

FETAL MOVEMENT COUNTS IN PREGNANCY:
A COMPARISON OF THE CARDIFF AND
SADOVSKY METHODS

by
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ABSTRACT

The purpose of this study was to compare the Cardiff and Sadovsky methods of daily fetal movement counts for maternal compliance, perception of difficulty, and reactions. Maternal-fetal attachment was also evaluated in relationship to compliance.

The pretest-posttest control group design was chosen for this study. Eighty women between 35 and 39 weeks gestation were randomly assigned to one of the two methods to count fetal movement. Fifty-six women completed the counts for 1 week.

There were no statistically significant differences in compliance, perceived difficulty or reactions between the groups of women who used the Cardiff and Sadovsky methods. Maternal-fetal attachment was not correlated with completion of the movement counts. Some of the women did feel that counting fetal movements made them feel anxious about their baby.

Implications from this study include maternal compliance and reaction issues. Further research is needed on fetal movement counts to evaluate their use as an antenatal screening tool.

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CHAPTER I

INTRODUCTION AND REVIEW OF LITERATURE

Within the field of midwifery and obstetrics, maternal perception of fetal movement in utero has long been an indicator of fetal well-being. Early textbooks defined maternal recognition of fetal movement as "quickening," a milestone for dating the pregnancy and a verification of viability. A decrease or cessation of movement was further acknowledged as a sign of fetal death. In the past 20 years the assessment of fetal movement has been refined as an accurate and valid tool for fetal surveillance.

Health care providers have made achievements in decreasing poor outcomes of pregnancy by using newer technological procedures for the assessment of fetal well-being. The nonstress test, contraction stress test, ultrasound scan, and biophysical profile are accepted screening and diagnostic tools in antepartal care. Yet these procedures are costly, invasive, and carry risks, making them impractical for use as routine screening tools in low risk pregnancies.

Fetal death in utero occurs at the rate of 9.2 per 1,000 live births annually in the United States (Pritchard, MacDonald & Gant, 1985, p.2). A small proportion of these deaths can be attributed to congenital anomalies, yet approximately one half of these are normal fetuses that die in utero without a known cause. Although the number is not large, each death is a tragedy and many such deaths occur in "low

risk" pregnancies. Perinatal mortality, stated as the number of stillbirths and the number of neonatal deaths per 1,000 live births, occurs at a rate of 17.7% in the United States. This high number is primarily a result of preterm delivery, intrauterine growth retardation, diabetes, and lethal congenital anomalies (Depp, 1982, p. 803). Early identification of the first three entities and evaluation of the fetoplacental unit can reduce poor outcomes. A compromised fetus entering the stress of the intrapartal period may further be compromised, resulting in permanent damage. A low cost, practical, and valid screening tool is needed to identify at-risk fetuses needing further evaluation. Daily fetal movement counts (FMCs) through maternal assessment may serve this purpose.

Active fetal movement has been associated with positive neonatal outcomes, including high Apgar scores and cord pH values, adequate birth weight (above 2500 grams), and improved neonatal mortality and morbidity statistics (Ehrstrom, 1979; Leader, Bailee & Van Schaalkwyk, 1981; Neldam, 1980; Pearson & Weaver, 1976; Sadovsky, Yaffe & Polishuk, 1974). Decreased fetal movement has been correlated with deteriorating placental function, intrauterine growth retardation, low Apgar scores, meconium stained fluid, and intrapartal fetal distress (Leader et al., 1981; Liston, Cohen, Mennuti & Gabbe, 1982; Mathews, 1975; Neldam, 1980; Sadovsky & Yaffe, 1973; Sadovsky, 1981). Cessation of fetal movement with an audible fetal heart rate is a signal that in utero demise will occur within 12 to 48 hours (Sadovsky & Yaffe, 1973). Because of these studies, formal methods of fetal movement counting have been developed.

Today within clinical practice two main methods of fetal movement counting are taught to women. In one method, known as the "Cardiff Count to Ten" (Pearson, 1977) or the fixed number approach, the woman counts fetal movements up to 10, and records the time period in which she reached the number. The other method, developed by Sadovsky (1973), is a fixed time approach in which the woman counts for three half hour to hour periods per day and calculates the number of movements per 12 hours. If fetal movement falls below set criteria when either method is used, the woman is to notify her health care provider for further evaluation. Evaluation and management sequelae for decreased fetal movement include a nonstress test for fetal reactivity and health. If a nonreactive nonstress test is obtained, further management may include observation, a contraction stress test or the induction of labor. These approaches have become standards of practice within the field of perinatology, particularly among high risk clientele. In low risk pregnancies, fetal movement counts are more commonly taught if the pregnancy begins to show signs of pregnancy-induced hypertension, intrauterine growth retardation, gestational diabetes, or becomes post dates. These situations indicate decreasing placental function requiring closer observation of fetal health.

The counting of fetal movement is a sound recommendation in antepartum management, yet only one large prospective controlled study has been conducted on the effect of formal fetal movement counting on the stillbirth rate (Neldam, 1980). This study involved 2,250 pregnant women. Subjects in the treatment group were formally instructed in a method to count fetal movement and documentation of movement was made in

the chart. The control group was not specifically instructed in counting fetal movement but were always asked whether they were feeling a decrease in fetal movement. Management for decreased fetal movement was the same for both groups. A significant difference ($p < 0.01$) in the stillbirth rate was found between the two groups. Among infants weighing more than 1500 grams, eight intrauterine deaths occurred in the control group and no deaths in the monitoring group (Neldam, 1980).

Maternal counting of fetal movement can be used as a screening tool for low and high risk pregnancies. Few studies have demonstrated which method of counting has increased compliance. Furthermore, few studies have included maternal variables that may affect compliance. Maternal-fetal attachment may be related to the woman's compliance with antenatal screening care such as fetal movement counts. As a screening tool, fetal movement counts rely fully on the woman's participation. However, even fewer studies have evaluated the mother's reaction to the completion of fetal movement counts. In order to be clinically useful, movement counts must be well accepted by the mother, easy to use, and not cause unnecessary anxiety with her pregnancy.

Purpose Statement

The purpose of this study is to compare the Cardiff and Sadovsky methods of daily fetal movement counts for maternal compliance. Maternal-fetal attachment will be evaluated in relationship to compliance. The overall maternal reaction to the use of daily fetal movement counts in pregnancy will also be assessed.

Review of Literature

Fetal movement has been discussed from a variety of perspectives within the literature. This review begins with a synopsis of studies of the normal ranges and types of fetal movement during pregnancy, and of the factors which may affect movement, i.e., gestational age, maternal food intake, circadian cycles, and neurobehavioral states of the fetus. Secondly, studies are reviewed in which fetal movement counts are compared as a surveillance tool to other measures of well-being, such as the nonstress test. Finally, the different formal methods of fetal movement counts are described. A few studies are presented which have tested the methods for compliance, accuracy, and maternal reaction.

Characteristics of Fetal Movement

Fetal movement in utero is known to begin mainly as reflexive activity at 7 to 8 menstrual weeks. Movements increase in frequency and range in a cephalocaudal progression as gestation advances. It is not until the 16th to 21st weeks that fetal movement is perceptible to the mother. At this time, the movements are infrequent, weak, and difficult to distinguish from peristaltic movements of the intestines. Gradually, the movements become stronger, more frequent, and discernible from peristaltic movements (Coleman, 1981; Sadovsky & Polishuk, 1977).

The relationship between gestational age and the number of fetal movements per day has been studied by several investigators with varying results. Sadovsky (1981) studied 127 pregnant women with normal outcomes, finding daily means of fetal movement increasing from 200 in the 20th week to a maximum of 575 in the 32nd week, and gradually decreasing to a mean of 282 at delivery. Ehrstrom (1980) also found

fetal activity increased from the 24th week to the 32nd week and then slowly decreased until term. However, Patrick, Campbell, Carmichael, Natale and Richardson (1982) found mean fetal movements per hour to be similar at 30 -31, 34-35, and 36-39 weeks gestation.

Several investigators have found decreased fetal movements with postmaturity (Edwards & Edwards, 1970; Sadovsky & Polishuk, 1977; Wood, Gilbert, & O'Connor, 1979). Physiologic changes of pregnancy have been thought to be the rationale used to support these findings. As gestation advances, space and fluid ratio decreases leaving less room for fetal movement. Timor-Tritsch (1979), studying the types of fetal movement, suggested that decreased movement at term correlated with a maturing fetal neurological system and longer sleep cycles. Decreased placental perfusion in a postmature placenta has also been suggested as a causative factor.

The effects of maternal meals and serum glucose concentrations on the frequency of fetal movement have also been studied. In a well-controlled study, serum glucose values were obtained every 30 minutes for 2 hours after meals and compared to fetal movement counts. Maternal plasma glucose concentrations increased significantly to peaks one hour following meals, but there was no relationship between the number of gross fetal body movements and glucose concentrations (Patrick et al., 1982).

There appears to be a diurnal variation in fetal movement with increased periods of fetal activity between the hours of 2000 to 0100 (Ehrstrom, 1979; Goodin & Lowe, 1974; Spellacy, Cruz, Gilman & Buhi, 1977; Wood, Walters & Trigg, 1977). Women may perceive an increase in

fetal activity during evening and bedtime hours when there is more focus on the fetus. Another factor affecting the frequency of fetal movement includes the cyclic asleep/active pattern of the fetus. Multiple investigators have examined the behavioral states of the fetus and identified cyclic activity. Periods of fetal rest with little or no movement have been found to average 22 minutes, but may last up to 75 minutes (Patrick et al., 1982; Timor-Tritsch, Zador, Dieker, Hetz & Rosen, 1978).

The patterns of fetal movement have been studied using real time ultrasound, pressure transducers, and pleismographs. One classification system divided the patterns of fetal movement based on duration, shape, and amplitude of the wave form created by fetal movement on the maternal abdomen. Four types of movement were identified: rolling or stretching movements lasting greater than 3 seconds, simple trunk and limb movements lasting less than 3 seconds, high frequency types (i.e., hiccoughs), and fetal respiratory movements (Timor-Tritsch, 1979).

Other classification systems used maternal perceptions and categorized movements as weak, strong, or rolling movements. At 20 weeks, movements were predominantly weak with the stronger and rolling movements progressively increasing until 36 to 37 weeks. From 37 weeks on, strong movements decreased with a slight increase in weaker movements (Sadovsky, Laufer & Allen, 1979).

The overall daily range of perceived fetal movement varies among mothers with frequencies from 4 to 1646 per day. Individual variation is between 30 to 40 movements for the same fetus and may fluctuate

between 200 to 700 per day. The clinical value of the absolute number of fetal movements has not been firmly established (Sadovsky, 1985).

Normal outcomes have been found with fetal movements as low as four to ten per day, although this pattern occurs in less than 2.5% of the population. A clear pattern of decreased fetal movement over time coupled with a low daily movement pattern, or fetal movement in an active fetus decreased to less than 10 movements in 12 hours indicates a compromised fetus (Sadovsky, Laufer, & Allen, 1979; Sadovsky, 1985).

Relationship of Fetal Movement Counts to the Nonstress Test

Movement of the fetus has been compared to changes in fetal heart rate. Lee, Dilereto, and O'Lane (1975) demonstrated that acceleration of the fetal heart in association with fetal movements is considered normal and an expression of well-being. This correlation has led in part to the development of the nonstress test (NST). A reactive nonstress test is commonly defined as acceleration of the fetal heart 15 beats for fifteen seconds in association with fetal movement.

Yet studies on the relationship between nonreactive/reactive nonstress tests to fetal movement records have not been fully conclusive. Rayburn (1982) found a positive correlation between fetal activity and the reactive nonstress test. In contrast, O'Leary and Andrinopoulos (1981) found through statistical analysis that the NST results and fetal movement count record were not related. Sadovsky and Polishuk (1977) studied fetal heart rate in association with fetal movement in 141 normal and pathologic pregnancies. They concluded that no consistent change in fetal heart rate occurs with each fetal

movement. Fetal movement of less than 1 second duration may not be accompanied by acceleration of the fetal heart, and this does not indicate a compromised fetus. Yet fetal movement lasting longer than 3 seconds duration is associated 98% of the time with an increase of the fetal heart rate. Clinically, fetal movement counts should be used with other tests when evaluating a compromised fetus, rather than being the sole indicator of fetal status (Gantes, Schy, Bartasius & Roberts, 1986).

Fetal movement counts have also been studied in relationship to biochemical tests of placental function such as serum and urinary estriol levels. Rayburn and McKean (1980) concluded that low serum estriol values and a documented slow fetal activity pattern indicated severe fetal distress and impending death. Yet these low estriol values and positive fetal activity were within normal limits. Other investigators have found that the counting of fetal movement was more useful than the determination of serum estriol values in predicting perinatal mortality and morbidity (Harper, Greenberg, Farahani, Glassman & Kierney, 1981; Pearson & Weaver, 1976; Sadovsky & Polishuk, 1977).

The Daily Fetal Movement Record

Maternal perception of fetal movement is a reliable index of fetal activity. Using ultrasound and electromechanical devices to record fetal movement, women's subjective sensation was 82-90% accurate (Hertogs, Roberts, Cooper, Griffin & Campbell, 1979; Rayburn & McKean, 1980; Sadovsky, Polishuk, Mahler & Malkin, 1973; Sadovsky et al., 1979). Maternal sensitivity to fetal movement has not been found to be affected

by maternal age, parity, obesity, duration of fetal movement, or the presence of an anterior placenta. In contrast, maternal perception has been found to be influenced by the mother's character, occupation, and willingness to participate. Some mothers mistake fetal breathing movements, fetal hiccoughs, and Braxton-Hicks contractions for fetal movement.

The first formal method for fetal movement counts was developed by Sadovsky in 1973. Sadovsky noted in clinical practice that a decrease or cessation of fetal movement, but with an audible fetal heart rate, was followed by fetal demise within 12 to 48 hours (Sadovsky & Yaffe, 1973). Using this information, he developed a protocol for fetal movement counts which continues to be updated. The woman begins to count fetal movement at 27 weeks gestation in a high risk pregnancy. The woman counts movements for 30 to 60 minutes, three times a day in the morning, afternoon, and evening. If she notes more than four movements during each period, the woman can be reassured the fetal movement is within a normal range. If less than four movements, the woman continues to count for 1, 2 or more hours. When there are less than 10 fetal movements in 6 hours, the woman is to notify the health care provider for a nonstress test (Sadovsky, 1985). The sum total of the three 30 to 60 minute recordings are multiplied by 4 to give a 12 hour daily count. In a low risk pregnancy, women begin to count fetal movements at 32 to 36 weeks gestation. These women are taught to pay attention to fetal movements two to three times a day. If fetal movements are markedly reduced, the women are treated as high risk patients.

Pearson developed a different method of recording fetal movements known as the Cardiff Count to Ten chart. The count begins at 0900 and continues in half hour blocks until the 10th movement is perceived. This time is recorded on a chart. By 2100 if the movement count is less than 10, the actual number of movements perceived is recorded. The client is to notify her provider immediately if movements are not felt for 1 day or less than 10 movements by 2100 hours (Pearson, 1977). This method is the most widely used system in the United Kingdom.

Variations have been developed for both formal count systems. Utilizing Sadovsky's method, count periods have been decreased to 10 to 20 minute periods (Spellacy et al., 1977; Wood, Walters & Trigg, 1977). Problems encountered with decreasing the count time included increasing false alarms. The fetal sleep cycle ranging from 20 to 70 minutes was thought to overlap with the counting periods, thus producing the false alarms. Neldam (1980) instructed the mothers to count once a week in the morning, at noon, and in the evening, until the 32nd week. Thereafter they were to count three times weekly, three times a day. This method may increase compliance with fewer count periods, but at the risk of decreasing the sensitivity of the method. A third variation developed by Grant and Hepburn (1984) combined the methods to form an individualized approach to the counting of fetal movement. The pilot test of this new system was associated with fewer false alarms for decreased movement. Although the individualized approach was developed to decrease time per day women would need to count, it was found the time women spent counting was similar in length to Sadovsky's method, yet less time than the Cardiff method.

Many studies have used Sadovsky's, Pearson's, and variations of these methods to investigate the validity of movement counts and the relationship to neonatal outcomes. Within these studies problems have been identified with the methods of counting and documenting. Investigators have commented that women are unsure what constitutes a movement, become confused about how to complete the chart, and have had inadequate teaching and reinforcement to increase compliance. Very few studies have focused on the differences in the counting methods, or which method improves the validity and compliance within a population .

Clark (1985) found when using the Cardiff method in a low risk population that compliance was inadequate: 27% of the subjects filled out the chart less than 50% of the time, and 65% of those who experienced a movement alarm signal did not notify their provider. In contrast, a 98% compliance rate has been obtained by other investigators (Draper, Field, Thomas & Hare, 1986; Fischer, Fullerton, & Trezise, 1981). In studies using variations of Sadovsky's method, the investigators reported no specific compliance rates, but indicated that this method provided improved reliability, accuracy, and completion with the shorter count periods (Neldam, 1980; Rayburn, 1980; Valentin, Lofgren, Marsal & Gulberg, 1984; Wood et al. 1977).

Research investigating the woman's perception and reactions to doing fetal movement counts is minimal. Because the screening tool places the responsibility of monitoring on the mother, it has been questioned if this places unnecessary anxiety on the pregnancy (Mathews, 1973; McIlwaine, Howat, Dunn & McNaughton, 1980; Thompson & Wheeler, 1985). Draper et al. (1986) found that two thirds of the women in their

population were reassured by completing a fetal movement chart, and one third were worried. The main reasons expressed for concern were an inadequate knowledge about fetal movement.

Summary

In review, fetal movement in pregnancy has been studied thoroughly. Fetal movement is first perceived by the mother between 16 and 20 weeks gestation. From then on the fetus remains active, varying in the number and types of movements per day. The active fetus is associated with positive neonatal outcomes and documented decreased fetal movement with intrapartal fetal distress or impending in utero demise. Because of studies which correlate fetal movement to other antepartal tests of well-being, the instruction of counting fetal movement has become an accepted part of antenatal care.

Both the Cardiff and Sadovsky methods of counting fetal movements have been developed and are sensitive to identifying fetuses at risk needing further evaluation. But in order for a screening tool to be beneficial in clinical practice it needs to be applicable to clientele of various ages, occupations, levels of education, and socioeconomic status. The purpose of this study is to evaluate in a low risk population which method of fetal movement counting encourages compliance. The relationship of maternal-fetal attachment to compliance with FMCs will also be investigated. Maternal reaction to completing both methods will be examined with the purpose of further developing fetal movement counts as a useful screening tool in pregnancy.

Research Questions

1. Are there differences in maternal compliance between the Cardiff and Sadovsky methods of counting fetal movement?
2. Are there differences in perceived difficulty between the Cardiff and Sadovsky methods of counting fetal movement?
3. Is maternal-fetal attachment related to compliance with the counting of fetal movement?
4. What are maternal reactions to using formal methods of fetal movement counting, and do they differ between the methods?

Definition of Terms

Compliance: a ratio of the number of days the movement count record was completed as directed to the number of days possible to complete the movement count record.

Maternal Perception of Difficulty: a composite score of questions 1 through 7 on the Fetal Movement Count Evaluation Form.

Maternal Reactions: the mother's attitudes, beliefs, and feelings as expressed by responses to questions 8, 9, and 10 on the Fetal Movement Count Evaluation Form.

Cardiff Count to Ten Method: a formal method of daily assessing fetal activity and well-being by the mother, which includes the counting of fetal movements beginning each morning until the 10th movement is perceived.

Sadovsky Daily Fetal Movement Record: a formal method of daily assessing fetal activity and well-being by the mother which involves the counting of fetal movement for three half hour to hour periods in the morning, noon, and evening.

Maternal-Fetal Attachment: "the extent to which women engage in behaviors that represent an affiliation and interaction with their unborn child" (Cranley, 1981), as measured by the Maternal Fetal Attachment Scale.

Low Risk Pregnancy: a prenatal risk score of 9 or less as identified by the Hobel scale.

Assumptions

It was assumed within this study that mothers between 35 and 40 weeks gestation were capable of perceiving fetal movements. It was also assumed that after instruction by the investigator on what counts as fetal movements, women would be able to distinguish fetal movements from false contractions and fetal hiccoughs. Furthermore, it was assumed that the self-reported data concerning fetal movement were accurate.

CHAPTER II

METHODOLOGY

Design

An experimental design, the pretest-posttest control group design (Campbell & Stanley, 1963, p. 13), was chosen for this study. Forty subjects were randomly assigned to each of the two groups for a final sample size of 80 subjects. To assess whether randomization was effective in minimizing pretreatment differences, data were collected on demographic variables. Both groups were given the identical pretest and posttest, but received different treatments or interventions. The random assignment of the first treatment was determined by the flip coin approach, and thereafter the treatments were alternately used. The method of instruction or intervention was individually provided, enabling both groups to run simultaneously throughout the study. Each group acted as a control for the opposite group being studied (Table 1).

Sample

The sample included 80 healthy women in the last 4 weeks of their pregnancies, living in the Salt Lake area. A heterogeneous sample was sought who met the following inclusion criteria:

1. Multiparous and primiparous women between the end of the 35th week gestation and the beginning of the 39th week gestation.

Table 1
Study Design

Group I	R	01	X ₁	02
Group II	R	01	X ₂	02

X₁ = Cardiff method
X₂ = Sadovsky method

2. Single gestation pregnancies.
3. Women between the ages of 18 and 35.
4. Women with no previous history of stillbirth.
5. Women with a risk score of 9 or less as identified by the Hobel scale (Appendix A).
6. All women regardless of their marital status.
7. Only women who were able to understand and read English.

Data Collection Instruments

Hobel's Prenatal High Risk Screening

Hobel (1973) developed a high risk screening system, the first part of which focuses on problems detected in the antepartal period (Appendix A). The screening tool is based on a prospective analysis of 738 pregnancies. Factors are assigned weighted values according to assumed risk (low risk scores < 9). According to a stepwise multiple regression analysis, actual intrapartum scores are most predictive of neonatal risk, followed by prenatal scores.

Maternal Background Questionnaire

A data collection instrument was developed by the researcher to measure independent variables that may affect the dependent variable of compliance (Appendix B). Parity, socioeconomic class, and level of education in previous research have not been found to affect maternal perception of fetal movement or compliance in completion of fetal movement counts. Variables that may affect compliance include the mother's occupation, religious preference, and the participation of a support person in her pregnancy.

Cranley's Maternal-Fetal Attachment Scale

Cranley (1981) developed a 24-item scale to measure the construct of maternal-fetal attachment in pregnancy (Appendix C). Six aspects of the relationship were identified and developed into subscales. Content for the subscales was obtained from consultation with clinicians, LaMaze instructors, and expert nurses in the field of maternal child health. Originally tested among 71 subjects, an item analysis was performed which led to the deletion of the subscale "nesting" which demonstrated no reliability. The redefined subscales were analyzed and results were sufficiently high to claim internal consistency. The subscales include:

1. Differentiation of Self from Fetus: four items with a Cronbach's alpha of .62.
2. Interaction with the Fetus: five items with a Cronbach's alpha of .68.
3. Attributing Characteristics or Intention to the Fetus: six items with a Cronbach's alpha of .67.

4. Giving of Self: five items with a Cronbach's alpha of .52.
5. Role Taking: four items with a Cronbach's alpha of .73.

Cranley found the coefficient of reliability for the total scale of 24 items is .85. Intercorrelations were performed among the subscales and the total scale to examine construct validity. All subscales are positively associated with the total scale ($r = .61$ to $.83$). According to Cranley, this provides some statistical evidence that the subscales measure different aspects of the construct of maternal-fetal attachment (Cranley, 1981).

Cardiff and Sadovsky Protocols for Fetal Movement Counts

The formal methods of counting fetal movement used in this study are known as the Cardiff Count to Ten Method (Pearson, 1977 & Appendix D), and the Daily Fetal Movement Record (Sadovsky & Yaffe, 1973 & Appendix E). Both methods have been used in clinical practice and by researchers investigating the relationship of fetal activity/inactivity to pregnancy outcomes. Through both retrospective and prospective studies, active fetal movement has been correlated with positive outcomes and considered a reliable measure of well-being. The subjective maternal perception of fetal movement has been compared to the objective measures of fetal movement, i.e., ultrasound recordings. The correlation of maternal perception to movements sensed by ultrasound was found to be between 82% to 90%, affirming the reliability of fetal movement counts performed by the mother.

Criterion-related validity for fetal movement counts has been developed through the correlation of reactive nonstress tests to active movement counts, and nonreactive tests at times consistent with decreased fetal movement. In addition, an accepted fetal surveillance tool in practice is the biophysical profile. This tool includes the assessment of fetal body movements as one of the parameters for scoring well-being.

Investigators have examined the predictive values of fetal movement counts. In a prospective study by Leader et. al (1981), using four half hour count periods per day similar to Sadovsky's protocol, a specificity (the proportion of normal fetuses giving a normal result) of 91% is obtained. The sensitivity (the proportion of compromised fetuses giving an abnormal result) is 86%. Overall the predictive value (the likelihood of compromise if the result is abnormal) is only 46%, thought to be low, secondary to the tendency of mothers to undercount fetal movements.

Liston et al. (1982), in a prospective study using the Cardiff protocol for counting fetal movements, found a sensitivity of 64% and specificity of 98%. The predictive value is 55% with the level of significance set at .001. In comparison to other biophysical and biochemical tests of well-being with sensitivities of 21% to 76%, specificities of 69% to 97%, and predictive values of 55% to 83%, the counting of fetal movement can be considered a valid measure of assessing fetal well-being.

The "movement alarm signal" (MAS, less than 10 fetal movements in 12 hours) used as the parameter to identify fetal distress has been

compared in both the Cardiff and Sadovsky protocols through a retrospective study in 252 high risk pregnancies (Sadovsky, Ohel, Havazeleth, Steinwell & Penchas, 1983). The alarm signal was compared to other definitions of decreased fetal movement. The criteria for establishing a poor outcome include intrauterine death after the 26th week of pregnancy, intrauterine growth retardation (defined as fetal weight less than the tenth percentile), 1-minute Apgar scores of 6 or less, and meconium stained fluid. All definitions of decreased fetal movement were found to be highly sensitive (the conditional probability that the test would be positive once the disease state was in existence), but only the MAS showed specificity (the conditional probability that the test would be negative once the disease state did not exist), thus decreasing the false negative prediction rate. Overall, while the maternal perception of fetal movement does not detect all fetal movements, has false positive alarm signals, and is subject to patient compliance, the tool is universally available, is inexpensive, and may alert the clinician to possible fetal compromise.

Ethical Considerations

Prior to initiating this research, approval was obtained from the Institutional Review Board for Research with Human Subjects at the University of Utah. The study was also approved by the research review board within the clinical institution where data were collected.

The participants for the study were voluntarily recruited from prenatal clinics during the last 4 weeks of their pregnancies. The investigator approached prospective participants individually and

verbally explained the purpose of the research study and its components (Appendices A - F). The approximate time involved for participation was also explained. Subjects were told that the benefits of the study for themselves included learning a simple tool they could use daily to assess fetal well-being. It was also explained that the study was noninvasive and carried no identifiable risks, but might inconvenience their time and cause them to increase their focus on the fetus in utero. Confidentiality would be maintained through the use of code numbers on all forms provided. If the individuals agreed to participate, a written consent form was signed and a copy was given to them explaining the study, their rights, and telephone numbers to use for any questions. They were told they were free to withdraw from the study at any time, and it would have no affect on their health care.

Data Collection Procedures

The study was conducted at Family Health Plan, a large health maintenance organization serving the Salt Lake City area. The organization's prenatal clinics, clients, and office hours were used for data collection.

Initially prospective participants for the study were obtained by the investigator, who reviewed the daily scheduled appointment sheet. Return prenatal visits for women between the end of the 35th gestational week and beginning of the 39th gestational week were identified using estimated dates of confinement. The clinic charts were then reviewed by the investigator to assess if the individual met the inclusion criteria for the study. These included primiparous and multiparous women between

the ages of 18 and 35, English-speaking, and with a risk score of 9 or less as identified by the Hobel Prenatal High Risk Screen (Appendix A). Those identified as meeting the inclusion criteria were approached for voluntary participation in the study.

When the client registered for her appointment, the investigator approached the individual and verbally explained the study. At this time informed consent for participation was obtained. If time was available before the woman's visit with the health care provider, she was asked to complete the Maternal Background Questionnaire (Appendix B) and the Cranley's Maternal-Fetal Attachment Scale (Appendix C). If unable to complete prior to being called for her visit, she was asked to finish the instruments after her prenatal visit. When both instruments were completed, the participant was individually instructed in a method to formally count fetal movements by the investigator. The first subject in the study was assigned to the Cardiff Count to Ten Fetal Movement Protocol (Appendix D), which was randomly determined by a flip coin approach. The next participant was placed in the opposite intervention, and instructed in Sadovsky's Daily Fetal Movement Record Protocol (Appendix E). From then on subjects were alternately assigned to one of the two methods to count fetal movement.

Instructions were provided using standard written protocols of the method, which were also given to the client (Appendices D & E). The instructions provided also contained the chart the woman was to complete on a daily basis for 1 week. Any questions on how to count and graph the count were answered by the investigator using a sample sheet of the method in which they were instructed. The participant was then asked to

bring the movement chart back at her next prenatal visit in 1 week, or to return the movement chart by mail using a provided envelope. She was told that her time at the next visit would be approximately 15 minutes to complete participation in the study.

Each participant was contacted at the woman's next prenatal visit or through a telephone call. The completed charts (Appendix D or E) were collected at the visit, or the client was again asked to return the chart by mail. Attrition information was also obtained at this time. The participant was asked to complete the provided evaluation form (Appendix F) to conclude her participation in the study. If interested in continuing to use the method in which she was instructed, she was provided with additional forms on which to complete her counts.

Questionnaires were checked for completeness and data were coded and analyzed at the University of Utah Computer Center using the Statistical Package for Social Sciences (SPSS). Descriptive statistics were used for analysis of the demographic variables. The variables of parity, age, income, level of education, and maternal-fetal attachment were assessed in relationship to the dependent variable of compliance using Spearman's correlation coefficient. Compliance data for both the Cardiff and Sadovsky methods were obtained on an interval scale and analyzed using inferential statistics including t -tests and chi-square analyses. Both descriptive and inferential statistics were used to analyze the participants' evaluation of the fetal movement counts.

CHAPTER III

RESULTS AND DISCUSSION

Results

The data obtained from the questionnaires were computed at the University of Utah Computer Center using the Statistical Package for Social Sciences (SPSS) program. General descriptive statistics were computed on the demographic variables and the questionnaire responses. Independent t-tests were used to analyze differences between completers and noncompleters of fetal movement counts (FMCs). To determine if there were any significant differences in compliance or maternal reactions between the Cardiff and Sadovsky methods, independent t-tests and chi-square analyses were computed.

Fifty-six women in this study completed fetal movement counts for one week, an overall compliance rate of 70%. Twenty-four women (30%) did not complete the counts. Of these 24, 6 (7.5%) stated they withdrew from the study because they were busy working. Four (5%) did not complete the counts because they delivered 2 to 3 days after entering the study. Fourteen (17.5%) stated they completed the counts but failed to return the charts. Of the 24 women who did not complete the counts, 66% were assigned the Sadovsky method.

Mean scores were calculated on the total MFA scale. Mean scores were also calculated on the subscales. To identify any differences between subjects that completed FMCs and those that did not, independent t-tests were computed. There were no significant differences in

demographic variables or maternal-fetal attachment between the two groups.

Demographics of the Sample

Fifty-six of the 80 women who entered the study completed it. Using Hobel's risk screening tool for prenatal factors, 66% of the women had no identifiable risk (Table 2). The remaining 34% carried a risk score of 1 to 7, still within the low risk pregnancy category. The gestational week in pregnancy ranged from 35 to 39, ($\underline{M} = 36.3$, $\underline{S.D.} = 5.1$). The ages of the women ranged from 18 to 35, ($\underline{M} = 25.9$, $\underline{S.D.} = 5.1$). According to ethnic groups, 91% were Anglo-American, 2% Black American, 5% Hispanic, and 2% Polynesian (Table 2). The background questionnaire revealed that 53.6% completed high school and the remainder had some college education. Fifty-nine percent were not working at the time of the study and 41% were working part- to full-time. Thirty-nine percent of the women were primigravidas and 61% reported having one to four children, 1 subject having six children.

Almost half (43.8%) of the women reported an annual income of greater than \$20,000 per year. In a listing of religious preference, 57.1% were Latter Day Saints, with the remaining listing Catholic, Protestant, Jewish, and no religious preference. All the subjects reported having a support person in their pregnancy.

To assess whether randomization was effective in reducing pretreatment differences between the two groups that completed the Cardiff and Sadovsky FMCs, independent t-tests were computed on

Table 2
Demographics of the Sample

Characteristic	Categories	<u>n</u>	Percentage
Risk Score	0	37	66.0
	1-5	17	30.4
	6-7	<u>2</u>	<u>3.6</u>
		56	100.0
<u>M = 1.143, S.D. = 2.03, Range = 0-7</u>			
Gestational Week	35	17	30.4
	36	16	28.6
	37	10	17.9
	38	11	19.6
	39	<u>2</u>	<u>3.6</u>
		56	100.0
<u>M = 36.37, S.D. = 1.214, Range = 35-39</u>			
Maternal Age	18-20	10	17.9
	21-25	20	35.8
	26-30	14	25.6
	31-35	<u>12</u>	<u>21.5</u>
		56	100.0
<u>M = 25.94, S.D. = 5.16, Range = 18-35</u>			
Ethnic Group	Caucasian	51	91.0
	Black	1	1.8
	Hispanic	3	5.4
	Polynesian	<u>1</u>	<u>1.8</u>
		56	100.0
Education (in years)	8-12	30	53.6
	13-14	18	32.2
	15-16	<u>8</u>	<u>14.2</u>
		56	100.0
<u>M = 12.64, S.D. = 1.6, Range = 8-20</u>			

Table 2 (continued)
Demographics of the Sample

Characteristic	Categories	<u>n</u>	Percentage
Employment/School (hrs/wk)	0	33	58.9
	10-20	4	7.2
	20-40	<u>19</u>	<u>33.9</u>
		56	100.0

Number of Children	0	22	39.3
	1-2	27	48.2
	3-4	6	10.7
	6	<u>1</u>	<u>1.8</u>
		56	100.0

Religion	LDS	32	57.1
	Protestant	4	7.1
	Catholic	6	10.7
	Other	2	5.4
	No preference	<u>12</u>	<u>19.6</u>
	56	100.0	

Income (\$/year)	< 5,000	6	10.7
	5,000 - 14,999	8	14.3
	15,000 - 19,999	13	23.2
	20,000 - 29,999	6	12.5
	30,000 - 39,999	7	12.5
	40,000 and above	8	14.3
	Missing data	<u>8</u>	<u>14.3</u>
	56	100.0	

demographic and the attachment variables. No significant differences were identified between the two groups (Table 3).

Instrument Reliability

Cronbach's alpha coefficient of reliability was computed on the total scale and subscales that were used to measure the construct of maternal-fetal attachment. The Cronbach's alpha coefficient is .80 for the total scale, whereas the subscales have coefficients ranging from .43 to .66. The instrument women used to evaluate their difficulty in participation with their assigned methods of fetal movement counts was also analyzed for reliability. A Cronbach's alpha coefficient of .80 was obtained.

Research Question 1

Are there differences in maternal compliance between the Cardiff and Sadovsky methods of counting fetal movement?

Eighty subjects were randomly assigned to the two groups to count fetal movements, 40 in each group. Fifty-six subjects completed the fetal movement counts; 31 (55.4%) completed the Cardiff method and 25 (44.6%) completed the Sadovsky method.

The number of possible days to count fetal movement ranged from 3 to 7 days ($M = 6.17$, $S.D. = 1.47$), with 78.6% counting between 6 and 7 days, and 75% counting the full 7 days. To identify any differences in compliance between the two methods, independent t -tests on the percentage of days completed were computed. There was no significant difference between the two groups (Table 3).

Table 3
 Comparison of the Cardiff and Sadovsky
 Fetal Movement Count (FMC) Methods

Comparison Factor	Cardiff (n=31)		Sadovsky (n=25)		Range
	x	S.D.	x	S.D.	
Compliance (% days completed)	92.48	18.64	91.41	19.27	
Maternal-Fetal Attachment (MFA) Scale					
Roletaking	17.08	2.18	17.68	1.86	4.0 - 20.0
Differentiation	16.77	2.88	16.96	2.38	4.0 - 20.0
Attributing	22.06	2.93	22.84	3.80	6.0 - 30.0
Self-giving	19.74	2.46	20.04	2.57	5.0 - 25.0
TOTAL MFA	93.16	9.41	94.96	10.31	24.0-120.0
Perception of Difficulty	27.96	3.34	27.84	2.96	7.0 - 28.0
Anxiety Reaction to FMC	2.90	1.10	3.04	1.13	1.0 - 5.0
Value of FMC	2.45	.88	2.24	.87	1.0 - 5.0

Note: No statistically significant differences were found.

A chi-square analysis was conducted on the 80 subjects to determine if there were any significant differences in the frequencies of compliance between the two methods among women that completed the counts. Of the Cardiff group, 77.5% completed the fetal movement counts and 22.5% did not. Of the Sadovsky group, 62.5% completed the counts and 37.5% did not. The difference in frequency of compliance between the two methods was not statistically significant.

To evaluate which factors may be related to compliance with fetal movement counts, Spearman correlation coefficients were calculated for the relationship between compliance and several of the independent variables identified in the study. There were no significant correlations between risk factors, gestational week, maternal age, level of education, parity, income, and maternal-fetal attachment to compliance with fetal movement counts (Table 4).

Research Question 2

Are there differences in perceived difficulty between the Cardiff and Sadovsky methods of counting fetal movement?

Identical posttests or questionnaires were given to both groups of women after completing the fetal movement counts. The evaluation questionnaire was developed using an ordinal scale, higher scores indicating a lesser degree of difficulty. Mean scores and frequencies were calculated from the responses on the questionnaire. Overall 89.3% felt comfortable completing fetal movement counts; the remaining 10.7% were uncertain. Fifty-five women (98.3%) indicated they felt they knew how to complete the charts, and only one individual (1.8%) felt uncertain. Fifty-five women (98.3%) indicated they knew what counted as a fetal movement, and again one individual indicated she was not certain. Most women (82.2%) definitely did not find the method hard to complete, 7.1% were uncertain, and 10.7% responded it was hard to complete. Also, most women (82.2%) did not feel fetal movement counts took too much of their time, 10.7% were uncertain, and 7.1% indicated that they did.

Table 4
Spearman Rho Correlation for Maternal
Variables and Compliance

Variable	Compliance/Adherence
Risk score	.149
Gestational week	-.095
Maternal age	.198
Years of education	.096
Primipara/multipara	.201
Income	.127
Maternal-fetal attachment	
Roletaking	-.080
Differentiation	-.104
Interaction	-.148
Attributing	-.167
Self-giving	.026
Total maternal-fetal attachment	-.135
Perception of difficulty	-.041
Value of fetal movement count	-.191
Reaction/anxiety	.028

To identify differences in the perceived difficulty between the two methods, independent t-tests were computed. No statistically significant differences were found between the Cardiff and Sadovsky methods on the maternal rating for difficulty.

Research Question 3

Is there a relationship between maternal- fetal attachment and compliance with fetal movement counting?

Scores and frequencies were tabulated from the women's responses on Cranley's Maternal Fetal Attachment Scale (MFAS). Most (85.4%) indicated that they at times engaged in behaviors or attitudes represented on the scale. Over three-fourths (78.2%) indicate they frequently do, and 7.2% state that they do most of the time.

Within the group that did complete FMCs, maternal-fetal attachment was evaluated in relationship to compliance. Using Spearman correlation coefficients, it was found there was no significant relationship between the subscales or total scale measuring attachment and compliance to FMCs (Table 4).

Research Question 4

What are maternal reactions to using formal methods of fetal movement counts and do they differ between methods?

Of the 56 women that completed the fetal movement counts, 23 (41.1%) indicated that counting fetal movement did not make them feel anxious about their baby. Nine (16.1%) were uncertain, and 24 (42.8%) felt counting fetal movement did cause them to feel anxious about their baby. Thirty-three (59%) women felt fetal movement counting was a

worthwhile tool in pregnancy, 6 (10.7%) felt it was not, and 17 (30.3%) were uncertain. To evaluate if there was a difference in maternal reactions between the methods of fetal movement counts, independent t-tests were calculated. There was no statistically significant difference between the two methods.

Discussion

The purpose of this study was to evaluate, in a low risk population, which method of fetal movement counting encourages compliance. The sample in this study had several characteristics that are comparable to the general population in the last trimester of pregnancy. These include the subject's age, gestational week, level of education, income, and parity. Characteristics that may not reflect the general population include this sample's religious preference and ethnic group. However, these two characteristics are representative of the population residing in the metropolitan Salt Lake City area.

The scores obtained on the Maternal-Fetal Attachment Scale are higher in this sample compared to those obtained by Cranley (1981). Overall, this sample indicated that 98% of the women engaged in behaviors or attitudes represented on the scale. Cranley found a lower positive response of 78%. The responses on the questionnaire revolve around developmental tasks in pregnancy, hence groups with similar gestational periods should score similar frequencies of response. It may be that this sample is skewed with higher maternal-fetal attachment behaviors and attitudes.

Research Question 1

Are there differences in maternal compliance between the Cardiff and Sadovsky methods of counting fetal movement?

In analyses of the two methods, Cardiff and Sadovsky, there were no statistically significant differences found in compliance. Compliance using the Cardiff method was 77.5% ($N = 31$), and 62.5% ($N = 25$) with the Sadovsky method. Studies which have evaluated the Cardiff method for compliance have yielded a wide range in adherence. Draper et al. (1986) states there was 98% compliance with the Cardiff method, but used only verbal reports that the women completed the charts. Fischer et al. (1981) found a 50% ($N = 332$) compliance rate; 19.8% ($N = 128$) stated they completed the charts but failed to return them. Similar to this investigator's study, there was no statistical significance in maternal variables between the groups that complied with the methods and those that did not.

Clark et al. (1985) found that only 42% in her study completed Cardiff charts daily as instructed, and 27% failed to keep the charts 50% of the days. The population in this study was different in that 72% had family incomes less than \$12,000 and also carried risk factors which included a previous stillbirth or premature infant. The instruction on using the charts were also given by a variety of health care providers.

Fewer studies have been conducted to investigate compliance using the Sadovsky method to count fetal movement. Studies using this method primarily use samples of women with high risk pregnancies, comparing fetal movement to neonatal outcomes. Observations were made on completed records obtained, and few studies indicated the initial number

of participants. Harper et al. (1981) using the Sadovsky method collected 82.7% ($N = 91$) completed charts. The sample was a mixture of high and low risk pregnancies. Ehrstrom (1979) reported no specific compliance rates, but mentioned 14% withdrew from his study due to lack of time or other reasons. Thompson et al. (1985) found a 55% compliance rate using daily 1-hour count periods.

Generally, the compliance rate in this study of collected charts and percentage of completed days is similar if not higher than what other studies have reported. The compliance rate is significant, because the use of fetal movement counts as a screening tool places the total responsibility for assessment on the mother. Although not statistically significant, the Cardiff method had a higher compliance rate.

In order for fetal movement counts to be most effective in detecting decreased fetal movement, women must use them daily. In this study, there were no maternal variables that correlated with compliance. This can be interpreted that fetal movement counts can be universally instructed with an equally expected adherence, regardless of the women's age, socioeconomic status, parity, occupation, or level of education.

Most importantly, this study identified compliance with formal methods of counting fetal movement. The actual rate is lower than the investigator anticipated. The percentage of days of adherence to counting was high in those that completed, which may have been the effect of testing on the women who chose to participate. Instruction was provided separately from the women's actual prenatal care which may have affected the women's sense of value in completing fetal movement

counts. However, the degree of adherence identified in this study and previous research points to the issue that formal methods of counting fetal movement are not readily accepted as valuable by the mother, who carries the responsibility of completing them. In obstetrical and nurse midwifery care, these results point to the need for reinforcement to develop FMCs as a useful screening tool in antenatal care.

Research Question 2

Are there differences in difficulty between the Cardiff and Sadovsky methods of counting fetal movement?

There were no significant differences in women's perception of difficulty between the two methods. Most women (89.3%) felt comfortable completing the charts. This result is similar to the 90% positive response rate in ease of use found by Valentin et al. (1984). Fischer et al. (1981) found that of the Cardiff charts returned, 98% were completed accurately. In contrast, Clark et al. (1985) found women had difficulty completing the chart when presented with different situations, i.e., how to mark the chart if the count began later than 9 a.m. Clark's study was perhaps influenced by the five different levels of careproviders that instructed women in the use of the fetal movement counts. No specific results on women's perception of difficulty with the Sadovsky method have been reported.

Women in this study had ample time to ask questions if uncertain how to complete the chart. Verbal and written instruction was provided by the investigator only, and was not combined with any other prenatal

instructions. This could have decreased the women's perception of difficulty with use of the charts.

Other responses collected in this study indicate that women found no particular difficulty with the completion of fetal movement counts. Only 7.1% felt that counting fetal movement took too much of their time, regardless of the method used. These data were from the women whom completed the counts; it is likely the 30% noncompletion rate may have been related to the time demands placed on women to complete FMCs.

The results from this study imply that the actual completion of the FM count chart is not difficult given verbal and written instructions. Both methods can be taught easily and both methods appear to be relatively simple for the women to complete.

Research Question 3

Is there a relationship between maternal-fetal attachment and compliance with fetal movement counts?

Maternal-fetal attachment (MFA) is a process which begins physically and psychologically during pregnancy and not solely with the birth of the infant. Quickening, or the recognition of fetal movement, is significant in the developmental changes and tasks of pregnancy. It is at this point the mother begins to identify the fetus as a separate entity from herself. By the last 4 weeks of pregnancy, healthy psychological responses would include an already established degree of maternal-fetal attachment.

This study utilized the instrument developed by Cranley (1981) which measures the construct of maternal-fetal attachment. MFA was

evaluated in relationship to compliance with fetal movement counts. FMCs place full responsibility on the mother to be able to observe and assess her infant's health. It would seem that women who are strongly attached to their infants would be more likely to comply with FMCs. But no significant differences were found between the women who completed or did not complete fetal movement counts and their scores on the MFAs. The degree of attachment does not appear to reflect the woman's participation in antenatal screening tools such as FMCs.

Similar to Cranley's (1981) study, no significant relationship was found between MFA and other maternal variables such as age, parity, and socioeconomic class. The data from this study support the concept that maternal-fetal attachment is an ongoing developmental process and is not affected by demographic variables.

Research Question 4

What are maternal reactions to using formal methods of fetal movement counts and do they differ between methods?

Women in this study had mixed responses to the completion of formally counting fetal movements. Less than half (41.1%) of the women felt that counting fetal movements did not cause them to feel anxious about their baby; 42.8% felt it did cause them to feel anxious, and 16.1% were uncertain. There were no statistically significant differences between the Cardiff and Sadovsky methods. Draper et al. (1986) found 55% were reassured with fetal movement counts, 23% were worried, and 17% were neither reassured nor worried. Other investigators have found women generally comfortable with the

completion of fetal movement counts, but use no specific data to support these findings (Ehrstrom et al., 1979; Rayburn, 1930).

Several authors have questioned the amount of anxiety that may be placed on the mother with formally counting fetal movements (Mathews, 1973; McIlwaine, Howat, Dunn & McNaughton, 1980; Thompson & Wheeler, 1985). The data from this study and other investigators suggest that FMCs increase focus on the fetus, and may cause a significant part of the population to have anxious feelings regarding fetal health. It is possible that this same percentage of the population may feel anxious regarding any other fetal tests of well-being, including glucose tolerance tests, ultrasounds, and nonstress tests. The difference with fetal movement counts is that it requires the mother to assess fetal well-being daily. Perhaps the anxiety women report is solely related to her involvement and responsibility with observing fetal health. These results implicate the need for frequent discussion with the woman regarding her participation in antenatal screening tools such as FMCs.

Conclusions

Normal fetal movements are an indicator of fetal well-being, whereas reduced fetal activity may precede fetal death. Women are sensitive to 80% to 90% of fetal movements that can be detected by ultrasound and electronic devices. Several protocols have been developed and are used in antepartal management for maternal counting of fetal movements. The two main protocols on which many studies have been based are the Cardiff Count to Ten Method and Sadovsky's Daily Fetal Movement Record. Both of these protocols have tested sensitivity and

specificity to be included as a valuable screening tool in pathological and normal pregnancies. There is evidence that maternal monitoring of fetal movements can lead to a lowered stillbirth rate.

The difference with fetal movement counts is the fact that the assessment of fetal health is placed on the mother. The use of daily fetal movement counts has also not been a part of routine prenatal care. Compliance rates that have been found in past research and in this study may reflect these two concepts. Women may be more likely to adhere to counts if there were instruction and reinforcement at prenatal visits rather than random questioning regarding fetal movement. What has not been adequately investigated is the different methods women can use to count fetal movement and which method they might prefer.

It is also interesting that researchers investigating women's reactions to fetal movement counts find a significant portion of the population do have anxious feelings regarding formally counting fetal movement. The amount of anxiety and negative effects need to be more specifically identified to evaluate the value of formal fetal movement counts in normal pregnancies. Further research is needed in these areas on the counting of fetal movement. Counts will only be clinically useful if women adhere to them with a certain degree of comfort.

APPENDIX A

HOBEL'S RISK SCREENING PRENATAL FACTORS

I. Cardiovascular and renal		V. Miscellaneous	
1. Moderate to severe toxemia	10	1. Abnormal cervical cytology	10
2. Chronic hypertension	10	2. Multiple pregnancy	10
3. Moderate to severe renal disease	10	3. Sickle cell disease	10
4. Severe heart disease, Class I - IV	10	4. Age > 35 or < 15	5
5. History of eclampsia	5	5. Viral disease	5
6. History of pyelitis	5	6. Rh sensitization only	5
7. Class I heart disease	5	7. Positive serology	5
8. Mild toxemia	5	8. Severe anemia(<9 Gms Hgb)	5
9. Acute pyelonephritis	5	9. Excessive use of drugs	5
10. History of cystitis	1	10. History of TB or PPD > 10mm	5
11. Acute cystitis	1	11. Weight <100 or > 200	5
12. History of toxemia	1	12. Pulmonary disease	5
II. Metabolic		13. Flu syndrome (severe)	5
1. Diabetes . Class A - II	10	14. Vaginal spotting	5
2. Previous endocrine ablation	10	15. Mild anemia (9 - 10.9 gms Hgb)	1
3. Thyroid disease	5	16. Smoking >1 ppd	1
4. Prediabetes (A -1)	5	17. Alcohol consumption	1
5. Family history of diabetes	1	18. Emotional problem	1
III. Previous histories			
1. Previous fetal exchange transfusion for Rh	10		
2. Previous stillbirth	10		
3. Post-term > 42 weeks	10		
4. Previous premature infant	10		
5. Previous neonatal death	10		
6. Previous cesarean section	5		
7. Habitual abortion	5		
8. Infant > 10 pounds	5		
9. Multiparity >5	5		
10. Epilepsy	5		
11. Fetal anomalies	1		
IV. Anatomic abnormalities			
1. Uterine malformation	10		
2. Incompetent cervix	10		
3. Abnormal fetal position	10		
4. Polyhydraminos	10		
5. Small pelvis	5		

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APPENDIX B

MATERNAL BACKGROUND QUESTIONNAIRE

Directions: Please complete the following.

1. In what week of your pregnancy are you? _____ week

2. What is your due date? _____

3. What is your age? _____ years

4. What is your ethnic group?

Anglo American _____ Hispanic _____

Black American _____ Polynesian _____

Asian _____ Other (please specify) _____

5. What is your highest level of education? (please circle the number corresponding to completed years of education)

Elementary 1 2 3 4 5 6

Junior high/ High School 7 8 9 10 11 12

College 13 14 15 16

Postgraduate 17 18 19 20 21 or more

6. What is your primary occupation?

7. How many hours per week do you work and/or go to school?

0 hours per week _____

0 to 10 hours per week _____

10 to 20 hours per week _____

20 to 40 hours per week _____

8. How many other children do you have at home? _____
9. Do you have a support person through your pregnancy that might be at your infant's birth? Yes _____ No _____
10. How many times this pregnancy have you been to see your physician/ midwife?
- 1 to 4 _____ 10 to 15 _____
- 5 to 9 _____ more than 15 _____
13. Have you been taught a method to count and keep track of your baby's movements in this pregnancy or previous pregnancies?
- Yes _____ No _____
14. Have you read any information about counting your baby's movements in pregnancy?
- Yes _____ No _____

The two questions below are considered by some to be personal. They are optional for you to complete but the information you provide will assist data analysis, and all information will remain confidential.

15. What religious preference do you have?
- LDS _____ Protestant _____
- Catholic _____ Jewish _____
- None _____ Other (please specify) _____
16. In what range was your family's income from all sources last year?
- under 5,000 _____ 20,000 - 29,999 _____
- 5,000 - 14,999 _____ 30,000 - 39,999 _____
- 15,000 - 19,999 _____ 40,000 or over _____

APPENDIX C

CRANLEY'S MATERNAL FETAL ATTACHMENT SCALE

Directions: Please place a check in one of the columns for each statement on the left to describe your feelings about this pregnancy.

	Defi- nitely Yes	Yes	Uncer- tain	No	Defi- nitely No
1. I talk to my unborn baby.	_____	_____	_____	_____	_____
2. I feel all the trouble of being pregnant is worth it	_____	_____	_____	_____	_____
3. I enjoy watching my tummy jiggle as the baby kicks inside.	_____	_____	_____	_____	_____
4. I picture myself feeding the baby.	_____	_____	_____	_____	_____
5. I'm really looking forward to seeing what the baby looks like.	_____	_____	_____	_____	_____
6. I wonder if the baby feels cramped in there.	_____	_____	_____	_____	_____
7. I refer to my baby by a nickname.	_____	_____	_____	_____	_____
8. I imagine myself taking care of the baby.	_____	_____	_____	_____	_____
9. I can almost guess what my baby's personality will be from the way he/she moves around.	_____	_____	_____	_____	_____

Reprinted by permission of Cranley, M. (1981). Development of a tool for the measurement of maternal attachment during pregnancy. Nursing Research, 30 (5),282.

	Defi- nitely Yes	Yes	Uncer- tain	No	Defi- nitely No
10. I have decided on a name for a girl baby.	_____	_____	_____	_____	_____
11. I do things to try to stay healthy that I would not do if I were not pregnant.	_____	_____	_____	_____	_____
12. I wonder if the baby can hear inside of me.	_____	_____	_____	_____	_____
13. I have decided on a name for a boy baby.	_____	_____	_____	_____	_____
14. I wonder if the baby thinks and feels inside of me.	_____	_____	_____	_____	_____
15. I eat meat and vegetables to be sure my baby gets a good diet.	_____	_____	_____	_____	_____
16. It seems my baby kicks and tells me it's eating time.	_____	_____	_____	_____	_____
17. I poke the baby to get him/her to poke back.	_____	_____	_____	_____	_____
18. I can hardly wait to hold the baby.	_____	_____	_____	_____	_____
19. I try to picture what the baby will look like.	_____	_____	_____	_____	_____
20. I stroke my tummy to quiet the baby when there is too much kicking.	_____	_____	_____	_____	_____
21. I can tell that the baby has hiccoughs.	_____	_____	_____	_____	_____
22. I feel my body is ugly.	_____	_____	_____	_____	_____
23. I give up doing certain things because I want to help my baby.	_____	_____	_____	_____	_____
24. I grasp my baby's foot through my tummy to move it around.	_____	_____	_____	_____	_____

APPENDIX D

CARDIFF COUNT TO TEN FETAL MOVEMENT PROTOCOL

"Counting to Ten"

This is a simple method by which the mother herself plays an important part in checking the health of her own baby. It involves counting the number of movements made by the baby during the day.

1. Starting at 9 o'clock in the morning, count the number of times your baby moves until you reach 10. Then record what time you reached the tenth movement on the graph. For example, if you start on Monday, and count to 10 movements by 10 minutes past 2, block out the whole square between 2 pm and 2:30 pm. That is, rather than filling in the exact time, you must fill in the whole 1/2 hour period in which the tenth movement falls. It is not necessary to do any more counting until the following day when you start again at 9 a.m.

2. Kicks, rolls and stretches all count as movements. If the baby kicks three times and then rolls, that counts as four movements.

3. Hiccoughs or false contractions do not count as movements.

Important : If you feel less than 10 movements in twelve hours, or no movements for one day call your FHP OB Physician or Nurse-midwife immediately at 973-9999. If you have any questions on how to count call me, Diane Heubusch, at 572-0539.

Date:	Sun	Mon	Tues	Wed	Thur	Fri	Sat
9:00							
:30							
10:00							
:30							
11:00							
:30							
12:00							
:30							
1:00							
:30							
2:00							
:30							
3:00							
:30							
4:00							
:30							
5:00							
:30							
6:00							
:30							
7:00							
:30							
8:00							
:30							
9:00							

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APPENDIX E

THE DAILY FETAL MOVEMENT RECORD

"Daily Fetal Movement Count"

This is a simple method by which the mother herself plays an important part in checking the health of her own baby. It involves counting the number of movements made by the baby during the day.

1. Take three half hour periods during the day, in the morning, noon, and at night, and count the number of times your baby moves.
2. Mark down in the slot the number of times the baby moves.
3. You should count at least 4 movements, and if it takes longer than 30 minutes, mark down the amount of time it took to reach four movements.
4. Kicks, rolls, stretches all count as movements. If the baby kicks three times then rolls, that counts as four movements.
5. Hiccoughs or false contractions do not count as movements.

Important: If you count less than 4 movements in a half hour, continue to count for an hour or as long as you need to count four movements. If it takes 6 continuous hours to count four movements, or if you count less than 10 movements in 12 hours on any day, call your FHP OB Physician or Nurse-midwife immediately at 973-9999. If you have any questions on how to count call me, Diane Heubusch, at 572-0539.

	Sunday	Mon.	Tues.	Wed.	Thur.	Fri.	Sat.
Morning							
Noon							
Evening							

Adapted from Sadovsky, E. (1985). Monitoring fetal movement: a useful screening test. Contemporary Obstetrics and Gynecology, 25 (4),123-125.

APPENDIX F

EVALUATION FORM

Please place a check in one of the columns for each statement on the left that best fits your feelings.

	Defi- nitely Yes	Yes	Uncer- tain	No	Defi- nitely No
1. Did you feel comfortable completing the fetal movement chart this week?	_____	_____	_____	_____	_____
2. Did you feel you knew how to fill in the chart correctly?	_____	_____	_____	_____	_____
3. Did you know what counted as a fetal movement?	_____	_____	_____	_____	_____
4. Did you find this method to count fetal movement hard to do?	_____	_____	_____	_____	_____
5. Was the chart difficult to complete?	_____	_____	_____	_____	_____
6. Did you feel counting fetal movement this way took too much of your time?	_____	_____	_____	_____	_____
7. Did the counting of fetal movement interfere with your day too much?	_____	_____	_____	_____	_____
8. Did counting fetal movements make you feel anxious about your baby?	_____	_____	_____	_____	_____
9. In general do you feel counting fetal movements is a worthwhile tool for mothers to use during their pregnancy?	_____	_____	_____	_____	_____
10. Please make any comments below about the method you used this week to count fetal movements.					

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