results will be reported by type of analysis.

Table 11

Medical Characteristics of Moderate Risk Women by Provider Group

Characteristics	Nurse-Midwifery Group	Obstetric Group	Total Population
	n (%)	n (%)	n (%)
Substance Abuse			
Within 6 mo of pregnancy*	17 (2.2)	19 (6.0)	36 (3.1)
During pregnancy**	25 (3.2)	27 (8.4)	52 (4.5)
Alcohol Abuse **	0 (0)	5 (1.3)	5 (.4)
Obstetric Risks			
Previous Cesarean Section **	87 (10.9)	64 (17.2)	151 (12.9)
> 3 SAB or TAB *	15 (1.9)	22 (5.9)	37 (3.2)
Close Interval Pregnancy *	79(10.1)	21 (5.7)	100 (8.7)
Admission for PTL *	24 (3.0)	22 (5.9)	46 (4.0)
Fibroids *	7 (.9)	10 (2.7)	17 (1.5)
BV, GBS **	212 (26.9)	62 (16.8)	274 (23.7)
> 1 UTI During Pregnancy*	45 (5.7)	9 (2.4)	54 (4.7)
Diseases of Pregnancy*			
Hypertension of Pregnancy *	42 (5.3)	31 (8.4)	73 (6.8)
Insulin Dependant GDM **	6 (.8)	16 (4.3)	22 (1.9)
Hypothyroid **	3 (.4)	8 (2.2)	11 (1.0)
Other Medical Risk Factors *	52 (6.6)	40 (10.8)	92 (8.0)

*p < .05. **p < .005.

Table 12

Adequacy of Prenatal Care by Provider Group

	Nurse-Midwifery Group	Obstetric Group	Total
	N, M, (SD)	*N, M, (SD)*	*N, M, (SD)*
Number of Visits	785, 10.6 (*SD* 3.6)	361, 10.4 (*SD* 4.6)	1146, 10.65(*SD* 3.9)
	n (%)	*n* (%)	*n* (%)
Inadequate PNC	295 (37.8)	138 (38.7)	433 (38.1)
Intermediate	66 (8.5)	24 (6.7)	90 (7.9)
Adequate	213 (27.3)	84 (23.5)	297 (26.1)
Adequate Plus	206 (26.4)	111 (31.1)	317 (27.9)

Table 13

Psychosocial Factors in Moderate Risk Women by Provider Group

Factors	Nurse-Midwifery Group	Obstetrician Group	Total Population
	n (%)	*n* (%)	*n* (%)
Living in Public Housing**	2 (.3)	13 (3.6)	15 (1.4)
Living in Hotel or Homeless**	12 (1.6)	21 (5.8)	33 (3.0)
On Medi-Cal/not enrolled in WIC**	42 (5.7)	7 (1.9)	49 (4.4)
Children in Foster Care or Adopted Out**	8 (1.1)	12 (3.3)	20 (1.8)
Monolingual –not English**	313 (40.9)	98 (27.1)	411 (36.5)
Unwanted Pregnancy*	5 (0.7)	7 (1.9)	12 (1.1)

*$p \leq .05$. ** $p < .005$.

Low Birth Weight

Hypothesis One: After controlling for medical risk status, nurse-midwifery care of women at moderate risk for poor pregnancy outcome will result in rates of low birth weight (< 2500 g) equivalent to or lower than rates in women cared for by obstetricians. This hypothesis was supported by the results.

Bivariate Analysis

In the *total* population (n =1293) delivered by either nurse-midwives or obstetricians during the study period, the rate of LBW was 6.9%. This includes women who were determined to be both low (n = 80) and high risk (n =130). Differences by type of provider were not statistically significant (p = .06). The rate for women beginning care with nurse-midwives was 6.0% and for those beginning care with obstetricians was 8.8%. The *OR* for low birth weight in patients beginning care with CNMs was .70. This was a 32% reduction in the rate of LBW.

The overall rate of low birth weight for the study population of moderate risk women (n =1173) was 5.9% (n = 69). No statistically significant differences between the provider groups for LBW were found with chi square analysis. In the women in the nurse-midwifery group 44 (5.5%) infants were LBW while in those cared for by obstetricians, 25 (6.7%) delivered a LBW infant.

When considered alone, 19 variables were found to have a statistically significant relationship to LBW. Table 14 presents significant differences for demographic variables. Having less than 11 years of education was associated with LBW (p = .018). Ethnic group was significantly related to LBW (p < .001). The rates of LBW range from 3.4% for Hispanic women to 11.6% for African American women. Table 15 presents rates of LBW by ethnicity.

Table 14

Demographic Characteristics Related to LBW

Characteristics	Birth weight < 2500 g *n* (%)	Birth weight ≥ 2500 g *n* (%)	Total *n* (%)
Race**			
African-American	21 (30.9)	160(14.7)	181 (15.6)
Asian/Pacific Islander	16 (23.5)	147 (13.5)	163 (14.1)
Hispanic	23 (33.8)	658 (60.3)	681 (58.8)
Non-Hispanic White	8 (11.8)	113 (10.4)	121 (10.4)
Other	0 (0)	13 (1.2)	13 (1.1)
< 11 years of Education*	20 (29.0)	473 (44.0)	493 (43.2)

*p < .02. **p < .001

Table 15

Rates of LBW by Ethnicity

Ethnic Group	Birth weight < 2500 g %
African-American	11.6
Asian/Pacific Islander	9.8
Hispanic	3.4
Non-Hispanic White	6.6

Table 16 presents the results of the bivariate analysis for medical risk factors. Women giving birth to a LBW infant had significantly more medical risks ($M = 4.39$, SD 2.71, t (1171) = 2.8, $p = .006$) than women giving birth to a normally weighted infant (M = 3.26, SD 1.79). The medical risk factors having a statistically significant relationship to LBW were: inadequate weight gain, drug or alcohol abuse during pregnancy, cigarette smoking, previous history of preterm delivery or LBW infant, infections requiring antibiotics during pregnancy, Tb risk, history of admission for preterm labor during this pregnancy, hypertension and severe pre-eclampsia, IUGR, and preterm delivery. History of previous preterm or LBW contributed significantly to LBW (OR 2.5, $p = .03$). The odds of LBW related to hypertension of pregnancy was approximately 3.0 ($p = .03$) and for severe pre-eclampsia 11.0 ($p = .004$). Women in the study with a diagnosis of IUGR had the highest odds of delivering a baby at LBW (OR 26.1, $p = .001$).

The rate of preterm delivery in the sample was 1.5 % and was not significantly different by provider group. Of the LBW infants in this study only 23% were pre-term ($\chi^2 = 227.5, p < .001$).

When considered alone, most of these variables, explained less than 2% of the variance in LBW. Admission for preterm labor explained a moderate amount (7%) of the variance. Birth at less than 37 weeks or preterm delivery (PTD) explained the largest percentage of variance at 20%.

The psychosocial risk factors associated with LBW are presented in Table 17. Women who were living alone at the time of the pregnancy were approximately 11 times more likely to give birth to an infant at LBW ($n = 9$, 4.6%) than women who lived with

Table 16

Medical Characteristics During Pregnancy by LBW

Characteristics	Birth Weight < 2500 g	Birth Weight ≥ 2500 g
	n, M, (SD)	*n, M, (SD)*
Mean Weight Gain *	58, 22.1 (*SD* 12.9)	1022, 28.9 (*SD* 15.7)
	n (%)	*n* (%)
Inadequate Weight Gain*	38 (62.3)	453 (43.1)
Drug or alcohol abuse during pregnancy**	15 (21.7)	76 (6.9)
Cigarette smoking*	16 (24.6)	148 (13.6)
History previous preterm or LBW delivery*	10 (15.4)	75 (6.9)
+ Chest x-ray or Tb clinic referral*	3 (4.5)	10 (.9)
Infections requiring antibiotics*	11 (16.7)	91 (8.3)
History of preterm labor**	17 (24.6)	29 (2.7)
Hypertension of pregnancy*	9 (13.6)	64 (5.9)
Severe pre-eclampsia**	3 (4.5)	6 (.6)
IUGR*	7 (10.6)	8 (.7)
Delivery < 37 weeks*	40 (58.0)	57 (5.2%)

*p < .05. **p ≤ .003.

others (n = 3, 0.9%). The results should be interpreted cautiously as this was a very small group (n = 12). The mean gestational age at birth for women who lived alone was 38 weeks (*SD* 2.2, p = .03) compared with 41 weeks for all other women in the study sample (*SD* 10.2).

Living alone was not significantly associated with any other psychosocial risk factors. A non-significant trend showed that women living alone are older (83% are ≥ 25 and none were under age 20) than the rest of the study population. A higher (but non-significant) proportion of the women living alone received either inadequate or adequate plus amounts of PNC (75%) compared to all other women in the study population (66%).

Table 17

Psychosocial Factors Related to LBW

Factors	Birth Weight < 2500 g	Birth Weight ≥ 2500 g
	n, M, (*SD*)	*n, M,* (*SD*)
Mean Number of Visits*	67, 8.2 (*SD* 3.9)	1079, 10.7 (*SD* 3.9)
	n (%)	*n* (%)
Living in Hotel or Homeless**	6 (9.5)	27 (2.6)
On Medi-Cal/not enrolled in WIC*	6 (9.5)	43 (4.1)
Lives Alone**	3 (4.6)	9 (.9)

*p < .05. ** p ≤ .002.

Hispanic Ethnicity. The bivariate results related to LBW for Hispanic women are presented separately, as they comprise the majority of the study population. Nearly 60% of this study population was Hispanic and a significantly higher proportion (67.8 vs. 38.6) of Hispanic women are in the nurse-midwifery group. Seventy percent of recent immigrants

(n =122) were Hispanic (n = 85). The rates of low birth weight for those who were and were not recent immigrants were nearly identical (5.8 and 5.7%).

Compared with women of other ethnicities, women of Hispanic descent had significantly higher rates of inadequate weight gain in pregnancy (p = .007) and less than 11 years of education (p < .001). Hispanic women had significantly lower rates of inadequate PNC (p < .001), underweight at entry to care (p = < .001) and cigarette smoking (p < .001) and drug or alcohol (p < .001) use compared to women of other ethnicities, as presented in Table 18.

Logistic Regression

The final model predicting LBW is described in Table 19. After all 16 variables that had a statistically significant relationship to LBW were entered into the model, only seven variables were found to predict low birth weight. These were ≥ 11 years of education, history of previous PTD or LBW, severe pre-eclampsia, diagnosis of IUGR, admission for preterm labor during current pregnancy, living alone, and delivery at less than 37 weeks GA. The model explains 14% of the variance in low birth weight deliveries.

Women with a diagnosis of IUGR were 45 times more likely to deliver a LBW infant (95% *CI* 13.0, 160.7). PTD carried the second highest increased odds for LBW (*OR* 12.1, *CI* 12.1, 49.8). Women living alone were 10.6 (*CI* 2.74, 41.41) times more likely to deliver a LBW infant than women who did not live alone. Women with less than 11 years of education were 2.3 times less likely to deliver a low birthweight infant (*CI* 1.1, 5.00).

Table 18

Selected Characteristics Related to LBW of Hispanic Women in the Study

Characteristics	Hispanic	Other Ethnicities	Total
	m, SD, n	*m, SD, n*	*m, SD, n*
Number of medical risks*	2.98, 1.55, 681	3.85, 2.17, 478	3.33, 1.88, 1173
Number of psychosocial risks*	4.68, 1.66, 681	3.48, 1.53, 478	4.16, 1.73, 1173
	n (%)	*n* (%)	*n* (%)
Low birth weight*	23 (3.4)	45 (9.4)	68 (5.9)
Marital Status*			
Single	367 (54.1)	322 (67.9)	689 (59.8)
Married	311 (45.9)	152 (32.1)	468 (40.2)
< 11 Years of education*	416 (62.2)	75 (16.3)	491 (43.5)
Underweight at entry to care*	39 (6.0)	58 (12.7)	97 (8.8)
Obese at entry to care*	300 (46.5)	164 (36.1)	464 (42.2)
Inadequate weight gain*	309 (47.9)	180 (39.7)	489 (44.5)
Close interval pregnancy*	44 (6.6)	55 (11.6)	99 (8.7)
Inadequate PNC*	204 (30.7)	226 (49.2)	430 (38.3)
Current alcohol or substance abuse*	12 (1.8)	78 (16.3)	90 (7.8)
Cigarette smoking*	43 (6.5)	117 (24.7)	160 (14.1)
Children living in another country*	63 (9.9)	6 (1.3)	69 (6.3)

* $p \leq .007$

Table 19

Logistic Regression Model Predicting Low Birth Weight

	AOR[a]	95% *CI*	*p*
< 11 years of Education	.44	0.2, 0.9	.03
History of preterm labor	2.7	1.1, 6.9	.04
Severe pre-eclampsia	10.3	1.3, 82.5	.03
IUGR	45.8	13.1, 160.7	< .001
Admission for preterm labor during pregnancy	3.1	1.3, 8.7	.02
Lives Alone	10.5	1.8, 59.0	< .001
< 37 weeks GA at birth	24.5	12.1, 49.8	.001

[a] controlling for all significant variables

Technological Interventions

Hypothesis Two: After controlling for medical risk status, nurse-midwifery care of women at moderate risk for poor pregnancy outcome will resulting lower rates of the following technologic interventions: sonograms, induction or augmentation of labor, epidural anesthesia and operative deliveries. This hypothesis was supported for four of the five variables examined.

Sonograms

All sonograms received during pregnancy were counted, including level one and two formal sonograms, and sonograms conducted as part of the formal assessment of fetal well-being. "Deck" sonograms (conducted in labor and delivery or in the antepartum clinic) conducted solely to determine presentation of the fetus or the presence of amniotic

fluid after suspected rupture of membranes were not counted since these were inconsistently documented in the charts.

The numbers of sonograms received by women in the study are presented in Table 20. The number of sonograms received ranged from 0 to 16. As indicated in Table 20, in this moderate risk population, only 15% of the women did not have any sonograms during pregnancy. Nearly half (45%) had one sonogram. The nurse-midwifery group had a higher proportion of women receiving only one sonogram as compared to the obstetrician group (49.1 vs. 36.1, $p = < .001$).

The average number of sonograms did not differ significantly by provider group. Women cared for by obstetricians received on the average 1.84 sonograms during their pregnancy and women cared for by nurse-midwives received 1.72 sonograms.

A majority of women had fewer than two sonograms. To determine whether there were differences between the provider groups for women receiving ≥ 2 sonograms, this variable was divided into two categories: women who had 0 or 1 sonogram and women who had two or more sonograms. There were significant differences by type of provider when the number of sonograms was grouped. Sixty two percent (62%, $n = 479, p < .001$) of women cared for by nurse-midwives compared with 52% ($n = 196$) of women cared for by obstetricians had either 0 or 1 sonogram during pregnancy.

There were significant differences in mean number of sonograms for women receiving an inadequate amount of prenatal care. Those with an inadequate amount of care ($n = 430$) received a mean of 1.51 sonograms and those with intermediate amounts of prenatal care or better received 1.91 sonograms ($p = .001$). Women with diseases of pregnancy ($n = 146$) had significantly more sonograms than those who did not have pregnancy related diseases (2.28 vs. 1.68, $p < .001$). There were no significant differences

in the number of sonograms received for women delivering either preterm or postdates.

Table 20

Number of Sonograms by Provider Group

Number of Sonograms	Nurse-Midwifery Group	Obstetrician Group	Total
	n (%)	*n* (%)	*n* (%)
0	107 (13.5)	63 (17.1)	170 (14.6)
1	390 (49.1)	133 (36.1)	523 (45.0)
2	175 (22.0)	94 (25.5)	269 (23.1)
3	50 (6.3)	40 (10.9)	90 (7.7)
4	23 (2.9)	15 (4.1)	38 (3.3)
≥ 5	49 (6.2)	23 (6.3)	72 (6.2)

$p < .001$

Table 21

Differences in Aggregate Numbers of Sonograms by Provider Group

Number of Sonograms	Nurse-Midwifery Group	Obstetrician Group	Total
	n (%)	*n* (%)	*n* (%)
≤ 1	497 (62.0)	196 (52.7)	693 (73.2)
≥ 2	304 (38.0)	176 (47.3)	46 (26.8)

$p < .002$

Multiple Regression. Only 8% of the variance in the number of sonograms received were explained by 6 optimally weighted independent variables: diseases of pregnancy, other medical risks, fibroids, runs out of food, inadequate PNC, and private insurance ($R^2 = .075$, $F_{6, 1015} = 13.76$, $p = .000$). All 6 of the variables provide significant unique contributions to explaining the variance in the number of sonograms.

Logistic regression. Five variables had significant relationships with women having two or more sonograms during pregnancy. These are listed in Table 22. Women cared for by nurse-midwives were .57 times less likely to have two or more sonograms during pregnancy than those cared for by physicians after controlling for private insurance, inadequate amount of PNC, admission for preterm labor and other medical risks.

Table 22

Logistic Regression Model Predicting Two or More Sonograms

Covariates	*OR*	95% *CI*	*p*
Private insurance	0.45	0.27, 0.75	< .002
Inadequate amount of PNC	0.62	0.47, 0.83	.001
Admission for preterm labor	4.03	1.90, 8.54	< .001
Other medical risks	1.74	1.30, 2.33	< .001
Nurse-midwifery care	0.57	0.42, 0.77	< .001

Intervention in Labor

Four hundred and ninety-one (n = 491, 42%) women had spontaneous labor without subsequent augmentation compared with 674 women who had either no labor (n = 94) or labor induced (n = 263) and augmented (n = 317). Significantly more women cared for by nurse-midwives had spontaneous labor (n = 382, 48%) than those cared for by obstetricians (n = 109, 30%, $\chi^2 = 35.79, p < .001$).

Induction of Labor. Two hundred and sixty three women (23%) had induction of labor. Women whose labors were induced and later augmented were included only in the induced group. There were no significant differences between provider groups for induction of labor.

When considered alone only a few conditions were significantly associated with induction. These were IUGR ($p < .001$), diseases of pregnancy ($p < .001$), cholestasis ($p < .001$), post dates delivery ($p < .001$), and unintended pregnancy ($p = .05$). All variables except unintended pregnancy were included in the final regression model, which explained only 6% of the variance in induction of labor. Women with IUGR had greatest odds of being induced (*OR* 7.5; *CI* 2.5, 23.1; $p < .001$) compared with to women with other factors.

Augmentation of Labor. Augmentation of labor ($n = 317$, 27%) was significantly associated with only 4 variables: ethnicity ($p < .001$), parity ($p < .001$), prolonged labor ($p < .001$) and provider group ($p < .001$). Table 23 presents the results of the logistic regression.

Table 23

Logistic Regression Model Predicting Augmentation of Labor

Covariates	*OR*	95% *CI*	*p*
Ethnicity			.01
African American	1.4	0.9, 2.2	NS
Asian/Pacific Islander	0.8	0.6, 1.3	.001
Hispanic	0.1	.03, 1.6	NS
Other	0.6	0.3, .99	.05
Primigravida	1.8	1.4, 2.4	< .001
Prolonged Labor	2.1	1.1, 4.0	.03
Nurse-Midwifery Care	0.6	0.5, 0.9	.001

In logistic regression all variables remained in the model and explained only 5% of the variance in augmentation of labor. After controlling for ethnicity, parity, and prolonged labor, women cared for by nurse-midwives were 1.6 times less like to experience augmentation of labor (*CI* 1.3, 2.1; $p = .001$).

Epidural Anesthesia

Two hundred and seventy two women (23.3%) had either no anesthesia or only local anesthesia. Cases of epidural or spinal anesthesia ($n = 579$, 49%) were counted for any occurrence of epidural or spinal anesthesia whether given alone or in combination with other analgesia or anesthesia. Thirty-five (35%) of the women who had epidural anesthesia gave birth via cesarean section ($n = 203$). Only 18 women (8%) having a C/S did not have an epidural. A significantly higher proportion of women cared for by physicians ($n = 232$, 62.5%) had epidural anesthesia, compared to women cared for by nurse-midwives ($n = 347$, 32.6%, $p < .001$).

When considered alone main provider for care ($p < .001$), ethnicity ($p < .001$), public insurance ($p < .001$), < 11 years of education ($p < .001$), current alcohol or substance abuse ($p = .02$), asthma ($p = .01$), genital herpes ($p = .007$), and monolingual in a language other than English ($p < .001$) were significantly associated with epidural anesthesia. These variables were entered into logistic regression using forward selection at the 95% confidence interval. The final model, after controlling for ethnicity ($p = .007$), public insurance (*OR* .44, *CI* 0.27, 0.74, $p = .002$), and genital herpes (*OR* 2.7, *CI* 1.18, 6.31, $p = .02$) demonstrates that women cared for by nurse-midwives were 1.7 times less likely to have epidural anesthesia than women cared for by physicians (*CI* 1.25, 2.3, $p = .001$).

Epidural anesthesia is the most frequently used anesthetic for cesarean section at the two study sites. When the data were restricted to vaginal deliveries ($n = 917$) and re-

analyzed, genital herpes was not a significant variable in the model, suggesting an interaction between herpes and cesarean section. After controlling for the 2 factors significantly associated with epidural anesthesia (ethnicity and public insurance), women in the nurse-midwifery care group having vaginal deliveries were 1.5 times less likely to have an epidural than women in the physician care group (*CI* 1.1, 2.1, $p = .02$).

Vaginal Delivery and Cesarean Section

The overall rate of cesarean section in the study population was 19%. There were significant differences between provider groups for both the dichotomous variable of vaginal delivery vs. cesarean sections as well as by type of delivery ($p < .001$). Table 24 details the analysis of the differences by type of delivery.

Bivariate analysis. There was a statistically significant relationship between the dichotomous variable Vaginal Delivery/Cesarean Section and 12 other variables. Table 25 presents the results for demographic variables. When the variables were considered alone women who were more likely to have a vaginal delivery were younger and less educated.

Table 26 presents the associated medical and psychosocial risks. Women significantly more likely to have a cesarean section had more medical risks, were overweight at entry to care, smoked cigarettes, had genital herpes, diseases of pregnancy, were homeless or lived in a hotel, and had a prior history of domestic violence. Proportionally more women currently experiencing domestic violence experienced cesarean section (6.0%) vs. vaginal delivery (3.9%) but this was not statistically significant ($p = .17$).

Logistic Regression. The first logistic regression model included all the variables that were significantly associated with type of delivery. Table 27 presents the initial and final models.

Table 24

Between Group Differences by Type of Provider in the Type of Delivery

Type of Delivery	Nurse-Midwifery Group	Obstetrician Group
	n (%)	*n* (%)
Total Vaginal*	674 (84.1)	276 (74.2)
Vaginal*	647 (80.8)	256 (68.8)
VBAC*	27 (3.4)	20(5.4)
Total C/S*	127 (15.9)	96 (25.8)
Primary Cesarean Section*	67 (8.4)	51 (13.7)
Repeat Cesarean Section*	38 (4.7)	24 (6.5)
Failed VBAC*	22 (2.7)	21 (2.7)

*$p < .001$

Table 25

Demographic Differences for Vaginal and Cesarean Deliveries

Variables	Vaginal	Cesarean Section
	M, (SD), n	*M, (SD), n*
Mean Age in Years**	25.2 (*SD* 6.1) 950	28.2 (*SD* 6.2) 223
Mean Years Education*	9.9 (*SD* 3.6) 927	10.6 (*SD* 3.7) 215
	n (%)	*n* (%)
Age > 35 at Delivery**	90 (9.5)	37 (16.6)
Education ≤ 10 years*	78 (36.6)	415 (44.8)
Ethnicity**		
African-American	143(15.2)	38 (17.3)
Asian/Pacific Islander	130 (13.8)	33 (15.0)
Hispanic	570 (60.7)	111 (50.5)
Non Hispanic White	89 (9.5)	32 (14.5)
Other	7 (0.7)	6 (2.7)
Nulliparous (G1)*	303 (31.9)	53 (23.8)

** $p \leq .007$, * $p < .05$

Table 26

Differences for Vaginal and Cesarean Section by Medical and Psychosocial Variables

Variables	Vaginal	Cesarean Section
	m, (*SD*), *n*	*m*, (*SD*), *n*
Mean Medical Risks**	3.19 (1.79) 950	3.94 (2.11) 223
Mean Total Risks**	7.38 (2.61) 950	7.95 (2.84) 223
	n (%)	*n* (%)
Inadequate Weight Gain**	415 (46.2)	76 (35.7)
Underweight at entry to care*	87 (9.6)	10 (4.7)
Overweight at entry to care**	355 (39.6)	117 (54.2)
Smokes Cigarettes**	120 (12.9)	44 (19.9)
Herpes *	21 (2.2)	12 (5.5)
Diseases of Pregnancy**	106 (11.2)	41 (18.4)
Previous Preterm Delivery or LBW*	60 (6.4)	25 (11.3)
Living in a Hotel/Homeless*	22 (2.5)	11 (5.1)
Prior Domestic Violence**	78 (8.7)	32 (14.9)

* $p < .05$. ** $p \leq .007$.

Table 27

Logistic Regression Models Predicting Vaginal Delivery

	Initial Model			Final Model		
Covariates	*OR*	95% *CI*	*p*	*OR*	95% *CI*	*Sig.*
Ethnicity			NS			
African-American	1.21	.68, 2.21				
Asian/Pacific Islander	1.21	.64, 2.36				
Hispanic	1.39	.82, 2.36				
Non Hispanic White	1.00					
Nulliparous (G1)	0.97	.62, 1.52	NS			
Mean Years Education	0.94	.82, 1.08	NS			
Mean Age in Years	0.73	.61, 0.89	.001	.94	.92, .97	.001
Overweight	0.72	.51, 1.02	.06	.72	.52, .99	.05
Inadequate Weight Gain	1.49	1.05, 2.11	.03	1.64	1.17, 3.31	.004
Underweight	1.44	.70, 2.95	NS			
Smokes Cigarettes	0.87	.54, 1.38	NS			
Herpes	0.50	.22, 1.14	NS	.41	.19, .92	.03
Diseases of Pregnancy	0.72	.46, 1.14	NS			
Previous PTD or LBW	0.55	.31, 0.99	.05			
Living in a Hotel/Homeless	0.62	.25, 1.54	NS			
Prior Domestic Violence	0.67	.40, 1.12	NS			
Nurse-Midwifery Care	1.42	1.00, 2.05	.05	1.60	1.16, 2.20	.004

Four variables besides type of care provider predicted type of delivery. Age at LMP, herpes and being overweight at entry to care each were significant predictors of cesarean section. Inadequate weight gain in pregnancy was protective against Cesarean section. After non-significant covariates were removed from the model, women cared for by nurse-midwives were .63 times less likely to have a cesarean section (95% *CI* 0.86, 0.46; $p = .004$) than women cared for by physicians.

Operative Vaginal Deliveries

Table 28 presents the rates for all methods of delivery. Thirteen variables were significantly associated with operative vaginal delivery (vacuum or forceps) and entered into the first model of the logistic regression. Table 29 presents the final model. Women having an augmented labor and evidence of personalized care intrapartum were more likely to have an operative vaginal delivery. Being multiparous was protective against vaginal operative delivery. Women cared for by nurse-midwives were 2.12 times less likely to have a vaginal operative delivery than women cared for by physicians (*CI* 1.35, 3.33, $p = .001$).

Table 28

Method of Delivery By Provider Group

Type of Delivery	Nurse-Midwifery Group	Obstetrician Group	Total
	n (%)	*n* (%)	*n* (%)
Vaginal vertex*	620 (77.5)	229 (61.7)	849 (72.5)
Forceps or vacuum	53 (6.6)	45 (12.1)	98 (8.4)
Vaginal breech	0 (0)	2 (0.5)	2 (0.2)
Total C/S	127 (15.9)	96 (25.8)	223 (19.0)

Table 29

Logistic Regression Models Predicting Operative Vaginal Delivery

	OR	95% *CI*	*Sig.*
Multiparas	0.43	0.31, 0.59	< .01
Augmentation of labor	1.75	1.12, 2.72	< .01
Personalized care IP	1.83	1.10, 3.08	.02
Nurse-midwifery care	0.47	0.30, 0.74	.001

Non-Technologic Care Measures

Hypothesis Three: After controlling for medical risk status, nurse-midwifery care of women at moderate risk for poor pregnancy outcome will result in higher rates of non-technologic care measures: viz. personalized care, psychosocial/educational care measures, and non-technologic comfort measures in labor than rates among women cared for by obstetricians.

Antepartum Care Measures

Personalized care antepartum. This variable was defined as evidence of the provider altering a routine plan of care based upon the patient's wishes antepartum (AP). For example, if there was evidence in the chart that a patient wished to defer routine third trimester laboratory studies for gestational diabetes and anemia, this was counted as personalized care. This type of care was documented for only 101 women (8.9%) of the study population.

Table 30 presents the 8 characteristics which, when considered alone, were significantly associated with personalized care AP. The final model demonstrates that after controlling for ≥ age 35 at delivery, > 1 UTI and unwanted pregnancy, women cared

for by nurse-midwives were 1.79 times more likely to have experienced personalized care AP than women cared for by physicians (*CI* 1.10, 3.00; $p = .03$).

Table 30

Characteristics Related to AP Personalized Care Measures

	Personalized Care	No Personalized Care
	n (%)	*n* (%)
Nurse-midwifery care*	78 (10.1)	691 (89.9)
Ethnicity*		
African-American	12 (11.9)	168 (16.4)
Asian/Pacific Islander	9 (8.9)	151 (14.8)
Hispanic	61 (60.4)	590 (57.7)
Non Hispanic White	19 (18.8)	101 (9.9)
Other	0 (0)	13 (1.3)
Age ≥ 35 at delivery*	18 (17.8)	109 (10.5)
Fibroids*	4 (4.0)	12 (1.2)
STDs*	4 (4.0)	104 (10.0)
> 1 UTI**	11 (10.9)	41 (4.0)
Children in another country*	11 (11.6)	57 (5.6%)
Unwanted pregnancy*	6 (6.3)	21 (2.1)

* $p < .05$. ** $p \leq .003$.

Evidence of provider discussions. The second AP dependent variable, evidence of provider discussions ($n = 368$) captured evidence of the health education and counseling activities of providers. For example, this variable was scored "yes" when charting indicated that providers discussed nutrition, exercise, social stressors, plans for labor etc.

Using bivariate analysis, ethnicity, public and private insurances, previous birth of preterm or LBW infants, close interval pregnancy, diagnosis of IUGR, infections requiring antibiotics, gestation diabetes (both insulin dependent and diet controlled), eligible for but not enrolled in WIC, single without support, inadequate amount of prenatal care, evidence of personalized care and nurse-midwifery care were all found to be significantly associated with evidence of provider discussions.

Table 31 presents the final logistic regression models for this variable. When controlling for all significant covariates, women receiving nurse-midwifery care were 3.1 times (*CI* 2.2, 4.5; $p < .001$) more likely to have had provider discussions and health education activities antepartum.

Table 31

Logistic Regression for Evidence of Provider Discussions

	OR	95% *CI*	*p*
History previous preterm or LBW delivery	2.0	1.2, 3.3	.004
IUGR	3.7	1.1, 12.3	.03
Infections requiring antibiotics	2.3	1.4, 3.6	< .001
GDMI	5.3	1.9, 2.5	.002
GDM Diet	1.9	1.0, 3.4	.05
On Medi-Cal/not enrolled in WIC	1.9	1.0. 3.6	.04
Private insurance	0.3	0.1, 0.7	.004
Inadequate PNC	0.7	0.5, 0.9	.02
Nurse-midwifery care	3.1	2.2, 4.5	< .001

Women with IUGR, previous preterm or LBW births, infections requiring antibiotics, insulin dependent gestational diabetes, single without social support, or not enrolled in the WIC program were also more likely to have had provider discussions. Women with an inadequate amount of prenatal care or private insurance were less likely to have had provider discussions.

Intrapartum Care Measures

Non-technological processes of care. In this category, information was collected using three separate variables: intermittent fetal monitoring, no IV ordered, and "permitted to eat in labor". These 3 variables were combined into a new variable termed non-technological care processes. This was scored "yes" if any one of the three non-technological care measures had been documented. For women receiving non-technological care measures, the mean number of processes received was 1.5.

The final logistic regression model is presented in Table 32. After controlling for all 14 significant covariates found in bivariate analysis, women having nurse-midwifery care were more likely to have received non-technological care processes (*OR* 1.8; *CI* 1.3, 4.2). Hispanic women were also more likely to have non-technological processes of care. For every additional psychosocial risk factor women had, there was a very small (*OR* 1.1) but significant increase in the odds of receiving non-technological care methods. Those with private insurance, having experienced a previous cesarean section, having diseases of pregnancy and other medical risks were less likely to receive non-technological care processes.

Comfort measures in labor. Comfort measures in labor were defined as evidence in the chart that a woman was encouraged to walk, shower, change position, etc. When considered alone, ethnicity, age < 17, < 11 years of education, asthma, insulin dependent

gestational diabetes, previous cesarean section, number of medical and psychosocial risks, and unwanted pregnancy were significantly associated with comfort measures (n = 398). In the final logistic regression, the mean number of medical risks (*OR* .91; *CI* .84, .97; $p < .008$), age < 17 (*OR* 2.1; *CI* 1.2, 3.6; $p = .01$), and nurse-midwifery care (*OR* 2.6; *CI* 1.9, 3.5; $p < .001$) significantly predicted the use of non-technological care practices.

Table 32

Logistic Regression for Non-Technological Care Processes IP

	OR	95% *CI*	*p*
Hispanic ethnicity	2.3	1.4, 3.7	.001
Private insurance	.35	.17, .73	.005
Previous cesarean section	.26	.16, .40	< .001
Diseases of pregnancy	.51	.33, .76	.001
Other medical risks	.60	.44, .83	.002
Number of psychosocial risk factors	1.1	1.0, 1.2	0.03
Nurse-midwifery care	1.8	1.3, 2.5	< .001

Evidence of personalized care IP. When considered alone, 11 variables were significantly associated with evidence of personalized care IP. The final logistic regression model was presented in Table 33. After controlling for these variables, women having a nurse-midwife provide care were three times more likely to have received personalized care in labor.

Table 33

Logistic Regression for Personalized Care IP

	OR	95% *CI*	*p*
< 11 Years of education	2.1	1.5, 2.9	< .001
Cholestasis	3.2	1.4, 7.5	.006
Infections requiring antibiotic	2.6	1.6, 4.4	< .001
Runs out of food	5.7	2.2, 4.4	< .001
Nurse-midwifery care	3.1	2.2, 4.5	< .001

Breastfeeding

Hypothesis 4: After controlling for medical risk status, nurse-midwifery care of women at moderate risk for poor pregnancy outcome will result in higher rates of breastfeeding at six weeks postpartum than rates in women cared for by obstetricians. This hypothesis was supported.

Information about infant feeding was collected at four points in time: within 6 hours after delivery, at discharge, two weeks postpartum, and six weeks postpartum. Presented here are results of the two most important points in time: breastfeeding (BF) following delivery and at 6 weeks postpartum.

Breastfeeding Following Delivery

Table 34 presents the significant demographic differences between women who did and did not breastfeed with 6 hours postpartum. Chi square analysis revealed that significantly more women cared for by nurse-midwives breastfed within 6 hours post delivery (n =531, 70.5%, p < .001) compared to women cared for by obstetricians (n =187, 52.5%).

Table 34

Demographic Characteristics: Breastfeeding within 6 Hours Following Delivery

Characteristics	Breastfed within 6 hours	Did not breastfeed
	M, SD, n	*M, SD, n*
Age in Years*	25.3 (6.1) 718	26.6 (6.4) 391
Years Education*	9.8 (3.9) 704	10.5 (3.6) 375
	n (%)	*n* (%)
< 11 Years Education*	331 (47.0)	136 (36.3)
Ethnicity*		
African-American	76 (10.7)	93 (24)
Asian/Pacific Islander	80 (11.3)	71 (18.3)
Hispanic	481 (67.8)	175 (45.2)
Non Hispanic White	67 (9.4)	41 (10.6)

* $p \leq .007$

Factors having significant relationship to breastfeeding within 6 hours post delivery were ethnicity, mean age at LMP, mean years of education, less than 11 years of education, inadequate weight gain, current substance abuse, diseases of pregnancy, eligible for WIC but not enrolled, recent immigrant, evidence of personalized care during labor and type of delivery.

Table 35 details the model predicting breastfeeding within 6 hours of delivery. After controlling for all statistically significant confounding variables, women cared for by nurse-midwives were 1.79 times more likely to breastfeed than those cared for by physicians (95% *CI* 1.32, 2.25).

Table 35

Logistic Regression for Breastfeeding within 6 Hours After Birth

Covariates	*OR*	95% *CI*	*p*
Ethnicity			< .000
Non-Hispanic White	1.00	Reference	
African-American	0.48	(0.28, 0.82)	.007
Asian/Pacific Islander	0.69	(0.39, 1.19)	0.18
Hispanic	1.28	(0.80, 2.05)	1.28
Other	0.40	(0.12, 2.02)	0.49
Not enrolled in WIC	0.40	(0.20, 0.78)	.007
Recent Immigrant	1.90	(1.13, 3.02)	0.02
Type of Delivery			< .001
Vaginal	1.00	Reference	
VBAC	0.69	(.35, 1.63)	0.29
Primary C/S	0.28	(.18, 0.43)	< .001
Repeat C/S	0.27	(.15, 0.51)	< .001
Failed VBAC	0.21	(.09, 0.45)	< .001
Personalized care IP	1.84	(1.21, 2.81)	.004
Nurse-Midwifery Care	1.79	(1.32, 2.44)	< .001

Women who received personalized care during the intrapartum period and were recent immigrants were also more likely to breastfeed within 6 hours postpartum. Other variables remaining in the model were ethnicity, not enrolled in the WIC program, and type of delivery.

In the group of women who were cared for by a nurse-midwife and who received

personalized care IP, the *OR* for breastfeeding within 6 hours of birth was 2.2 (*CI* 1.4, 3.5; $p = .001$). This was an increase in the *OR* for women in either nurse-midwifery care (*OR* 1.6) or who experienced personalized care IP (1.8).

Breastfeeding at 6 Weeks Postpartum

Missing information about infant feeding choices increased with each subsequent data point. At discharge, 72 (1%) cases had missing information for this variable, at 2 weeks postpartum, 739 cases or 63% of the total study population had missing information. At 6 weeks postpartum information was found in only 233 cases (20%).

Three variables significantly associated with breastfeeding at 6 weeks postpartum were identified using bivariate analysis. Women who were cared for by nurse-midwives ($n = 147$) were 1.84 (*CI* 1.10, 3.2; $p = .03$) times more likely use breastfeeding as the only type of infant feeding than women cared for by obstetricians ($n = 86$). Women who had a close interval pregnancy were also more likely to breastfeed. Women who were over the age of 35 at birth were 2.6 times *less* likely to breastfeed (*CI* 1.1, 6.3; $p = .03$).

The effect of provider group on breastfeeding as the only method of infant feeding was not found at 6 weeks postpartum. After reviewing the results, a new variable "Any breastfeeding at 6 weeks PP" was created from breastfeeding only and breast and bottle. This variable is more inclusive, including women who used mixed feeding methods. For example, those who return to work or wish partners to participate in feeding their child may supplement breast with bottle-feeding. Some use formula, others pump their breasts and use breast milk in bottles.

Of the 233 women returning for care at 6 weeks postpartum, 100 (48%) were exclusively breastfeeding and another 85 (36%) women used both breast and bottle. Only ethnicity, evidence of personalized care IP and nurse-midwifery care were associated with

any type of breastfeeding at 6 weeks postpartum. In the logistic regression, only ethnicity and nurse-midwifery care remained in the model. Women cared for by nurse-midwives were 2.2 times more likely to either exclusively breastfeed or to use breast and bottle at 6 weeks postpartum (*CI* 1.1, 4.5; $p = .03$).

Contacts With The Health Care System Postpartum

Hypothesis Five: After controlling for medical risk status, there will be no significant differences in the number of contacts with the health care system for problems related to the mother's health between discharge and 8 weeks postpartum for women receiving nurse-midwifery outcome compared to women cared for by obstetricians. This hypothesis was supported.

Women in both provider groups had and average of 1.3 visits in the first 8 weeks postpartum ($n = 430$, t = - .10, df 428). When considered alone, a significantly ($p = .002$) smaller proportion of single women had 2 or more postpartum visits ($n = 90$, 35.2%) compared with married women ($n = 87$, 50%). Women receiving an inadequate amount of prenatal care ($n = 53$, 30.1%) also were less likely (*OR* = .66; *CI* .43, .99) to have more than two visits in the first 8 weeks postpartum as compared to those with intermediate or better levels of PNC (n =123, 69.2%, $p = .05$). Women with a history of previous cesarean section were 1.9 times more likely to have 2 or more postpartum visits in the firs 8 weeks postpartum than other women ($n = 56$; *CI* = 1.1, 3.4; $p = .02$). Women experiencing a cesarean section were 2.1 times more likely to have 2 or more visits ($n = 50$; *CI* =1.3, 3.3; $p = .002$).

Summary

The results for Hypotheses 1 (LBW) and 5 (number contacts with health care system) demonstrate no significant differences, confirming the hypotheses. After controlling for

significant covariates, in this sample population of moderate risk women the differences by type of provider for the following dependent variables were:

Hypothesis 2: Technological interventions

Sonograms- *OR* .6 (*CI* 0.42, 0.77; $p < .001$)

Augmentation of labor- *OR* 0.6 (*CI* 0.5, 0.9; $p = .003$)

Epidural anesthesia- *OR* 0.6 (*CI* 0.4, 0.8; $p = .001$)

Cesarean section- *OR* 0.6 (*CI* 0.5 0.9, $p = .004$)

Forceps or vacuum- *OR* 0.5 (*CI* 0.7, 3.03; $p = .001$)

Hypothesis 3: Personalized care AP- *OR* 1.8 (*CI* 1.1, 3.0; $p = .03$)

Evidence of provider discussions *OR*3.3 (*CI* 2.2, 4.5; $p < .001$)

Non-technological processes of care *OR* 3.1 (*CI* 2.3, 4.2; $p < .001$)

Comfort measures in labor *OR* 2.6 (*CI* 1.9, 3.5; $p < .001$)

Personalized care intrapartum *OR* 3.1 (*CI* 2.2, 4.5; $p < .001$)

Hypothesis 4: Breastfeeding within 6 hours of delivery *OR* 1.8 (*CI* 1.3, 2.4; $p < .001$)

Breastfeeding at 6 weeks postpartum *OR* 2.2 (*CI* 1.1, 4.5; $p = .03$)

The results provide evidence that nurse-midwifery care was appropriate and safe for women who are at moderately increased risk of poor pregnancy outcome. The results confirm that nurse-midwives achieve outcomes equivalent to or better than those of physicians while using fewer technologic interventions.

CHAPTER 5

Discussion

Although retrospective in nature, the design of this research permitted several important comparisons to be made between the nurse-midwifery and obstetric models of care. In this section of the report the findings will be discussed in the context of the contemporary research literature about low birthweight, technologic interventions, and non-technologic care measures. The limitations are delineated, and implications of the study findings as well as directions for future research are described.

Significance of the Study

Significant study findings are presented in this chapter; one of the most notable contributions is that this research provided the *first* definition, description, and testing of some of the variables and conditions that make a woman at "moderate risk" for poor pregnancy outcomes. In order to understand the scope of this contribution, it is necessary to describe some of the history of the care of childbearing women in the United States.

In the United States the practice of medicine and obstetrics has been defined by its practitioners and ratified by law. In other words, the practice of medicine is what its practitioners say it is, and anyone who is believed to infringe on this practice is liable for legal action because they are "practicing medicine without a license".

In obstetrics, physicians have defined their practice as the care of all childbearing women. As maternal mortality decreased during the last century, the focus of obstetrical care has changed to the assessment and management of risk for poor pregnancy outcomes. Generally there is consensus about what conditions and factors constitute a "high risk" pregnancy as described earlier in this report. At the other end of the

continuum, the definition of "low risk" for obstetric complications has become the absence of any of those complications. These two categories of risk are fairly discrete. However, little attention has been directed toward the conditions that fit into neither category of risk and could be identified as "moderate risk" variables.

Nurse-midwives began to carve out a niche for themselves during the late 20th century, and the definition of their clinical practice was negotiated within a medico-political environment. Then and now, care of childbearing women with significant medical or obstetric risk factors was exclusively in the domain of medical practitioners. The practice of nurse-midwives was restricted to "normal" women, viz. those who had little medical or obstetric risk of poor pregnancy outcomes. The effect of psychosocial risk on pregnancy outcome was seldom studied.

However, nurse midwives have always cared for women who have complicated pregnancies. In nurse-midwifery practice, research and education, the health, social, and economic status of childbearing women has been described from the earliest reports about nurse-midwifery care in the United States. Certainly the childbearing women of Appalachia cared for by the nurse-midwives in the Frontier Nursing Service were at risk for poor pregnancy outcomes because of economic, psychosocial, medical, and obstetric factors.

Throughout the nurse-midwifery literature the definition of nurse-midwifery practice has continued to be the care of "normal", "essentially normal", or "low risk" women. This has continued in spite of all of the evidence about the level of complexities of the women cared for by nurse-midwives. When research about the outcomes of midwifery practice has been conducted, it has been with the unquestioned assumption that the women cared for were "normal" and at "low risk" for complications. When

comparisons with obstetric outcomes were made, that assumption clouded findings because of the lack of clarity about midwifery outcomes in the context of the risk status of those women for whom they provided care.

Conducting research that compares and contrasts the outcomes of care within midwifery and medical models of care is important in order to develop health policy in an era of cost containment. It is also essential to acknowledge that contemporary midwifery practice occurs within a context of collaboration with physicians. In order for that collaboration to be most effective, clarity about what facilitates good outcomes among which groups of women is fundamental. A central contribution of this research is that "moderate risk" has been defined and tested within different models of care.

Study Population

This study restricted the study population to moderate risk women and was comprised of mainly poor women in ethnically diverse groups. This is an understudied population in midwifery outcomes research (Fullerton & Wingard, 1990; Thompson, 1986). Only one recent study comparing outcomes of nurse-midwives to physicians (Visintainer et al., 2000) was identified that used a population of women cared for by nurse-midwives similar to those in this dissertation project.

In the current research project the demographic profile of women cared for by nurse-midwives reveals trends comparable to the population based research findings of the 1990's (Paine et al., 1999). For example, in the current study, women of color were more likely to be cared for by nurse-midwives than by obstetricians, as were single women, those < 17 years of age and those with ≤ 10 years of education, similar findings to those of earlier research. These results confirm earlier findings demonstrating that midwives care for a greater proportion of women with demographic risks associated with poor pregnancy

outcome.

The similarities in the number of risk factors by type of provider are of importance when interpreting the results. For total risk factors, the means were nearly identical (7.5 for women in the nurse-midwifery care group and 7.4 for the women in the obstetric care group). The difference in numbers of medical risk factors between women in obstetric or nurse-midwifery care (3.6 and 3.2 respectively) while statistically significant, was not clinically important.

Women cared for by the nurse-midwives had slightly more (4.3 vs. 3.8) psychosocial risk factors than those cared for by physicians. This might be related to a bias held by ancillary personnel (who have some influence on a women's selection of the type of provider) that that the midwives have more time to spend with women who have increased social risks.

In the current study nurse-midwives cared for a higher proportion of women who have had a close interval pregnancy, bacterial vaginosis or Group β, any STD or vaginitis, any other infectious disease, and > 1 UTI during pregnancy. This higher proportion of women diagnosed with infections of the uro-genital tract and other infections requiring antibiotics might be the result of a higher rate of testing, as found by Oakley et al. (1995) and Slome et al. (1974). Thos researchers found that nurse-midwives used significantly more physiological tests ($p < .005$) than physicians, such as testing for urinary tract infections and gestational diabetes.

In summary, the between group differences found in the current study are comparable to those found in earlier population based research. These results, similar to those of previous studies, refute the assertion that nurse-midwives care *only* for patients who represent a low risk population. The findings also demonstrate the generalizability of the

current findings to the broader population of women cared for by nurse-midwives.

Low Birth Weight

Rates of LBW in the Study Population

This study was rooted in a feminist perspective. When developing knowledge about the outcomes of nurse-midwifery care from that framework, it is important to identify outcome measures which are important to women as well as to society and to researchers representing the academic and scientific communities. Confirming a taken for granted notion, Powell-Kennedy (Kennedy, 1999, 2000) found that women and midwives each regarded optimal infant health to be an important outcome of maternity care. This finding confirms that low birth weight is an important outcome measure to be used in research examining the efficacy of nurse-midwifery care for women of moderate risk status.

No significant differences between rates of low birth weight by type of provider group were found. The non-significant results are a positive finding. This evidence demonstrates that nurse-midwifery care is appropriate for women who are at moderately increased risk of poor pregnancy outcome and not only for women in low risk populations.

An accurate determination of the main provider for the majority of care was made possible by the retrospective study design. Using chart review and computerized data files, it was possible to track the patterns of care for women who transferred from midwifery to physician care. It was possible to analyze both the amount of care received from each provider group as well as the outcomes for women delivering under physician care.

The results of this analysis helps to illuminate the seeming paradox between previous epidemiologic studies suggesting that nurse-midwifery care improves rates of LBW and

the intervention studies reporting more equivocal results (Heins et al., 1990) & (Slome et al., 1976). Without the ability to use intent to treat analysis, transfer of high risk women from a nurse-midwifery group to physician care either antepartally or for delivery introduces a possibility that the samples are biased toward higher risk in the physician group. If statistically significant differences are found, they may be the result of Type 2 error.

In the current study, the comparison groups were independent of one another and the aggregate risk profile of each was similar. Where significant differences occurred they were controlled for in the regression model. Therefore, the non-significant differences found in rates of LBW represent an accurate picture of the small differences in LBW related to type of provider in this population. Heins et al. (1990) found similar results: differences that were clinically important but statistically non-significant in an experiment comparing the efficacy of nurse-midwifery to physician care in the prevention of LBW.

While these differences are not statistically significant, and therefore may be due to chance, the findings demonstrate a pattern of reduction in LBW and have clinical implications. If care by nurse-midwives was the standard type of care available to most pregnant women of low or moderate risk, as it is in many European countries, a strong potential could exist for a reduction in the rate of LBW in the U.S.A.

Two important and related issues are demonstrated in the above discussion: (a) Research aiming to find causal relationships should use appropriate populations, i.e. women who are not low risk but are truly at risk of LBW, and (b) the research should carefully specify the intervention (in this case, nurse-midwifery care including accounting for transfer of care). In the current study, these issues were successfully addressed. Therefore, the non-significant differences contribute to evidence that nurse-midwifery

care is appropriate for women at moderate risk for LBW.

Risk Factors Related to LBW

Demographic Risks. In the logistic regression, women with less than 11 years of education were 2 times less likely to deliver a LBW infant. Only 4% of women with this level of education (n = 493) delivered a LBW infant. This finding is counter to that of population based research. This may be the result of the large proportion of Hispanic women with < 11 years of education (n = 416, 84.7%) who have an impressively low rate of LBW.

While in the general U.S. population women of Hispanic origin have overall rates of LBW equivalent to those of non-Hispanic White women, the rate of LBW for the Hispanic women in this study (3.4) was approximately one half that of non-Hispanic White women (6.6) and one third that of women from all other ethnic backgrounds (9.9). Additionally, the low rate of LBW for Hispanic women in the current study was lower than the California state average for Hispanic women of 5.5% (Fuentes-Afflick & Lurie, 1997).

With normal or greater weight for height at entry to care, and low rates of smoking and drug or alcohol use, the Hispanic women in the study have good baseline health status despite poverty and increased psychosocial risks. In combination with appropriate use of PNC, a protective effect on LBW was seen. This is consistent with the results of previous research. For example, Lu (2000) reported rates of low birth weight tripled (from 6.0% to 18.0%) among undocumented Hispanic women who did not receive prenatal care.

The lower rate may also be due to the country of origin of the women. In the current study, data were not available about the women's country of origin. A majority of the women at the SFGH site are of Mexican and Central American descent, groups who are

shown to have the lowest rates of LBW among Hispanics. For example, Stinson, Lee, Heilman, Goss and Koshar (2000) determined the rate of LBW for Hispanic women in their study to be 6.0%. The women (N = 783) were from the Central Valley of California. Consistent with other research, they found that the rates between US-born and Mexico-born women were significantly different.

Researchers have pointed out that while health indicators for Hispanic women are usually reported in the aggregate, it is more helpful to study and report outcomes by country of origin as rates vary significantly by this factor (Portillo et al., 2001). Since country of birth was not able to be determined in the current study, a definitive analysis of this important covariate was not possible.

Medical Risk Factors

As would be expected, women giving birth to a LBW infant had significantly more medical risks than women giving birth to a normal weight infant. However, this was not a significant factor in the logistic regression for LBW.

In the final logistic model the medical conditions were history of delivering a previous low birth weight or pre-term infant, admission for pre-term labor during the current pregnancy, hypertensive diseases of pregnancy and IUGR. These risks are consistent with risk of LBW described in the literature.

Hypertensive diseases, mild pre-eclampsia, pregnancy induced hypertension and severe pre-eclampsia are common predictors of LBW. In Kaltrider and Kohl's (1980) classic description of the epidemiology of LBW, hypertensive diseases were associated with 8-fold increases in LBW in term LBW. The current study had similar results demonstrating a 3-fold increase in the odds of LBW related to hypertension of pregnancy and an 11-fold increase for severe pre-eclampsia.

Women with a diagnosis of IUGR had the greatest risk of LBW. Since the clinical indications for evaluation of the potential for IUGR stem from assessment that the fetus is not size appropriate to dates (either by measurement of fundal height or by clinical estimation of fetal weight), it was not surprising to find this relationship. Additionally, the suspected etiology for IUGR is either inadequate maternal nutrition or restricted blood flow to the uterus. When considered alone each of these mechanisms were significantly associated with LBW in the current study (hypertensive disease and inadequate weight gain), though only hypertensive disorders remained in the final regression.

There is a great deal of attention in the public health literature focused on reduction strategies for behavioral risks associated with low birth weight. In this study population, behavioral risks were not significantly associated with rates of LBW. This is due to the large proportion of Hispanic women in the study who have significantly lower rates of substance abuse compared with women in other ethnic groups.

Women of Hispanic descent historically have low rates of smoking, drug or alcohol abuse. In the study sample only 2% of Hispanic women had a history of drug or alcohol abuse or current abused drugs or alcohol. In comparison, approximately 20% of non-Hispanic white women in this study had a history of or currently abused drugs or alcohol.

Rates of smoking in the current study were slightly higher than the national average. In 1999 the rate of smoking was for all women giving birth in the United States was 12.3%. The overall rate of smoking for the study populations was 14%, lower than the 18% rate found by Mac Dorman and Singh for births occurring during 1991 (1998).

For Hispanic women giving birth in the U.S. during 1999 the rate of smoking was 3.7% (Mathews, 2001). For Hispanic women in the current study the rate of smoking was 6.5%. However, these rates are considerably lower than those of women in other ethnic

groups in the study. For example, for non-Hispanic white women the rate of smoking was 32%.

Psychosocial risk. In the final logistic regression model only one psychosocial risk factor was significantly associated with LBW. Women who were living alone at the time of the pregnancy were approximately 11 times more likely to give birth to an infant at LBW than women who lived with others. None of the women living alone delivered preterm and none had any of the medical conditions significantly associated with LBW in the final logistic regression model.

Lack of social support has been associated with LBW. While none of the women living alone were identified in the chart as being without social support, perhaps the effect of a solitary living situation makes accessing her support system more difficult and magnifies the stressors inherent in pregnancy.

Technological Interventions

In recent years, use of technology has increased nationwide (Ventura, Martin, Curtin, Menacker, & Hamilton, 2001) although the benefits of routine use of technology have not been proven (Chalmers, Enkin, & Keirse, 1989). The appropriate use of technology is a hallmark of the nurse-midwifery model of care (Kennedy, 1999; Lehrman, 1981, Thompson et al., 1989).

It is important to restate that women's preferences for intervention have been shown to contribute to rates of intervention (Gamble & Creedy, 2001; Goldberg, Cohen, & Lieberman, 1999; Oakley et al., 1995). In the current study, women's specific preferences could not be assessed because of the retrospective design of the research project. However, the philosophy of nurse-midwifery care includes individualization of care, and the participation of the woman in all decisions regarding her care. It was assumed that this

participation, and by extension, the woman's preferences for care practices, are reflected in the rates of interventions used by nurse-midwives in this study.

The results of this study confirm the results of earlier midwifery outcomes research reviewed in Chapter 2. In general, women cared for by nurse-midwives in the current study were less likely to experience operative deliveries, augmentation of labor and epidural anesthesia. The results of this study make a unique contribution to the body of knowledge about nurse-midwifery care because the study population was representative of women at risk for these interventions. Additionally, the results indicate that nurse-midwives appropriately use technologically based interventions when necessary.

Sonograms

The rate of women receiving at least one sonogram (n = 992, 85%) was considerably higher than the national rate of 66% for 1999 (Ventura et al. 2001). When conditions potentially associated with use of sonography were examined, several significant associations were observed.

Diseases of pregnancy, fibroids, other medical risk factors, and running out of food were each significant predictors of number of sonograms. This is consistent with the need for assessment in women having conditions of pregnancy that increase the risk of poor outcomes. Having private insurance and receiving an inadequate amount of prenatal care were significantly associated with fewer sonograms received during pregnancy. Inadequate prenatal care is indicative of late entry into prenatal care and/or fewer visits than expected. Both result in less time in which evaluations can be made. Additionally, the experience of this clinician is that women with inadequate amounts of prenatal care are less likely to make additional contacts with the health system, e.g. to keep sonogram appointments.

Women with private insurance represent a group with higher SES than the rest of the study population. Obstetricians cared for 95% of the women covered by private insurance. Women with private insurance had significantly fewer risk factors compared with women covered by public insurance. While number of risks was not a significant contributor to the model explaining the variance in the number of sonograms received during pregnancy, the lower risk profile of women with private insurance may have influenced physicians' decision to utilize few sonograms for this group.

Sonography is also used in the assessment of fetal well-being in post dates pregnancy (> 40 weeks gestational age [GA]). The customary management of this condition includes twice weekly assessments, including sonography. Women may receive 1-2 sonograms per week after 40.5 weeks GA. Interestingly, neither the continuous variable gestational "age at delivery" nor the dichotomous variable "post dates pregnancy" were uniquely associated with number of sonograms or made a significant contribution to the model.

In this moderate risk population, use of sonograms to assist in the diagnosis of congenital diseases, to follow up clinical indications of lagging fetal growth, and to assess fetal well-being is expected and appropriate. There were no significant differences found in the number of ultrasounds received by women in the study population by type of provider. This result begins to illustrate the pattern of appropriate use of technology by nurse-midwives, that is, when indicated by a clinical condition.

In studies investigating outcomes of nurse-midwifery care in a *low risk* population, nurse-midwives have been shown to use fewer sonograms than obstetricians (Harvey et al., 1996, (MacVicar et al., 1993; Oakley, et al., 1995). In the current study, this trend is confirmed. The nurse-midwifery group had a higher proportion of women receiving only one sonogram as compared to the obstetrician group. Both results together confirm that

nurse-midwives provide safe care, investigating risk conditions when necessary and practice within their philosophical framework, minimizing the use of technology when possible.

Induction and Augmentation of Labor

Induction of Labor. Appropriate intervention can also be demonstrated by a discussion of induction of labor. The rates of induction of labor are similar for obstetricians (24%, n= 89) and nurse-midwives (22%, n = 174). In this study, when considered alone, the medical conditions significantly associated with induction of labor are diseases of pregnancy, cholestasis and IUGR. Selected interventions, including induction of labor, are appropriate in order to safeguard the health of the woman or the infant when these conditions have been diagnosed. In the final regression, all three variables predicted increased odds for induction of labor.

Nationally, rates of induction of labor have risen steadily from 15% in 1990 to 20 % in 1999 (Ventura et al, 2001). The slightly higher rates seen in the current study are understandable when the risk profile of the study population is considered. Consistency in the rates of induction across provider groups, for moderate risk women having the conditions listed above, was an indication of medically appropriate nurse-midwifery care. Since midwives in the two sites consult obstetricians when induction of labor was being considered, the rates are also indicative of a positive consulting relationship between the CNMs and obstetricians.

Augmentation of Labor. Augmentation of labor is a common and clinically important intervention. The positive effects include the prevention of cesarean section for failure to progress in labor. However, augmentation carries risks including increased pain in labor and decreased maternal satisfaction with the labor experience. Results of a recent RCT

investigating active management of labor in New Zealand found that women who received augmentation of labor were less satisfied with their birth experience than those who were not augmented (Sadler, Davison, & Mc Cowan, 2001).

In the current study the most common reason for augmentation was prolonged labor. Data on length of labor were not collected in this study. However, information on intrapartum complications was collected, among them was prolonged labor.

Forty (3.4%) women were identified as having a prolonged labor while 317 women were identified as having augmentation of labor. This compared favorably with the U.S. the 3% rate of dysfunctional labor in 1999 (Ventura et al., 2001). It is likely that prolonged labor is under reported as a complication of labor, both nationally and in the current study. Even with this potential limitation, the logistic regression indicates that women with prolonged labor listed as a complication were twice as likely to undergo augmentation of labor as those without this complication.

After controlling for race, parity, and prolonged labor women cared for by nurse-midwives were 1.6 times less likely to have augmentation of labor when cared for by nurse-midwives compared to women cared for by obstetricians. For women in nurse-midwifery care the rate was 24% and for women in the obstetric care group the rate was 34%. The overall rate of augmentation was 27%. These rates are all higher than the 18% national rate of stimulation of labor for 1999 (Ventura et al., 2001).

In the U. S., the rationale for augmentation of labor using either rupture of membranes or I.V. oxytocin may be based upon the frequency and perceived strength of contractions or lack of dilation of the cervix for one hour, even if the diagnosis of active labor has not been met. The reason for this is to shorten the duration of labor whether progress in labor is occurring at a normal rate. This practice is called "active management

of labor".

During chart review for the current study, many cases of augmentation were identified as beginning in latent phase labor or, conversely when a woman was admitted in active labor and advanced dilation (> 8 cm). The high rate of augmentation seen in the current study may be due to use of an informal active management of labor protocol at the study sites. The effect of this practice can be seen in the national increase in rates of stimulation of labor (Ventura et al., 2001). In 1990, 11% of all labors in the U.S. were stimulated (augmented) and by 1999, the rate had risen to 18%.

Epidural Anesthesia

Epidural use has been investigated as a marker for a provider's approach to intervention in birth by Klein (2001). The researchers found significant associations between high use of epidural anesthesia and other interventions in birth. The researchers theorize that this represents the belief system of the provider (i.e. that intervention was preferable and necessary), upon which they base their rationale for care practices. In general, nurse-midwifery care is based upon a philosophy that considers birth to be a normal process and believes the decision for intervention should be individualized and grounded in scientific evidence (Paine, 2001).

In the current study, when the three variables significantly associated with epidural anesthesia were controlled for in the logistic regression, women in nurse-midwifery care were 1.7 times less likely to have epidural anesthesia. This was consistent with the results of previous research (Mac Vicar et al., 1993; Oakley, 1995; Rosenblatt et al., 1997). This relationship held when the data were reanalyzed for vaginal deliveries only. The significant differences between provider groups for this variable again demonstrate consistency between the philosophy underlying midwifery care and the actual practice of

midwifery.

Methods of Delivery

Over the past four years U.S. rates of cesarean section have been rising and rates for vacuum and forceps deliveries have fallen (American College of Nurse-Midwives, 2000; Ventura et al., 2001). The rates for cesarean section in the study population (19%) compare positively to rates nationally (22%) and in California (23%) for 1999 (Ventura, 2001). In the current research, women cared for by nurse-midwives were less likely to experience both cesarean section and vacuum or forceps deliveries. This confirms the findings of other observational studies that found lower rates of these interventions (Butler, et al., 1993; Rosenblatt et al. 1997) in women cared for by nurse-midwives. However, in this study the finding was made more important by the moderate risk profile of the women in the study.

Concerns about the safety of VBAC has led to fewer attempted VBACs, leading to an increase in the rates of repeat cesarean section rates nationally. In 1996, the rate of VBAC in the U. S. was 28.3 % and by 1999, the rate had been reduced to 23.4% (Ventura et al., 2001). Rates of VBAC vary considerably from state to state and presumably, regionally within states. For California in 1999, the VBAC rate was 15%. In the current study, 60% of women with previous section (n = 152) attempted VBAC and of those, 52% (n = 47) were successful in achieving a vaginal delivery.

A significantly higher proportion of women having previous cesarean section were cared for by the nurse-midwives (57%) than obstetricians (43%). This relationship also held true for those women attempting VBAC (54% for women in CNM care vs. 46 % for women in obstetric care). Since the risk profile for the provider groups was similar, this suggests support for reduced use of technological intervention of the midwifery model.

After controlling for all factors found to be significantly associated with cesarean section, only four maternal characteristics were found to contribute to C/S. These were overweight at entry to care, inadequate weight gain during pregnancy, herpes and age at LMP. After controlling for these factors, women cared for by nurse-midwives were 1.6 times less likely to have a cesarean section.

While in the research conducted by Chambliss and colleagues (1992) the low (0.4%) rate of C/S of the physician caseload was paired with a statistically significant increase in the proportion of forceps and vacuum deliveries for women in the physicians group. In the current study, rates of both cesarean section *and* vacuum and forceps deliveries were lower for the women in nurse-midwifery care, leading to the conclusion that the differences in rate of C/S seen are related to the model of care, not to an alternative management technique.

Again, it is important to include the potential influence of women's preferences for a given care practices when interpreting the results of any study examining differences in outcomes by type of provider. Women's preferences for type of delivery ($n = 310$) were examined by Gamble and Creedy (2001). The researchers did not report the type of delivery experienced by women in the study. However, they concluded there was an important difference in the type of delivery experienced by women compared to the type of delivery they prefer.

Given the rising rate of cesarean sections in the U.S., this difference can be expected to increase. There have been other points in time when the type of care women were receiving (e.g. routine shaving of the perineum or routine episiotomy) was at odds with what they wanted and what was determined to be safer practice. Perhaps now, as in the past, the experience of and evidence from nurse-midwifery practice will contribute to a

change in practice, ultimately benefiting the health of all childbearing women.

Non-Technologic Care Measures

Non-technologic care practices exemplify the values and hallmarks of the profession of nurse-midwifery. Studies have documented increased use of counseling and educational processes of care used by nurse-midwives as well as use of non-technologically based care processes which assist a woman to cope with the labor and birth (Brown, & Grimes, 1993; Oakley et al. 1995). Individualization of care is also a core principle of nurse-midwifery care (Howell-White, 1997; Kennedy, 1995; Oakley et al., 1995; Rooks, 1997).

Antepartum Care Measures

In logistic regression, after controlling for significant covariates, nurse-midwifery care was significantly associated with personalized care (*OR* 1.8) and evidence of provider discussions (*OR* 3.1). Each of these care processes is an important indicator of the midwifery model of care.

Personalized care. Personalized care was defined as evidence in the chart that a provider altered a routine plan of care based on the preference of the pregnant woman. However, a definition of personalized care could have been structured to represent a woman's preference *for* a given test, procedure or assessment. The more restrictive definition was used in order to improve the precision of identifying cases where a discussion about the plan of care actually occurred and was documented in the chart. Given the moderate risk profile of study population, women receiving information about care measures (assessment for disease, fetal well-being or treatment for medical conditions) may not have felt it was appropriate to request an alteration in the plan of care. This may explain the relatively small number of cases (n = 101, 8.9%) for this variable.

Evidence of provider discussions. Health education counselors, nutritionists and social workers were available at each site as part of California's Comprehensive Perinatal Services Program (CPSP). Women enrolled in the Medi-Cal programs are entitled to have these ancillary services on request. Additionally, rates of financial reimbursement to the institutions are enhanced by provision of these services. An assumption was made that nurse-midwives would directly provide counseling and education in their care of women even though ancillary staff may also have provided those services. This assumption is rooted in the belief that in order to provide skillful care, which "considers the whole woman" (Kennedy, 1999); midwives must *personally* provide care practices that assess and address the concerns of each woman.

The results of the current study indicate that after controlling for significant covariates in the logistic regression, women cared for by nurse-midwives were three times more likely to have evidence of provider discussions documented in the chart. The other variables remaining in the model are: IUGR, previous preterm or LBW births, infections requiring antibiotics, insulin dependent gestational diabetes, single without social support, not enrolled in the WIC program, inadequate amount of prenatal care and private insurance.

In a "common sense" analysis, women having all of the other conditions listed above could be expected to have provider discussions about their conditions or situations. What was more surprising was that only two of the psychosocial variables had significant associations with the outcome in the final logistic model. One might expect that providers would have extensive discussions about issues related to psychosocial risk factors especially if a woman had either several problems or more serious problems.

The limited association found between psychosocial problems and provider

discussions could be a reflection of the large number of variables in model, although with a sample of over 1000 women this would not be expected. It could be representative of under-documentation of non-medical discussions in the medical records. This might stem from the providers awareness of the extensive notes made by ancillary staff and the providers desire to spend clinical time with the patient rather than in charting repetitive information.

Only two factors, inadequate amount of prenatal care and private insurance, were significantly associated with lower odds of provider discussions. Again, women with inadequate amounts of prenatal care have less opportunity to interact with providers over the course of their pregnancy and be an explanation for this result. Nearly 100% of women with private insurance were seen by obstetricians, suggesting an interaction between insurance and provider group for this variable.

Intrapartum Care Measures

A combined variable, non-technological care processes (NTCP), was constructed from intermittent EFM, no IV ordered, and permitted to eat in labor. For women receiving NTCP, the mean number of processes was 1.5. The results indicated a similar trend to that of the AP non-technological care practices. Women with medical conditions of pregnancy and private insurance were more likely to have an IV, to have constant EFM or not to be permitted to eat in labor. Hispanic women and women with a higher number of psychosocial risks were more likely to receive non-technological care measures. After controlling for these significant covariates, women cared for by nurse-midwives were 1.5 times more likely to be permitted to eat in labor, have intermittent EFM, and be without an IV in labor.

The results described here reflect written orders in the chart and/or documentation from progress notes. They reflect the intention of the provider on admission, and not whether the intention was carried out. For example, a provider may have written, "diet as tolerated" or "patient may eat in labor" and this was counted as evidence of a non-technological care measure. Whether the patient actually ate was not recorded.

Only 18% of women who had a cesarean section had evidence of non-technological care measures. Following from the results describes here, it was likely that nurse-midwives reserved the interventions (withholding food, starting an IV and using continuous EFM) for those women at highest risk for operative delivery.

Comfort Measures in Labor

Thirty five percent (35%, $n = 398$) of women in the study sample used comfort measures in labor such as shower, tub bath, or massage. After controlling for significant covariates, women cared for by nurse-midwives were 2.6 times more likely to use comfort measures in pregnancy.

This finding confirms the results of earlier research (Harvey et al., 1995; Kennedy, 1999; Oakley, 1995), which demonstrated the use of comfort measures during labor when nurse-midwives cared the women. Further analysis demonstrated the trend of a slightly decreased *OR* for women with medical risk factors using comfort measures as was seen in NTCP above.

Intrapartum Personalized Care

The definition of this variable was the same as that for personalized care AP. The final model shows that five variables are significantly associated with increased odds of personalized care IP. Women receiving nurse-midwifery care are three times as likely as those cared for by obstetricians to receive personalized care IP.

In this case, the results were the opposite of those for the AP period demonstrating that women with medical conditions were less likely to receive personalized care measures. In the final model, both cholestasis and infections requiring an antibiotic had significant association with personalized care. In the intrapartum setting, a common "personalization" of care is possible in the timing of interventions (a delay of induction of labor, for example) or the use of non-pharmacologic methods of intervention. The results demonstrate that use of personalized care is possible for women with medical conditions placing them at risk of poor pregnancy outcomes.

Breastfeeding

Breastfeeding is considered to be the most beneficial form of infant feeding. The beneficial effects are of greatest consequence in developing countries. The health advantages of breastfeeding are also important for infants and families of all ethnic and socio-economic groups in the U.S. (Rooks, 1997). For example, infants born at LBW who were exclusively BF for 6 months of life scored significantly higher on IQ tests than infants who were given formula or solid food (Rao, Heidiger, Levine, Naficy, & Vik, 2002). Historically, midwives have promoted breastfeeding as part of the "effective protection and nurturance" of the family (Rooks, 1997, p. 331) and of normal health processes. Rates of breastfeeding are important indicators of the midwifery model of care and, indirectly, of effective counseling and health education measures.

The results of the current study confirm trends noted in other research projects. For 1997-1999 (Mc Neill, Smith, & Chavez, 2000) approximately 85% of Hispanic women breastfed, the highest rate[7] in California among all ethnic groups. In the current study

[7] Noted at the time of discharge from the hospital and coded as "any type of breast feeding".

population, mothers who breastfed immediately after birth were younger and less educated, and more likely to be of Hispanic ethnicity.

In the Healthy People 2000 document, the target rates set for breastfeeding immediately after birth was 75% with a goal of 50% continuing to breastfeed until 5 months postpartum. In the current study, the overall rate of breastfeeding within 6 hours of birth was 65%.

However, for women who were both cared for by a nurse-midwife and received personalized care IP, the *OR* for breastfeeding within 6 hours of birth (*OR* 2.2) was higher than the *OR* for either nurse-midwifery care (*OR* 1.6) or personalized care IP (1.8). This demonstrates the effectiveness of personalized care within the midwifery model as it effects infant feeding choices immediately postpartum.

When considered alone, inadequate weight gain in pregnancy was positively associated with breastfeeding after immediately after birth in this study. Women with inadequate weight gain in pregnancy received intensive counseling from providers and nutritionists. Potentially, women with this factor may have received more education about breastfeeding during these sessions compared with those who gained an adequate amount of weight.

However, in the final model, only Hispanic ethnicity, being a recent immigrant, receiving personalized care IP and nurse-midwifery care were associated with increased odds of breastfeeding immediately after delivery. There was no interaction found between being a recent immigrant and Hispanic ethnicity for rates of BF.

Initiation of breastfeeding immediately after birth has been shown to effect the duration of breastfeeding (DiGirolamo, Grummer-Strawn, & Fein, 2001). Due to missing information about infant feeding choices which increased with each subsequent data point

in the current study it is difficult to draw conclusions about this influence in the current study. There are two reasons for these high rates of missing information. One is that it was not possible to access information about postpartum care for the Vallejo site and for most of the women who attended one of the San Francisco offsite clinics (n = 673, 53%). Secondly, information about infant feeding was obtained from records of the postpartum and other outpatient visits. While on the average women who returned for postpartum care had 1.3 visits, only 330 (28%) women returned for postpartum care.

Consequently, the information about rates of breastfeeding at 6 weeks postpartum must be interpreted with caution. In the logistic regression examining the combined variable, only ethnicity and nurse-midwifery care were associated with any type of breastfeeding at 6 weeks postpartum. For women who used breast and bottle or breast only, the significant relationship between breastfeeding and provider group found after delivery continued into 6 weeks PP.

Contacts with the Health Care System Postpartum

The results for this dependant variable were surprising. As explained in the breastfeeding discussion, information about postpartum contacts was available at only one site. At that site, routine postpartum visits are a practice only for nurse-midwifery clients. Not unexpectedly, type of delivery significantly influenced number of postpartum visits with those having experienced cesarean delivery having, on the average, more visits than those having an NSVD. Women who had inadequate levels of PNC were less likely to attend postpartum visits.

Conceptual Model for Nurse-Midwifery Care

With the completion of the data analysis of the major research questions, the conceptual framework guiding the research was refined. A conceptual model of the

relationships between factors influencing the processes and outcomes of nurse-midwifery care was developed as presented in Figure 2.

There are two important features of this model. The first is that this model demonstrates the *direct effect* of the midwifery care on processes and outcomes of care. In the current research project, nurse-midwifery care was shown to have statistically significant and independent associations with both processes and outcomes of care.

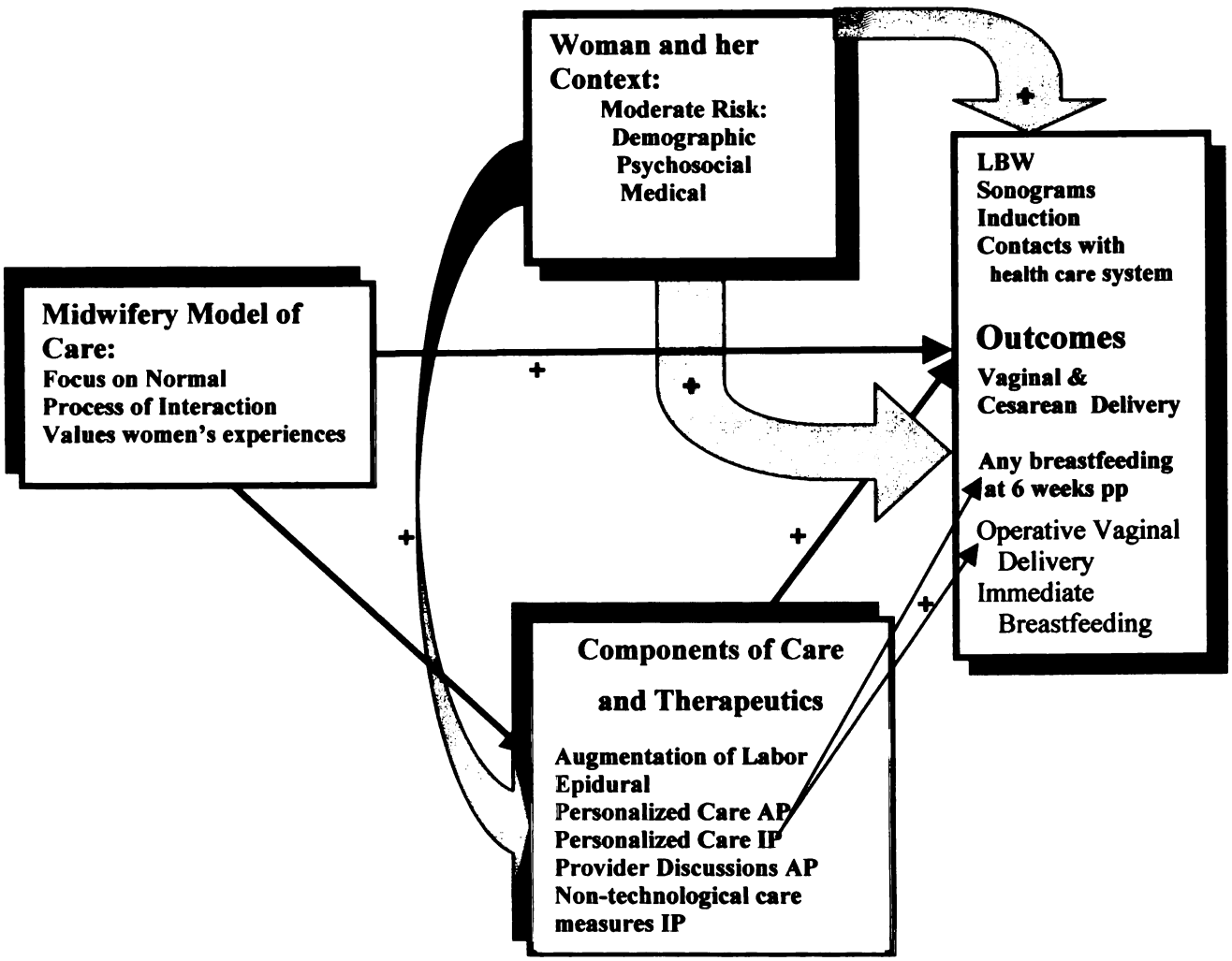
As stated earlier, the midwifery care practices which are distinct from medical practices are proposed to stem from three influences: (a) the philosophical belief that childbearing is a normal process which focuses on health rather than illness; (b) defining care as a contextually influenced process of interaction leading to a "nuanced interpretation of 'objective' evidence."(Benner, 1996, p. 290); and (c) when structuring care, giving equal authority to knowledge developed from women's experiences with that of technical-rational knowledge. *It is these underlying principles that are responsible for the direct influence of the midwifery model on the processes of care and outcomes of care.*

For example, belief in birth as a normal process leads to less reliance on (appropriate use of) technology. In the current study, the results of regression analysis demonstrate that women cared for in the midwifery model have significantly lower odds of experiencing technologically based interventions.

The effect of the second principle, i.e. care as a interactive process, was supported by the finding that women cared for by nurse-midwives are more likely to experience personalized care both antepartally and in labor. Further, the direct effect of this principle can be seen in the lower odds for operative vaginal deliveries for women who experienced personalized care during labor. These findings substantiate the assertion that midwifery model of care influenced the outcomes of care directly.

Figure 2

Conceptual Model of Midwifery Care



Key:

Association with factors describing the woman and her context

Other associations

The third principle, valuing the knowledge and experience of women, is also evidenced by the higher odds of provider discussions, personalized care, and non-technologic care measures for the group of women cared for by nurse-midwives. Provision of these care measures are dependent upon acceptance of an underlying assumption that women can and should rely on their own knowledge and experience to guide their care and to inform decisions about any necessary interventions.

The second important aspect of the model is that it demonstrates that factors describing the woman and her context are associated with all processes and outcomes of care, confirming the nurse-midwifery perspective that women and the context of their lives are the primary influence on health outcomes, to paraphrase Thompson and associates (1989). This perspective was supported by the results of the current research showing that for each process of care or outcome studied, there was an independent and statistically significant association with at least one demographic, medical or psychosocial factor.

Strengths

This research project investigated outcomes of care in an ethnically diverse, moderate risk population of women. The concept of "moderate risk" has been defined and tested within two models of care. From these results, a profile of moderate risk women has been described for the first time. The study was designed to reflect the reality of contemporary midwifery practice. Specifically, women with characteristics similar to that of the study population and the model of consulting between the obstetric and midwifery practices are currently found in many health care settings across the United States.

The current study has addressed common limitations of earlier midwifery outcomes research so that the data analyzed represents a more accurate picture of all women cared

for by nurse-midwives. The sample size was large enough to detect significant differences for all but one of the outcome variables (LBW). The design insured that the outcomes women who transferred care or had operative deliveries could be accounted for in the group from whom they received a majority of care. To insure that the comparison groups were equivalent in terms of medical and social risk, all prenatal medical social complications were abstracted from the charts, analyzed and controlled for in regression analysis.

Limitations

The limitations of this research project are those commonly found in retrospective studies: the accuracy of information recorded in the charts could not be verified, for some variables there were significant amounts of missing data and for other variables, the manner in which the original data was recorded was not ideal (Hulley & Cummings, 1998). In particular, there was a high rate of missing data for the breastfeeding variables and the number of contacts with the health care system postpartum. Another potential confounder, preferences of the women for specific processes of care, could not be derived from information included in the charts.

The conclusions developed from the results are limited by to what was documented in the charts, which may have been different from what was actually done. For example, if a woman was permitted to walk in labor, there was no way to confirm from the medical record that she did so. While the sample is ethnically diverse, it is weighted toward women of Hispanic descent. Also, nearly all the patients are poor and have public insurance. This limits generalizability of findings to women with a similar demographic profile. Generalizability is also limited to practices with similar practice styles and consulting relationships.

The remarkably low rate of LBW for Hispanic women in the study (3.4%) contributed to an overestimation of the effect size used in the calculation of sample size for the primary outcome variable of LBW. Therefore, the sample size was too small to find statistical significance in the differences in rates of LBW for women cared for by CNMs compared to those cared for by obstetricians.

Implications

The implications that derive from this study can be applied to clinical practice, research, education and health policy. The study provides new information about the safety and efficacy of nurse-midwifery practice as well as knowledge that supports the findings of earlier studies.

Clinical Practice

The outcomes of care in the current study are equivalent to or better than those achieved in the standard, medical model of care. While the women had medical and social conditions placing them at higher risk of poor pregnancy outcomes, nurse-midwives were able to care for them maintaining hallmarks of the midwifery model of care: care which is personalized to individual needs and preferences, relying on non-technological care measures, yet using appropriate technological interventions where these were needed.

This type of care is safe and appropriate for women at low and moderate risk of poor pregnancy outcomes. Nurse-midwives and other care providers can use the evidence from this research to change existing practice protocols calling for the routine use of technologically based interventions. This research was not meant to uncover "condition specific" results. For example, it was not within the bounds of the research to determine whether women with pre-eclampsia should have continuous fetal monitoring. However, the results demonstrate in a general manner that the midwifery model of care safely allows

individuation of care without increasing poor outcomes.

The results also confirm the importance of personalized care in the achievement of positive health behaviors, i.e. breastfeeding. The direct benefits of personalized care are rarely documented. As the results of this research indicate, clinicians should place greater emphasis on assessing women's preferences and tailoring care to those preferences. When medical conditions require intervention, personalization of care is still possible and preferable.

Research

While important new knowledge was developed from the results of this research, further knowledge about the processes and outcomes of nurse-midwifery care to women at risk of poor pregnancy outcomes is needed. Both the strengths and limitations of the current research reveal several directions for future studies of nurse-midwifery care to women at risk of poor pregnancy outcomes. Most importantly, studies should be conducted that use representative samples of the entire population of women given comprehensive (prenatal through postpartum) care by nurse-midwives. Alternatively, researchers should use samples in which medical or socioeconomic risk is specifically defined and connected to the outcome under investigation. Sample sizes should be calculated based on the hypotheses of the experiment.

Comparison groups should be carefully selected. Using sites with medical students or residency programs need not be a problem if the midwifery services also include student midwives who provide care to patients under the supervision of nurse-midwives. Studies should be multi-site in order to capture regional and practice variation, including the policies for transfer of patients to physician care. All data should be analyzed using intent to treat comparison. Statistical analysis should include regression methods to control for

variations in the socioeconomic or medical risk factors.

While RCTs are the "Gold Standard" for intervention studies, it is unlikely that in the United States a sufficient number of patients would consent to be randomized to provider group in order for RCTs to be conducted. However, multi-site quasi-experiments of prospective design, using convenience samples from selected nurse-midwifery practices where an appropriate control group also exists, may be feasible.

Prospective designs should be used in order to improve the precision of information collected. Whenever possible, in prospective studies, the characteristics of and preferences of the women for specific processes of care in the sample should be included to assess their contribution to the outcomes under investigation. The influence of women's preferences on the processes of the midwifery model of care as well as on subsequent outcomes should be investigated.

Education

Education of health care providers, including nurse-midwives, nurse-practitioners and physicians should include increased emphasis on the benefits of personalized care and the judicious use of technologically based interventions. Students should be given assistance in developing the intellectual and interpersonal skills that permit tailoring evidence based clinical decisions to an individual's preferences and beliefs about health.

Policy

Despite implementation of extensive managed care programs in the 1990's health care costs are again increasing at "double digit" rates. The costs associated with care of LBW infants are a part of this increase.

The reduction in rates of LBW, if replicable in other midwifery practices, would result in substantial saving to the health care system. The rate of LBW was reduced 18%

in the study population. Given an estimated direct of LBW of $8.5 billion dollars per year, an 18% reduction would potentially result in savings of over $1.5 billion dollars if all women in the United States had access to nurse-midwifery care. Additionally, the benefits of increased rates of breastfeeding for women cared for by nurse-midwives would have a positive effect on the health and well-being of infants and children.

The results of this study point to substantial and concrete differences in the quality of care provided by nurse-midwives compared with obstetricians. The differences are clearly linked to positive outcomes of care for both mothers and their infants. Efforts should be directed at easing legislation and regulations restricting or hampering the nurse-midwifery practice.

Conclusion

This research project has demonstrated that nurse-midwifery care is appropriate for women with a wide range of personal characteristics, including those placing her at moderate risk of poor pregnancy outcome. The project described for the first time characteristics of women in a moderate risk category. The results provide evidence that moderate risk women cared for by nurse-midwives have outcomes of care equivalent to or better than those cared for by physicians, with care given in a model emphasizing non-technological care measures, yet using appropriate technological interventions when necessary. The research provided important new information about the practice of nurse-midwifery and about the benefits of personalized care on positive health behaviors.

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Appendix A

Table A1

Definitions of Low Risk 1974-1998

Reference	Year	Low Risk	High risk
Lenaway et al	1998	not defined	
MacDorman & Singh	1998	not defined, analyzed all risk factors	
Rosenblatt, et al	1997	not high risk	Concurrent major medical illness, history of major obstetric complications: previous still birth, >4 SAB@ < 14 weeks gestational age, previous Cesarean section, previous premature birth <34 weeks, potential risk factors in current pregnancy: 1st PNV after fist trimester, > 3 previous births, history of alcohol or drug use
Blanchette, H.	1995	not defined-examined rates of antepartum complications	Patients transferred from CNM care to MD care :insulin dependant diabetics, Rh sensitization, cerebral aneurysm, chronic hypertension, congenital heart disease
Fischler & Harvey	1995	not defined; analyzed all risk characteristics	
Gabay, M. & Wolfe, S.	1995	not stated	
Oakley et al.	1995 1996	Without: hypertension requiring medication, serious cardiac disease, chronic renal or lung disease, drug addiction, current alcoholism, seizure disorder requiring medication, psychiatric illness requiring medication, known multiple gestation, elective C/S	

Table A1 (continued)

Definitions of Low Risk 1974-1998

Reference	Year	Low Risk	High risk
Davis et al.	1994	"not high risk"	<36 week, multiple gestation, malpresentation, pre-eclampsia, diabetes, placenta previa or abruption, IUGR, chronic hypertension, cord prolapse, elective Cesarean section
Brown and Grimes	1993	not stated (meta-analysis)	
Butler et al.	1993	>5 PNC visits, 37-42 weeks gestation, singleton, live birth occiput presentation, none of 52 medical or obstetric conditions	
Wilson	1989		
Kaufman	1988	spontaneous onset of labor 37-42 weeks gestational age, single fetus in vertex position, no medical or obstetric complications, <35 yr., parity <6, intact membranes on admission or SROM in active labor	
Feldman & Hurst	1987	MCA risk assessment tool<2	
Moore, et al.	1986	all but insulin requiring diabetics	
Piechnik & Corbett	1985	<5 ON "Heins Risk Scoring System"	
Reed & Morris	1979	"referral of high risk", deliver normal pregnancies	not defined
Dillon, et al.	1978	Hobel Risk Screening System	

Table A2

Factors Included in Papiernik and Creasy Risk Assessments

Papiernik & Kaminisky (1974)		Creasy et al. (1980)	
General and Social Factors	*Weight*	*Socioeconomic Factors*	*Weight*
More than 2 children without domestic help	1	Low SES	1
		2 children at home	1
Unwed mothers	2	Single Parent	2
≤20 yr. or ≥ 40 yr.*	2	≤20 yr. or ≥40 yr. *	2
Height <150 cm	3	Height <150 cm	3
<45 kg*	3	<45 *kg	3
Low SES	1 or 3	Very Low SES	3
		Less than 18 yr.*	4
Factors of Fatigue		*Daily Habits*	
Work outside home	1	Work outside home	1
		More than 10 cigarettes/day*	2
Apt above 3rd floor without elevator	2		
Strenuous work	3	Heavy work	3
		Long tiring trip	3
Long daily commute (> 1.5 hr/day)	5		
Unusual effort	3		
Long Travel	3		
Unusual fatigue	1		
More than 10 cigarettes/day	2		

Note. Items marked with and asterisk (*) indicates that the factor or a variation of it is included in Hobel's risk assessment

Table A2 (continued)

Factors Included in Papiernik and Creasy Risk Assessments

Papiernik & Kaminisky (1974)		Creasy et al. (1980)	
Unfavorable Obstetric or Gynecologic Antecedents		*Past History*	
< 1 yr. since last birth	1	< 1 yr. since last birth	1
		1 Abortion	1
> 2 Abortions	2 or 3	2 Abortions	2
		3 Abortions*	3
Cylindrical Uterus	4	Pyleonephritis*	4
Uterine Malformation*	5	Uterine anomaly*	5
		Des Exposure	5
Late Abortion (13-28 weeks)	5	Second trimester abortion	5
Premature delivery (<2500gm)*	5	Premature delivery	10
		Repeated second trimester abortions	10
Current Pregnancy	*Weight*	*Current Pregnancy*	*Weight*
Excessive weight gain (>9kg at 32 weeks)	1	Unusual fatigue	1
<5 kg weight gain at 32 weeks	2	<13 kg by 32 weeks	2
Less weight than previous month	3	Weight loss of 2 kg	3
Proteinuria*	2	Proteinuria*	2
Hypertension*	2	Hypertension*	2
		Bacteruria*	2
Breech at 32 weeks*	3	Breech at 32 weeks	3
		Febrile illness	3
Metrorrhaggia	3	Metrorrhagia after 12 weeks	4
Placenta previa*	5	Placenta previa*	5
Hydramnios*	5	Hydramnios*	5
Twins	5	Twins	10
Thinned lower uterine segment	3	Abdominal surgery	10
Head engaged	3	Head engaged	3
Shortened cervix	4	Effacement	4
Dilation	4	Dilation	4
Contractile uterus	5	Uterine irritability	4

Table A3

Factors Included in Hobel Risk Assessment

Factor	Weight	Included in Papiernik/ Creasy
Historical:		P= Papiernik, C= Creasy
Chronic hypertension	10	
Moderate-severe renal disease	10	
Heart disease Class 1	5	
Heart disease Class 11-111	10	
Eclampsia	5	
Pyelitis	5	
Cystitis	1	
Toxemia	1	
Previous endocrine ablation	10	
Thyroid disease	5	
Family history, diabetes	1	
Exchange transfusion	10	
Previous stillbirth	10	C=10
Previous premature birth	10	
Previous neonatal death	1	
Previous Cesarean section	5	
Habitual abortion	5	C=10
Infant >10 pounds	5	
Multiparity	5	
Epilepsy	5	
Fetal anomalies	1	
Uterine malformations	10	P, C=10
History of pulmonary disease	5	
Post term (~42 weeks)	10	

Table A3 (continued)

Factors Included in Hobel Risk Assessment

Factor	Weight	Included in Papiernik/ Creasy
Historical:		P= Papiernik, C= Creasy
Developing conditions:		
Moderate to severe toxemia	10	
Mild toxemia	5	
Acute pyleonephritis	5	C=4
Acute cystitis	1	
Diabetes ~ Class A- I 1	10	
Pre-diabetes Class A-1	5	
Abnormal fetal position	10	
Polyhydramnios	10	
Small pelvis	5	
Abnormal cervical cytology	10	
Multiple pregnancy	10	
Sickle cell disease	10	
Viral disease	5	
Positive serology	5	
Severe anemia (hemoglobin <9 gm/100 ml)	5	
Excessive use of drugs	5	
Positive purified protein derivative test (>10 mm)	5	
Weight <100 pounds or >200 pounds	5	P,C=3
Vaginal spotting	5	
Mild anemia (hemoglobin 9 to 10.9 gm/100ml)	1	
Smoking (=~ I pack per day)	1	C=2
Alcohol (moderate use)	1	
Emotional problems	1	

Table A3 (continued)

Factors Included in Hobel Risk Assessment

Factor	Weight	Included in Papiernik/ Creasy
Historical:		P= Papiernik, C= Creasy
Intrapartum Factors		
Early:		
Hydramnios	10	
Abnormal presentation	10	
Meconium –stained amniotic fluid		
Light	5	
Dark	10	
Toxemia		
Mild	5	
Moderate-severe	10	
Premature rupture of membranes	5	
Cesarean section	5	
Elective induction of labor	1	
Prolonged latent phase of labor	1	
Medical induction of labor	5	
Interim:		
Primary dysfunctional labor	5	
Secondary arrest of dilatation	5	
Pitocin augmentation	1	
Placenta previa	10	
Abruptio placenta	10	
Marginal separation of placenta	10	
Fetal bradycardia	10	
Prolapsed cord	10	
Fetal acidosis (pH :5 7.25)	10	
Fetal tachycardia	10	

Table A3 (continued)

Factors Included in Hobel Risk Assessment

Factor	Weight	Included in Papiernik/ Creasy
Historical:		P= Papiernik, C= Creasy
Intrapartum Factors		
Uterine tetany	1	
Amnionitis	10	
Excessive magnesium sulfate or Demerol	5	
Late:		
Uterine rupture	10	
Labor >20 hr.	5	
Second stage of labor >21/2hr.	5	
Precipitate labor (<3 hr.)	5	
Breech delivery, total extraction	10	
Operative forceps or vacuum extraction	5	
Breech delivery, spontaneous or assisted	5	
General anesthesia	5	
Outlet forceps	1	
Shoulder distocia	1	

Appendix B

Table B1

Descriptive Research 1990-1999

Reference	Hypothesis/Question	Sample Size	Design	IV	Outcomes/ DV	Analysis/ statistical tests	Findings
Lenaway, et al, 1998	"A county-wide CNM program would result in improvements in the processes and outcomes of perinatal care." [for all medically indigent women residing in the county as compared to all medically indigent women in control counties]	2791; 692 CNM, 726 FP, 1373 OB	Quasi-experiment	1 intervention county (CNM Care), 2 control counties	anemia, PIH, GDM, augmentation, induction, VBAC, GA, BW, 5 min Apgar and others	ITT, logistic-binomial random effects regression model, odds ratio, CI, interaction terms	Intervention county decr. no PNC, incr adequate PNC, dcr anemia, incr PIH, incr induction, incr augmentation, incr VBAC, dcr LBW (almost satisfaction sig.)
MacDorman & Singh, 1998	Examine whether there are significant differences in birth outcomes for infants delivered by CNMs compared with those delivered by MD, and whether these differences if they exist remain after controlling for socio-demo and medical risk factors	CNM 153,194 MD 2,634,550	cross section, descriptive analysis	Provider type	Infant, neonatal and post neonatal mortality, LBW and mean BW	logistic and ordinary least sq. regression, odd ratios	risk of LBW lower for CNM, mean BW higher for CNM, infant and neonatal mortality lower for CNM

Table B1 (continued)

Descriptive Research 1990-1999

Reference	Hypothesis/Question	Sample Size	Design	IV	Outcomes/ DV	Analysis/ statistical tests	Findings
Rosenblatt, et al., 1997	"Systematic differences exist in the style and resource intensity of care provided to similar groups of women by CNM, FP OB." (OB most intensive, CNM least FP in between)	CNMS=43 OB & FP= 54 ea.; charts CNM=371 OB =552 FP =399	retro, randomized, cohort study	Provider type	Practice styles, processes of care, cost (power analysis base on cost reduction)	ITT, F test, t test, multiple regression,	CNM= dcr amniocentesis, incr NST, dcr induction &augmentation ,EFM, epidural, episiotomy, CS, incr SVD, 12.2%<cost
Oakley, et al., 1996	" to determine whether pregnancy outcomes differ by provider group when alternative explanations are taken into account" with emphasis on processes of care	1181, 471 CNM, 710 MD	Prospec-tive cohort	Provider groups-CNM/ MD	many outcomes, satisfaction with care, cost	chi sq., student t test, multiple regression-logistic and linear	Provider group made a significant indep. contrib to am't of tech used, empathy, to # of U.S., other tests, ed re nutrition & sexuality, auscultation and PO food & fluids in labor
Blanchette, H., 1995	"Compare obstetric outcomes of a prenatal clinic staffed by CNMs, supervised by a private practice group of obstetricians wit obstetric outcomes of that group's private practice."	1107, 496 CNM 611 MD	retro cohort	CNM/ MD care	perinatal morbidity and mortality, Apgar, birth weights prematurity, Cesarean section	binomial probability distribution significance p<.05	only C/S significantly different, CNM rate 13.1 %, MD 26.4% (p<.05), MD pt. had increased epidural, increased oxytocin, increased episiotomies

Table B1 (continued)
Descriptive Research 1990-1999

Reference	Hypothesis/Question	Sample Size	Design	IV	Outcomes/ DV	Analysis/ statistical tests	Findings
Fischler & Harvey, 1995	Examined the relationships of provider and setting to pregnancy outcome	717, CNM/ clinic=309 CNM priv=111, MD/priv= 287	retro cohort	setting of care and provider group	BW, GA, apgar, NICU, C/S	ANOVA, chi sq., multiple regression	Socio-demographic varied significantly on all variables, private CNM BW higher, stg + ass'n w/ CNM care & BW, stg - ass'n w/ clinic & BW
Oakley et al., 1995	" to determine whether pregnancy outcomes differ by provider group when alternative explanations are taken into account	1181, 471 CNM, 710 MD	Prospect ive cohort	Provider groups- CNM/ MD	many outcomes, satisfaction with care, cost	chi sq., student t test, multiple regression- logistic and linear	Sig. differences on 7 clinically imp outcomes: infant abrasions, infection, remaining w/ mom, 3/4th lac, number of compl, satis,2 cost, measures. After risk, selection bias, medical intensiveness, women's pref only inf remain w/mom, perineal lac and satis .
Davis et al., 1994	"Assess the impact of selected medical interventions on c/s rates by comparing maternal and neonatal outcomes	8795, 529 CNM, 8,266MD	retro chart review	CNM vs MD	rate of c/s, induction/ augmenta- tion, analgesia/ anesthesia, Apgar, cord pH	chi-sq., ANOVA, student t, step wise logistic regression	non white pts more prevalent in CNM but c/s no different btwn grp or combined, all maternal study var lower in CNM gp, infant no diff, in logistic regression provider not sig predictor of C/S

Table B1 (continued)

Descriptive Research 1990-1999

Reference	Hypothesis/Question	Sample Size	Design	IV	Outcomes/ DV	Analysis/ statistical tests	Findings
Brown and Grimes, 1993	"to determine the impact of nurses in primary care roles on the health outcomes of people they serve and on the health care system."	68 studies identified, 15 met criteria for inclusion	meta analysis	CNM care vs MD (control)	Processes of care, clinical outcomes, cost/cost effectiveness	effect size, weighted effect size	CNM differs from MD: in 19 var. After controlling for risk only 12 remained.
Butler et al., 1993	care by a CNM associated with a reduced risk of c/s	4607, 1056 CNM, 3551MD	retro cohort	CNM, MD care	C/S rate	chi-sq., t-test, multiple logistic regression, odds ratio	OR:C/S, CNM/MD= .77, AOR (age parity yr. of delivery)=.71

Table B2
Overview of RCTs

Reference	Year	Hypothesis/Question	Sample CNM MD	*IV*	Outcomes/ DV
Harvey, et al.	1996	Nurse midwifery care is as effective as medical care for low risk women with respect to clinical outcomes. Rate of epidural and episiotomy would be less for CNM group.	194 101 93	CNM/MD	epidural rate, episiotomy rate
Turnbull, et al.	1996	Compared with shared care, midwifery managed care would result in fewer interventions, similar or more favorable outcomes and, similar complications and greater satisfaction.	1299 648 651	NM/ Shared care	"a priori- clinically significant, important to policy makers and consumers, and reliably obtained"
Rowley, et al.	1995	To compare continuity of care from a midwife team with routine care from a variety of providers. Benefits of continuity care from midwives would be seen in high risk as well as low risk women.	814 405 409	NM team/ MD & NM	AP, IP, PP events, satisfaction and cost.
MacVicar et al.	1993	Women cared for by midwives (AP & IP, home like environ IP) will have outcomes equal to those cared for by MDs. (AP &IP, hosp environ IP)	3510 2304 1206	NM & IP home-like MD & IP standard hospital	** too numerous to list

Table B2 (continued)
Overview of RCTs

Reference	Year	Hypothesis/Question	Sample CNM MD	IV	Outcomes/ DV
Chambliss, et al.	1992	C/S rate no different for MD than CNM in RCT when risk is controlled for.	487 234 253	CNM/ House staff	C/S rate operative delivery, episiotomy, 3rd and 4th laceration significantly higher for MD
Heins et al.	1990	In women at risk for LBW, the rate of LBW will be lower in those cared for by CNMs.	1458 667 679	CNM PNC/MD PNC	VLBW, LBW, GA, pre
Slome, et al.	1976	Evaluate the effectiveness of care provided to obstetric patients by CNMs and house staff.	438 298 140	CNM/ House staff	prenatal visit score, anemia, hypertension, diabetes, PIH, UTI, rates of evaluation for UTI, Rates of evaluation for diabetes, LOL, type of delivery, ROM, episiotomy, abnormal length of labor and birth, GA, wt, apgar, fetal distress, anomalies, birth injury.

Table B3

Results and Statistical Tests of RCTs

Reference	Analysis/ statistical tests	AP Care	IP	Delivery Method	Perineum	Infant	Satisfaction/Other
Harvey, et al., 1996	Fischer's exact, CI, Student's t,	**Sonograms** CNM 58.4% MD 80.6% (p.<01)	*Amniotomy* CNM=16.8% MD=32.9% (95%CI 1.44-25.1%) *IV in Labor* CNM=26.7% MD=42.9% (95% CI 1.97-28.4%)	*C/S* CNM 4% MD 15.1% (p<.01)	**Episiotomy** CNM=15.5% MD=32.9% (p<.007)	*Apgar score <7 @ 1 minute* CNM=14/101 MD=27/93 (p=.013) *NICU admission* CNM=7.9% MD=9.35% (p=.02)	*LOS in hospital* CNM=29.04 hrs. MD=59.47 hrs. (p<.0001)
Turnbull, et al., 1996	Intent to treat, Chi sq., CI, t-tests		*Induction of labor* MW*=23.9% SC=33% (CI 4.5-14.5) *Intermittent EFM* MW*=15.5%% SC=9.6%% (p<.0005)		**Intact perineum** MW*=30.5% SC=23.6% *Episiotomy* MW*=28.0% SC=34.0% (p<.02)		**Satisfaction** *AP, IP, PP Home visit* MW pt. 1.75-3.5 times more likely to be satisfied (95% CI)

Table B3 (continued)
Results and Statistical Tests of RCTs

Reference	Analysis/ statistical tests	AP Care	IP	Delivery Method	Perineum	Infant	Satisfaction/Other
Rowley, et al., 1995	Logistic regression Intent to treat, Odds Ratio, CI	*Attendance at antenatal classes* Team care group* 1.73 more likely to attend than controls (95% CI)				Team 1.6 times less likely to have *Apgar <7 @1 min,* Team babies 1.69 times less likely to be *Resuscitated* Control 1.19 more likely to be *admitted to Neonatal Intensive Care* Team mothers 1.11 times more likely to *Breastfeed* Team babies 1.17 more likely to be *LBW <2500gm*	*Satisfaction* Higher for Team mothers in three areas: *Information giving, participation in decision making and relationship with caregivers* Range of OR for various items 2.95-7.50, (95% CI) **Cost** Team care 4.5% less costly

Table B3 continued
Results and Statistical Tests of RCTs

Reference	Analysis/ statistical tests	AP Care	IP	Delivery Method	Perineum	Infant	Satisfaction/Other
Mac Vicar et al., 1993	Intent to treat, Mann-Whitney U test, Chi sq.	*Sonograms* HfH*=45% MD=53% (p<.0001)	*Spontaneous onset of labor* HfH*=73% MD=64% (p<.0001) **EFM** HfH*=50% MD=89% (p<.0001) *Irregular FHT* HfH*=22% MD=31% (p<.0001) **Analgesia** HfH used less of all types but N_2O_2 (p<.0001)		**Episiotomy** HfH*=23% MD=31% **Lacerations** HfH*=45% MD=40% (p<.0001)		**Satisfaction** *Prenatal Care (very satisfied)* HfH*=52% MD=44% *Intrapartum Care (very satisfied)* HfH*=73% MD=60% (p<.0001)
Chambliss, et al., 1992	Student t test, chi sq.		*IFSE*** CNM38 MD=110 (p<.00005)	*C/S* =ns, *Forceps/vacuum* CNM=0 MD=18 (p<.006)	Episiotomy CNM=24, MD=87 (p<.0005) *3rd &4th degree lacerations* CNM=2 MD=19 (p<.0003)		

Table B3 continued

Results and Statistical Tests of RCTs

Reference	Analysis/ statistical tests	AP Care	IP	Delivery Method	Perineum	Infant	Satisfaction/Other
Heins et al., 1990	Intent to treat, odds ratio					*VLBW* (<1500 gm) in AA women: CNMs 2.6% MD 6.7%*	
Slome, et al., 1976	chi sq. and t test	*Prenatal Visit Score* CNM=94% MD= 80%, P<.0005 *% tested for UTI* CNM 90 MD 65% (p not reported) *% tested for GDM* CNM 43.3%, MD 27.9% (p not reported		*Low forceps* CNM 9.7% MD 29.3% (p<.05)			

* approached significance (odds ratio .35, CI 0.1-0.9)

**IFSE internal fetal scalp electrode

* Abbreviations for midwife led care: CNM, HfH, Team, MW.

Table B4

Comparison of Sample Characteristics in RCTs

Reference	Mean Age	Education	SES	Married	Smoking	
Harvey, et al.	30.6	15.6[1]	-	-	<10%	
Turnbull, et al.	25.6	-*	40% live in least affluent neighborhood	54%	38%	
Rowley, et al.	26	-	20% employed in skilled labor	50%	>50% **not** smoking	
MacVicar et al.	25	-	-	-	27.3%	
Chambliss, et al.	25	-	-	-	-	
Heins et al.	62% age 20-34	35% 12 yr. or more	State funded clinics	44.8	83% smoked	16%[2]
Slome, et al.	20.8	-	low income	60.7	-	

* Dashes indicate data not stated

[1] Statistically significant difference between groups

[2] Stopped smoking during pregnancy

Table B5

Comparison of Sample Characteristics in RCTs: Ethnicity

Reference	YEAR	White*	Black	Hispanic	Asian/PI**	AI or Ab.***	Other/Unkn
Harvey, et al.	1996	96.8%	0	0	2.2%	1%	0
Turnbull, et al.	1996	-	-	-	-	-	-
Rowley, et al.	1995	"most"	-	-	-	-	-
MacVicar, et al.	1993	-	-	-	-	-	-
Chambliss, et al.	1992	-	-	-	-	-	-
Heins- et al.	1990	45%	53%	-	-	-	2%
Slome, et al.	1976	-	78%	-	-	-	-

*Non-Hispanic White
**PI = Pacific Islander
*** American Indian or Aboriginal

Table B6

Exclusions by Medical Risk Factors by Study

Reference	Year	Hypothesis/Question	Medical Risk Factors
Harvey, et al.	1996	Nurse midwifery care is as effective as medical care for low risk women with respect to clinical outcomes. Rate of epidural and episiotomy would be less for CNM group.	Previous C/S, primipara <17 or >37, > 20 wk GA
Turnbull, et al.	1996	Compared with shared care , midwifery managed care would result in fewer interventions, similar or more favorable outcomes and, similar complications and greater satisfaction.	"Absent of medical and obstetric risk factors" (not stated specifically)
Rowley, et al.	1995	To compare continuity of care from a midwife team with routine care from a variety of doctors and midwives.	Substance Abuse
MacVicar et al.	1993	Women cared for by midwives (AP &IP, home like environ IP) will have outcomes equal to those cared for by MDs. (AP &IP, hosp environ IP)	Previous C/S "or difficult vaginal delivery", diabetes, epilepsy, renal disease etc. Previous still birth or neonatal death, previous SGA, multiple pregnancy, Rh neg., high AFP
Chambliss, et al.	1992	C/S rate no different for MD than CNM in RCT when risk controlled for	no PNC & PN Hct. <30, temp > 100, station -3, sig. maternal or fetal complications, EFW<2500or >4000, SROM without labor, age <16 or >45
Heins et al.	1990	In women at risk for LBW, the rate of LBW will be lower in those cared for by CNMs	htn, diabetes, renal disease, multiple pregnancy
Slome, et al.	1976	Evaluate the effectiveness of care provided to ob pt. by NM and house staff	BP>140 /90, weight >180, hx of >7 pregnancies, hx diabetes, hx C/S, hx of edema or varicosity

Appendix C

Moderate Risk Factors

Medical Risk Factors	Demographic and Psychosocial:
1. Age < 17 or ≥ 35	African American
2. Underweight at entry to care (< 90% DBW)	Asian/Pacific Islander
3. Inadequate weight gain in pregnancy	Hispanic
4. Overweight at entry to care (> 120%DBW)	Non-Hispanic White
5. Hx Seizure Disorder, not on meds	Other
6. Previous PTD/LBW	Public Insurance (Medi-Cal or Medicare)
7. Hx fetal demise	Inadequate prenatal care
8. Substance abuse at conception/currently clean	Marital Status- Single
9. Current Drug Use (opiates, speed, cocaine, abuse of RX)	≤ 10 grade education
10. Alcohol abuse at conception/currently sober	> 2 living in one room/sleeps on floor/living room
13. Current smoking pot/cannabis	Living in public housing
14. Smoking at onset of PNC	Single without family/ friend support
15. Close interval pregnancy	FOB not involved
16. Previous C/S	Partner abuses ETOH/Drugs
17. Anemia (HGB < 10)	Prior DV
18. Asthma	Recent immigrant (during pregnancy or < 1 yr.)

Appendix C (continued)

Medical Risk Factors	Demographic and Psychosocial:
19. BV or GBS	Children in another country
20. Cholestasis	Children in foster care/adopted out
21. Chest x ray: + or needing Tb clinic referral	Monolingual (not English)
22. Depression	Unintended pregnancy
23. Fibroids	Unwanted Pregnancy
24. Mild HTN (W/O Proteinuria, < 165/95)	Lives Alone
25. Herpes Simplex	Counted as medical risks:
26. IUGR	Current DV (< 6 mo.)
27. Intestinal parasites	Living in hotel/homeless
28. Infections requiring Antibiotics: e.g. Bronchitis/pneumonia/abscess	Exposed to violence
29. Admission for preterm labor during this pregnancy	Pregnancy a result of rape
30. Pyleonephritis	Runs out of food
31. Persistent proteinuria/ not PIH	Eligible for WIC, not enrolled
32. Sickle cell trait	
33. STDs (except HIV)	
34. Thyroid Disease (hypo)	
35. > 1 UTI	
36. Severe pre-eclampsia	
37. Gestational diabetes-Diet Controlled	

Appendix C (Continued)

Medical Risk Factors

Demographic and Psychosocial:

38. Gestational diabetes-Insulin dependent

39. Hyperemesis

40. History of fetal demise

41. Other medical risk factors

Appendix E

High Risk Factors

Abdominal Mass	HIV positive
Abdominal pregnancy	Hodgkin's disease
Abscess, kidney	Hypertension (on medication)
Anomaly, fetal incompatible with life	Ileostomy
Aortic aneurysm	Intestinal obstruction
Aplastic anemia	Incompetent cervix with cerclage
Appendicitis	Kidney/organ transplant
Arteriovenous malformation	Leukemia
Bowel Obstruction	Listeriosis
Brain tumor	Lupus, systemic
Brain death	Meningitis
Cancer	No Prenatal Care
CVA	Paraplegia
Scheduled Cesarean Section	Pelvic mass/hx injury
Cardiac arrhythmias/disease/surgery	Renal failure
Chest mass	Rh isoimmunization
Coagulation defects	Rheumatoid arthritis
Colostomy	Schizophrenia/Major psychosis
Dandy-Walker cyst	Severe pre-eclampsia < 36 weeks
Diabetes B-R	Shock/trauma (acute)
Encephalitis	Sickle cell disease
Gastrostomy	TB (active)
Guillian-Barre syndrome	Thyroiditis/hyperthyroid
Hirshprungs disease	Ulcerative colitis

Appendix F

Data Collection Instrument

Begin Care CNM caseload		Moderate risk 2 P-S+1 med	Yes
Begin Care MD caseload		Low Risk (none)	Yes
Transfer from Health Center to MD		High Risk Exclusions (=Any)	Yes
Date of Transfer fr. HC		# Weeks GA	
Transfer from other to SFGH			
Date of Transfer fr. Other		# Weeks GA	

16. Parity(TPAL format)

12. Single	12	21. Total #PNC visits	21
13. Married	13	18. Date First Visit	
14. Age	14	22. Transfer of care from/to other provider @ ?GA	22
14a) ≤17 or≥35	14a	Circle AP IP	
20. Gestational age at entry to care	20		
20a) Late to care>20 weeks	20a		
22a Total # visits with main provider	22a		

REMEMBER: Most ethnicity, financial status, single, entry to care >20 weeks and ≤17 or ≥35 are moderate risk factors!

High Risk Exclusions (=Any)					
No Prenatal Care		Cardiac arrythmias/disease/surgery		Kidney/organ transplant	
HIV positive		Chest mass		Leukemia	
Insulin dependent diabetic (pre-preg)		Coagulation defects		Listeriosis	
Servere Pre-eclampsia Pre-term <36		Colostomy		Lupus, systemic	
Abdominal Mass		Dandy-Walker cyst		Meningitis	
Abdominal preganancy		Diabetes B-R		Paraplegia	
Abcess, kidney		Encephalitis		Pelvic mass/hx injury	
Anomaly, fetal incompatible with life		Gastrostomy		Renal failure	
Aortic aneurysm		Glomerulonephritis (acute)		Rh isoimmunization	
Aplastic anemia		Guillian-Barre syndrome		Rheumatoid arthritis	
Appendicitis		Hirshprungs disease		Schizophrenia/Major psychosis	
Arteriovenous malformation		Hodgekins disease		Shock/trauma (acute)	
Bowel Obstruction		Hypertension (on medication)		Sickle cell diease	
Brain tumor		Ileostomy		TB (active)	
Brain death		Intestinal obstruction		Thyroiditis/hyperthyroid	
Cancer		Incompetent cervix with cerclage		Ulcerative colitis	
CVA					

Outcomes IP/PP					
Processes of Care (orders)		92. BF after delivery (any mention of BF w/in 6hrs pp)		100. Breast only 6 weeks PP	
85. IV		93. Bottle feed only at discharge		101. Breast/Bottle at 6 weeks PP	
86. May eat in labor		94. BF only at discharge		102. Bottle at 6 weeks PP	
87. EFM Continuous		95. Breast/Bottle at discharge			
88. EFM Intermittent		96. Breast only 2 weeks PP			
89. Comfort Measures-any mention/order		97. Breast/Bottle at 2 weeks PP			
90. Evidence of personalized care IP		98. Bottle at 2 weeks PP			
91. # contacts with health system in first PP year		**99.# PP visits in first 8 weeks PP**			
		2	5		
Reasons for visits except NL 2&6 pp:		3	6		
1		4	7		
Questions: Please use specific language from chart and include as much detail as possible.			Notes:		
1					
2					
3					
4					
5					

Moderate Medical Risk Factors					
23. Pre-Pregnancy Weight	23	24. If none, wt at 1st PNC visit	24	25. Weight at Last PNC visit	
26. < 90% DBW	26	27. >120% DBW	27	28. Height	
Risk factors from Medical Hx:		**Antenatal Risk Factors:**		53. Infections requiring ABX (not UTI):broncitis/pneumonia/abcess	53
29. Hx Seizure Disorder, not on med	29	42. Anemia (HGB<10)	42	54. Hx Preterm labor (admission for	54
30. Substance abuse w/in 6mo conception/currently clean	30	43. Asthma	43	55. Pyleonephritis	55
31. Current Drug Use(opiates, speed, cocaine, abuse of RX)	31	44. BV/Gardnerella/**GBS**	44	56. Proteinuria/ not PIH	56
32. Alcohol abuse w/in 6mo conception/currently sober	32	45. Cholestasis	45	57. Sickle cell trait	57
33. MinCur ETOH Use <2 drinks/day	33	46. Chest x ray: + or Tb clinic referral during preg	46	58. STDs (except HIV) GC, Chlamydia, Syphillis	58
34. CurETOH >2 drinks/day or binge	34	47. Depression	47	59. Thyroid Disease (hypo)	59
35. Current smoking pot/cannabis	35	48. Fibroids	48	60. >1 UTI	60
36. Smoke cigarettes-any time	36	49. HTN (W/O Proteinuria &<165/95) or mild PIH (outpt mgmt only) or Labile HTN	49	**61. Severe pre-eclampsia**	61
37. >3 SAB/TAB	37	50. Herpes Simplex	50	**62. GDM-diet**	62
38. Prev PTD/LBW	38	51. IUGR-	51	**GDM insulin**	63
39. Hx fetal demise	39	52. Intestinal parasites	52	**64. Hyperemesis**	64
40. Previous C/S	40	65. Other Medical Risk factors			
41.Close Interval Pregnancy (≤1yr)	41				

Outcomes AP					
62. Evidence of personalized care AP	62	63. Total # Ultrasounds AP		64. Evidence of provider discussions: diet/social stressors/contraception/labor support	

21. Psycho-social Variables for Mod Risk					
65. > 2 livng in one room/sleeps on	65	72. Single without family/ friend support (Isolated)	72	78. Recent Immigrant(during preg or < 1 yr)	78
(include drug tx ctr)	66	73. FOB not involved	73	79. Children in another country	79
67. Living in hotel/Homeless	67	74. Partner abuses ETOH/Drugs	74	80. Children in foster care/adopted c	80
68. Exposed to Violence (see definiti	68	75. Current DV (< 6 mo)	75	81. Monolingual (not English)	81
69. Preg Result of Rape	69	76. Prior DV	76	82. Unintended preg	82
70. Runs out of Food	70	77. # Yrs Education	77	83. Unwanted Pregnancy	83
71. NO WIC but on M-Cal	71			84. Lives alone	84

Appendix G

Protocol for Chart Review

1. In the locked file drawer marked Chart Review you will find DCSs not yet completed filed in numeric order by pt id number. These are in the green file folders. At the front of the drawer in a manila folder is a master list of cases in the same order. (In the next drawer down here are also extra Chart Review Protocols and variable definitions lists if you have forgotten yours.)

2. Take out the number of case DCSs you expect to complete in your session (e.g. 16 sheets for a 4 hour session) and the master list of cases. Also remove the two plastic file envelopes: Yellow for those DCS which have been completed and for which there are no questions or missing information and Pink for those with missing data or for which you have questions.

3. Place a check mark **in pencil** in the "in medical records" column of the master list for each DCS you remove to medical records department, put the master list back in the file drawer and lock the drawer.

4. With the DCSs and plastic file envelopes, go to medical records and pull the charts. (All RAs and the doctoral student will be trained by the Medical Records Department to pull charts before data collection begins.)

If a chart is not found, write Missing and the date at the top of the DCS.

5. **Using a pencil (if you make a mistake, erase the X as completely as possible):** Fill out top of first case DCS with your name, date, and time started.

6. In the medical record on the right side are the sections of the chart pertaining to inpatient encounters. Find the admission that correlates with the delivery date noted on the top of the DCS. If the dates do not agree, follow these steps:

a) If the delivery date in the chart is date is within the time period of the study (May 1, 1999, to April 30, 200) write the date found in the paper chart directly under the DCS delivery date field.

b) If there are no deliveries in the paper chart for the time period of the study, write "WRONG YEAR" directly under the DCS delivery date field. And put the DCS aside. Do not collect any other data for that case.

6. Review the charts for missing variables beginning with the demographic/patient registration sheet.

7. Any shaded boxes requ umeric answer.

8. Mark an **X** in the boxes next to the variable to indicate yes, the variable is present for any non-numeric variable. A blank box means the variable was not found.

8. Find the prenatal record filed in the delivery section of the paper chart.

9. Fill in the first two sections of the chart with any missing variables.

10. After filling in the first two sections of the DCS with any missing data, look at the problem list on the second page of the prenatal record.

11. Review the patient history and problem list for high risk conditions first. If any 1 (one) high risk condition is marked, stop reviewing the chart. No further information is needed. Begin another chart review. ***Place the completed DCS in the yellow envelope.***

12. If no high risk factors are marked, begin reviewing for moderate medical risk factors. (Found on the prenatal problem list or pt's medical history.) Look for each risk factor and mark those present with an **X.**

13. After completing the review for medical risk factors move to the psychosocial section of the chart and follow the same process for the psychosocial risk factors.

14. After completing both sections on moderate risk factors if no **X** has been made in these two sections (medical moderate risk and psychosocial moderate risk), stop reviewing the chart. No further information is needed. ***Place the completed DCS in the yellow envelope.*** Begin another chart review.

15 a. If whole pages or sections of the chart are missing. Write "no medical (or psychosocial or demographic) data available, missing pages" at the bottom of the DCS in the notes section. However, complete as much of the data collection as possible.

Place these DCSs in the pink envelope.

THE FOLLOWING INSTRUCTIONS ONLY APPLY TO CASES WITH MODERATE RISK VARIABLES:

16. Check to see whether any IP outcomes are missing. If so review the IP section of the chart and fill in as necessary.

17. **For IP processes of care**: review both the inpatient order forms and the MD/CNM progress notes for evidence of personalized care and evidence of non-technologic IP care measures (see definitions page X).

18 **For IP type of delivery:** only **one** box should be marked.

19. **For Analgesia/anesthesia:** mark **all** that were used.

20. For Breastfeeding at delivery: check CNM notes and nurses' infant recovery notes.

21. For type of infant feeding at discharge: check discharge from.

22. After completing above, move to the left hand side of the paper record containing the outpatient encounters. Find the prenatal records corresponding to the delivery being reviewed.

23. Count the number of sonograms the patient received before admission to labor and delivery, mark this number in the box marked #78.

24. Review the progress notes for evidence of personalized AP care and evidence of psychosocial educational care measures (see variable definitions page X)

25. Review the outpatient encounters and count the number of visits in the first 6 weeks postpartum, If > 2 mark an **X** box #93.

26. Count the number of visits with any type of provider/for any reason for the period between 6 weeks postpartum and 1 year post partum. Mark that number in box # 92.

27. Place the completed form in the yellow plastic envelope.

28. Every DCS for a moderate risk case should contain information on the variables in the first two sections of the DCS and the following outcome variables: birth weight, total # sonograms AP, type of delivery, analgesia/anesthesia. If one of these variables is missing both on the DCS and not able to be assessed in the paper chart please indicate the name and number of the missing variable in the notes section (e.g. missing birth weight #78). Place these DCSs in the pink envelope.

29. Be sure to return the charts to the re-filing station or re-file them if asked by the clerk.

30. Go back to the office and return the Pink and Yellow envelopes to the locked drawer marked CHART REVIEW at the end of your session. Please complete your session by checking the appropriate box on the master list for each case completed: Completed DCS/yellow or Case needs review/pink.

31. In so far as possible try to complete the number of chart reviews for the DCSs you have taken to medical record. If you have not been able to complete the total number, return them to the appropriate green file folder in numeric order by pt id number. Also please erase the check mark which indicates you too the DCS to medical records.

32. When you begin a session, please begin with the DCSs "next" in order. Do not skip to the end or middle of the list, cases may be missed in this way.

33. There will be extra pencils on the top of the file cabinet. Please let me know if we are running low.

34. You may page me at any time (well, not after 10pm or before 5am) if you have questions during chart review: 415-719-4978.

35. If you are uncertain about what is written in a specific chart fits a variable definition or not, try to page me. If I am not available, then write your question as clearly as possible, quoting the chart and referring to the variable # (e.g. Is "fetal death at 19 weeks" equivalent to # 32 Hx of fetal demise?) keeping going with the chart review but Place these DCSs in the pink envelope.

36. If you have left any DCSs in the pink envelope, please send me an e-mail. I will check them ASAP.

37. Thank you for your help!

Appendix H

Variables By Type And Descriptive Tests

Variable #	Quantitative Variables Descriptive Statistics: mean, median standard deviation and standard error
1	Maternal age at entry to care
2	Level of education-number of years of school completed
3	Number of Times Pregnant
4	Number of Term deliveries ($\geq$ 37weeks)
5	Number preterm deliveries ($\geq$ 20 wk. and $\leq$ 36 weeks)
6	Number of abortions (spontaneous or therapeutic)
7	Number of living children
8	Height (in inches)
9	Weight at last PNC visit in lbs.
10	Pre-pregnancy weight in lbs.
11	Total number of PNC visits
12	Number of visits with primary provider type
13	Gestational age at entry to care (in weeks)
14	Gestational age at delivery (in weeks)
	Dependant Variables
15	Total number of ultrasounds in pregnancy
16	Birth weight in grams
17	Number of contacts with health care system in the first year postpartum for maternal health concerns

Appendix H (*continued*)

Variable #	Categorical Nominal Variables: Descriptive Statistics: Frequency counts, with cumulative percentages
18	Provider type (independent variable)
	CNM
	MD
19	Risk Status
	Low
	Moderate
	High
20	Race/Ethnicity:
	Hispanic
	African American
	Native American
	Asian/East Indian
	Caucasian
21	Marital Status
	Single
	Married/Partnered
22	Level of Prenatal care
	Inadequate
	Adequate
	Adequate Plus

Appendix H (*continued*)

Variable #	Categorical Dichotomous: Descriptive Statistics: Frequency counts, with cumulative percentages
	Financial Status
23	AFDC
24	WIC
25	Medi-Cal Aid Code
26	Self-Pay/ Package
27	Share of Cost
29	< 17 or > 35
30	Hx Seizure Disorder, not on meds
31	Previous PTD/LBW
32	Hx fetal demise
33	Substance abuse at conception/currently clean
34	Current Drug Use (opiates, speed, cocaine, abuse of RX)
35	Alcohol abuse at conception/currently sober
36	Minimal Current ETOH Use < 2 drinks/day no binge
37	Current ETOH > 2 drinks a day or binge
38	Current smoking pot/cannabis
39	Smoking at onset of PNC
40	Previous C/S
41	Late to care> 20 weeks

Appendix H (*continued*)

	Categorical Dichotomous:
Variable #	Descriptive Statistics: Frequency counts, with cumulative percentages
42	Anemia (HGB < 10)
43	Asthma
44	Cholestasis
45	Chest x ray: + or needing Tb clinic referral
46	Depression
47	Mild HTN (W/O Proteinuria & < 165/95)
48	Herpes Simplex
19	Intestinal parasites
50	Infections requiring Ax. (not UTI):
51	> 3 SAB/TAB
52	Pyleonephritis
53	Proteinuria/ not PIH
54	Sickle cell trait
55	STDs (except HIV)
56	Thyroid Disease (hypo)
57	>1 UTI
58	Underweight at entry to care*
59	Inadequate weight gain in pregnancy*
60	Severe PIH/co-managed

Appendix H (*continued*)

	Categorical Dichotomous:
Variable #	Descriptive Statistics: Frequency counts, with cumulative percentages
61	PIH-mild to moderate
62	Chorio/Amnionitis
63	Labor abnormality
	Categorical Dichotomous:
	Descriptive Statistics: Frequency counts, with cumulative percentages
	Psycho-social Variables
64	> 2 living in one room/sleeps on floor/living room
65	Living in public housing
66	Living in hotel/Homeless
67	Exposed to Violence (see definition)
68	Pregnancy Result of Rape
69	Runs out of Food
70	Single without family/ friend support (Isolated)
71	FOB not involved
72	Partner abuses ETOH/Drugs
73	Current DV (< 6 mo.)
74	Prior DV
75	Recent immigrant (during pregnancy or < 1 yr.)
76	Children in another country

Appendix H (*continued*)

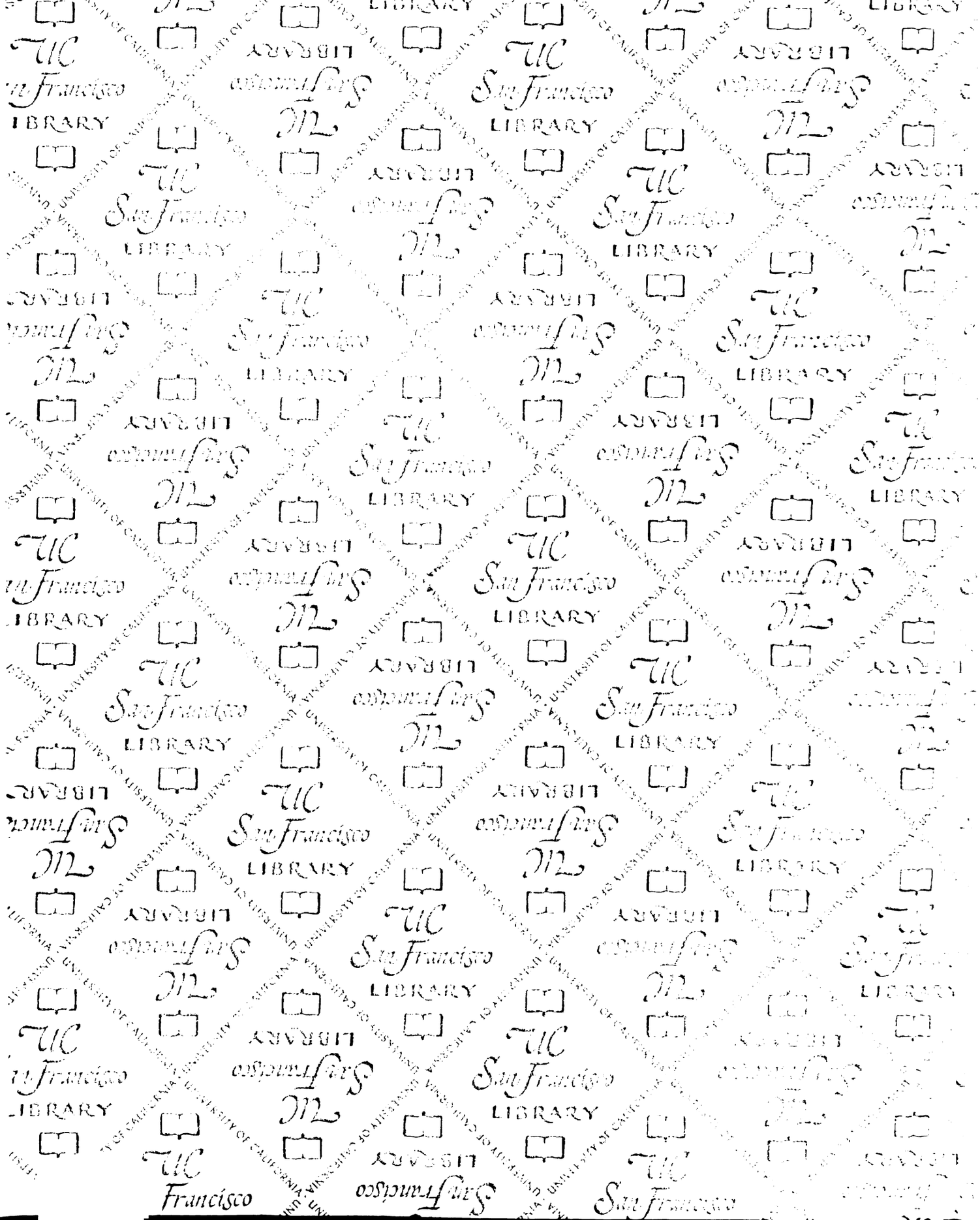
	Descriptive Statistics: Frequency counts, with cumulative percentages
Variable #	Psycho-social Variables
77	Children in foster care/adopted out
78	Monolingual (not English)
79	Unintended pregnancy
80	Unwanted Pregnancy
	Categorical Dichotomous:
	Descriptive Statistics: Frequency counts, with cumulative percentages
	Dependant Variables
82	Evidence of personalized care AP
83	Evidence of provider discussions: diet, social stressors, contraception, labor support
	Processes of Care
84	IV
85	May eat in labor
86	EFM Continuous
87	EFM Intermittent
88	Induction
89	Augmentation-pitocin
90	Augmentation-AROM

Appendix H (*continued*)

	Descriptive Statistics: Frequency counts, with cumulative percentages
	Dependant Variables
91	Comfort Measures-any mention/order
92	Evidence of personalized care IP
93	Method of Delivery: (one only)
	Vaginal not VBAC
	Vaginal-VABAC
	Forceps/vacuum
	C/S-Primary
	C/S-Repeat
	Categorical Dichotomous:
	Descriptive Statistics: Frequency counts, with cumulative percentages
	Dependant Variables
	Anesthesia/Analgesia: (may have one or more)
94	Local
95	Narcotic/anti-emetic
96	Regional-epidural, spinal, saddle
97	General
98	None

Appendix H (*continued*)

	Descriptive Statistics: Frequency counts, with cumulative percentages
Variable #	Dependant Variables
	Breast Feeding
99	BF within 1 hour after delivery
100	Bottle feed only at discharge
101	BF only at discharge
102	Breast/Bottle at discharge
103	Breast/Bottle at 6 weeks PP
104	Bottle only at 6 weeks PP
105	Breast only 6 weeks PP
	Contacts with the Health System
107	# Contacts with health system in first 8 weeks PP
	LBW
108	Low Birth Weight $\leq$ 2500 g
109	Very Low birth Weight $\leq$ 1500 g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