A STUDY OF NURSE-MIDWIFERY CLIENT COMPLIANCE IN THE USE OF TWO DAILY FETAL MOVEMENT COUNTING TOOLS

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CHAPTER I

Introduction

Antepartum fetal assessment has become increasingly important in obstetrical care. Currently, non-stress tests, contraction stress tests, biophysical profiles and other forms of monitoring are commonly used to assess the status of the fetal-placental unit (Nichols, 1985; Porto, 1987; Rayburn, 1982). As early as the 1970's evaluation of daily fetal activity patterns as a sign of fetal health has been advocated as an adjunctive method of fetal assessment (Pearson, 1976; Sadovsky & Yaffe, 1973). Over the last decade health care providers have begun to incorporate daily fetal movement counting into their plan of care for pregnant clients as a way of encouraging women to continuously monitor the health of their babies in utero (Rayburn, 1982).

Daily fetal movement counting is a low-cost, non-invasive method of ongoing maternal assessment of fetal well-being. Recently, client understanding and compliance have been reported to be important variables in performing daily fetal movement counting (Clark & Britton, 1985; Rayburn, 1982). Researchers have begun to evaluate women's perceptions of performing daily fetal movement

counts and the factors that may contribute to their compliance in the use of different methods (Clark & Britton, 1985; Draper, Field, Thomas & Hare, 1986; Rayburn, 1982; Valentin & Marsal, 1986). However, issues of client understanding, motivation, and compliance are poorly outlined in the literature. There have been no controlled trials to investigate the effect of various methods for teaching and implementing daily fetal movement counting tools on client understanding and compliance. Nor have there been studies to evaluate the effect of different types of methods of counting fetal movements on individual client needs or compliance.

Additional research is needed to address these issues as they affect the use of daily fetal movement counting by a variety of client populations. The present research seeks to solve some of the problems by evaluating compliance with two widely used methods of daily fetal movement counting by two distinct antepartum populations.

Review of the Literature

The following review of the literature will begin with a discussion of the evolution of fetal movement counting and its relationship to perinatal outcome. The reliability of maternal perception of fetal movements will be addressed and will be followed by a discussion of studies which have evaluated specific methods of daily

fetal movement counting. Finally, literature focusing on client concerns and compliance will be reviewed and critiqued.

Early Development of Fetal Movement Counting and its Relationship to Perinatal Outcome

Sadovsky can be credited with some of the pioneering work on fetal movement counts and the initial identification of their correlation with perinatal outcome. In an early paper Sadovsky and Yaffe (1973) presented case studies supporting the hypothesis that fetal activity is an expression of fetal well-being and that a dramatic reduction or cessation of that activity may be indicative of fetal distress and impending fetal death.

In each of five case studies, Sadovsky and Yaffe (1973) illustrated that fetal death or emergency delivery was preceded by cessation of fetal movement by at least one day. They developed the movement alarm signal (MAS) based on the assumption that prior to fetal death there is a period during which fetal anoxia causes a reduction or cessation of movements or their vigor. In two of the cases, absence of a MAS was used as the criterion for determining that compromised pregnancies could continue until optimal delivery time.

This early work, although limited by a case-study design, led Sadovsky and Yaffe (1973) to suggest that counting daily fetal movements could be a useful tool in assessing fetal well-being. They recommended that pregnant women record fetal movement for one hour three times a day -- in the morning, at noon and in the evening. The sum of the three hours was multiplied by four to give the 12-hour Daily Fetal Movement Record.

Pearson and Weaver (1976) also did early research on daily fetal movement counting. They analyzed the daily fetal movement counts of 61 women with normal pregnancies. Subjects counted fetal movements daily from 9am until 9pm from the 32nd week of pregnancy until term. Pearson and Weaver found that in 2.5% of the cases, across gestational lines, the daily fetal movement counts fell below 10 movements in 12 hours. Accordingly, they decided to use that value as the lower limit of normal for clinical purposes.

In the same study Pearson and Weaver (1976) focused on 122 women with high-risk pregnancies to compare the ability of daily fetal movement counting and urinary estrogen levels to predict fetal outcome. A normal daily fetal movement count (>10 movements/12 hrs.), in combination with normal urinary estrogen values, was associated with good fetal outcome in pregnancies at-risk.

A low daily fetal movement count accompanied by normal estrogen levels was associated with poor fetal outcome (asphyxia and death). The researchers concluded that daily fetal movement counting was more predictive of perinatal outcome than estrogen levels. Pearson and Weaver (1976) also described seven cases in which fetal death was preceded by drops in the fetal movement count to fewer than 10 movements in 12 hours over several days and then cessation of fetal movement for 12-48 hours prior to fetal demise.

This descriptive study was limited by a small sample and the method used for daily fetal movement counting was poorly described and difficult to implement. Pearson (1979) later realized that a full 12-hour daily count was unrealistic in terms of patient expectations and developed a method of counting commonly known as the Cardiff "Count to ten" method. The patient is asked to begin counting fetal movements at 9am and record the half-hour block when the tenth movement is felt. In this way most women spend considerably fewer than 12 hours counting fetal movements daily. If ten movements are not felt by 9pm (a MAS), the patient is required to report to her care provider for further evaluation. Pearson's work (Pearson, 1979; Pearson & Weaver, 1976) provided early evidence that normal daily fetal movement counts are associated with

good fetal outcome and may be used as a diagnostic tool for evaluating pregnancies which may be at risk.

Mathews (1978) reported findings which contradict the hypothesis that decreased fetal movement at term is associated with poor perinatal outcome. He compared the outcome of 25 women who reported a "marked diminution in the activity of their fetuses of at least one week's duration," with that of 25 matched controls who reported "unabated vigorous fetal activity." Fetal-placental well-being was assessed using blood levels of human placental lactogen, 24-hour urinary excretion of estriol, fetal scalp blood acid-base values in labor and hemoglobin concentration. Mathews found no significant differences in these assessment values between the two study groups. However, the validity of Mathews' results can be questioned due to the poorly defined differences between the case and control groups in terms of fetal movement. Daily fetal movement counts were not done in a standardized fashion, nor was a definition of "marked diminution in activity" provided. Thus, the results of this study are difficult to interpret.

Since these early works, a number of researchers have more carefully evaluated the role of fetal movement as a predictor of perinatal outcome. Data have documented that normal fetal movement patterns can be a predictor of

favorable perinatal outcome, especially in conjunction with other antepartum assessment tools such as the non-stress test (NST) (Fischer, Fullerton, & Trezise, 1981; Rayburn, Zuspan, Motley & Donaldson, 1980).

Most data collected over the past ten years have provided additional support for early investigators' (Sadovsky & Yaffe, 1973; Pearson, 1976) findings that a drop in, or cessation of, fetal movement in utero can be associated with poor perinatal outcome. Intrauterine fetal death, fetal distress in labor, low five-minute Apgar scores and a compromised neonatal condition have been significantly correlated with decreased fetal movement by a number of researchers (Leader, Baillie, & Van Schalkwyk, 1981; Liston, Cohen, Mennuti, & Gabbe, 1982; Neldham, 1980; Rayburn & McKean, 1980; Westgate & Jamieson, 1986). Other compromising perinatal factors which have been significantly correlated with decreased fetal movement are placental insufficiency, imminent preterm labor, neonatal hypoglycemia (Valentin, Marsal, & Wahlgren, 1986), and both large- and small-for-gestational-age babies (Fischer et al., 1981).

Retrospective data reported by Ahn, Phelan, Smith, Jacobs, and Rutherford (1987) provide support for the association of decreased fetal movement with results from other antepartum assessment tools indicating fetal

compromise. They found that among women who presented with a complaint of decreased fetal movement (n=390), there was a 3.7 times greater likelihood of diminished amniotic fluid volume with a concurrent incidence of fetal heart rate decelerations ($p<0.01$).

Within the medical community increasing use of more sophisticated tools for antepartum assessment is occurring (Porto, 1987). Many of these tools require in-hospital monitoring and are often reserved for patients known to be at-risk. Several researchers have provided support for the use of daily fetal movement counting in both low and mixed-risk clients as a monitoring tool to improve perinatal outcome (Fischer et al., 1981; Neldham, 1980; Rayburn & McKean, 1980; Valentin et al., 1986; Westgate & Jamieson, 1986). Although there is insufficient data to suggest that fetal movement counting should replace other antepartum assessment tools, it may be important to remember that daily fetal movement counting can be done on an ongoing basis at home as an early screening tool for women who might otherwise go unmonitored because of apparent low-risk status (Leader et al., 1981).

Reliability of Maternal Perception of Fetal Movements

Daily fetal movement counts done by pregnant women are a subjective measure of actual fetal movements in utero. Sadovsky (1973) compared maternally perceived

fetal movements with those recorded by a displacement-measuring electronic device. Twenty women, including those with normal and complicated pregnancies, were monitored for 30-90 minutes during the 27th to 42nd weeks of gestation. Sadovsky found an average correlation of 87% between maternally perceived movements and those recorded by the electromagnetic device (EMD). In no case was maternal perception more sensitive than that of the EMD. This study was limited by its sample size, descriptive data analysis and the use of a measuring device which, today, can be replaced by ultrasound. However, the data support the clinical use of maternal daily fetal movement counts as a reliable indicator of fetal activity.

Gettinger, Roberts, and Campbell (1978) followed up on Sadovsky's early work by comparing the subjective assessment of fetal movement perceived by 40 pregnant women (25 - 40 weeks gestation) with that seen using a real-time ultrasound scanner. A highly significant correlation between the subjective method of maternal assessment and that done by the real-time scanner ($P < 0.001$) was found. However, there was no significant correlation between the two assessment methods for women who reported few fetal movements. It was suggested that these women are candidates for follow-up ultrasonography

and other methods of fetal assessment. The researchers' evaluation of interrater reliability and use of real-time ultrasound lend credence to their conclusions that maternal perception of fetal movement is a reliable measure of fetal activity.

An analysis of the types of fetal movements perceived by pregnant women, as determined by real-time ultrasonography, was done by Hertogs, Roberts, Cooper, Griffin, and Campbell (1979), who evaluated 20 women accustomed to doing daily fetal movement counting and found most of them sensitive to major fetal movements. Sensitivity increased as the number of fetal parts involved in the movement increased. Some women reported Braxton Hick's contractions, passive fetal displacement, and fetal hiccoughs as fetal movements. The researchers suggested that more specific instructions should be given to women doing daily fetal movement counts in order to decrease the inaccurate report of perceived movements, which may result in false negative results.

Evaluation of Methods of Fetal Movement Counting

The research reported above has supported the role of fetal movement in contributing to the assessment of fetal health in utero. And, pregnant women have been found to be reliable in their determination of the number of movements made by their fetuses. Additional researchers

have sought to evaluate different techniques of daily fetal movement counting and to assess the ability of specific methods to predict perinatal outcome.

Research has focused on two basic methods of daily fetal movement counting - those requiring fixed periods of counting throughout the day such as a revised method described by Sadovsky (1985) and Cardiff-like methods (Pearson, 1979) advising women to record the time required to feel ten fetal movements in 12 hours. Studies addressing these two types of daily fetal movement counting methods will be reviewed below.

Fixed-time Methods. Following ten years of research and evaluation, Sadovsky revised his fetal movement counting method discussed earlier. He suggested that low-risk women need only count fetal movements twice daily for 20-30 minutes. Five to six movements during each counting were considered a reassuring sign of fetal well-being. High-risk women were asked to count for 30 minutes three times a day. If fewer than three movements were felt in a half-hour, the patient should continue to count for an additional hour or more. Patients were instructed to contact their care provider if fewer than 10 movements were felt in 12 hours, no movements were felt in the morning, or fewer than 3 movements were felt in 8 hours (a Mas) (Chez, 1984; Sadovsky, 1985).

Neldham (1980) prospectively studied 2,250 pregnant women randomly assigned to an experimental group who were formally taught another fixed-time fetal movement counting (FMC) method and a control group which was not given any specific instructions about FMC. The FMC group was asked to count fetal movements for two hours after meals and instructed to contact the hospital if fewer than three movements were felt per hour (a MAS). Subjects who were less than 32 weeks gestation were asked to count fetal movements one time per week while those who were more than 32 weeks counted three times per week.

Neldham reported a significant difference in the stillbirth rate ($p<0.01$) between the group who formally counted fetal movements and the controls. This prospective study provides good support for the ability of a fixed-time FMC method to aid in the prevention of stillbirth; however, it is difficult to compare to some other fixed-time methods because patients did not count every day.

In a well-controlled and clearly described prospective study, Rayburn and McKean (1980) evaluated the fixed-time daily fetal movement counting of a convenience sample of 306 clinic patients (205 high-risk pregnancies and 101 normal pregnancies). Subjects counted while on their left side for two predetermined hours each day for

at least seven days prior to delivery. The counting hours were selected by the patient, ideally at times of typical peak fetal activity, 12 hours apart. Strong movements and simple extensor movements were described to the patients and were to be recorded. Weak movements and hiccoughs were to be excluded. The technique was well-accepted and performed correctly, especially when clear instructions were given and return demonstrations were requested.

Fetal movement patterns were described as "alarming" if patients felt two movements or fewer for two consecutive days or a 50% or greater drop in fetal activity to a level of two or fewer. A pattern was considered "reassuring" when movement patterns did not fall into any of the above categories. Daily fetal movement counting correlated positively with non-stress test (NST) results ($p<0.008$), but there was no relationship between daily fetal movement counting and urinary estriol determinations. Alarming fetal movement patterns were correlated with measures of perinatal distress ($P < .0001$) while reassuring patterns were significantly correlated with the absence of perinatal distress ($P < .0001$). Distress arising after reassuring fetal activity was primarily from intrapartum causes. This is a well-controlled study comparing a fixed-time daily fetal movement counting technique with other methods

of antepartum assessment, intrapartum fetal-heart-rate patterns and perinatal outcome. The data provide additional support for the reliability and validity of fixed-time daily fetal movement counting as an effective method of antepartum fetal assessment in both high-risk and normal pregnancies.

Additional data providing support for another variation on the fixed-time method was reported by Leader et al. (1981). Daily fetal movement counting was used to prospectively monitor 264 South African women (26-40 weeks gestation) with various complications of pregnancy. Subjects were asked to count fetal movements for four half-hour periods each day. Computer analysis from the authors' previous work led them to define an abnormal movement pattern as either: a) a day of no fetal movement; or b) two successive days within the last week before delivery during which there were fewer than 10 fetal movements (when adding the movements felt during each of the four daily half-hour counting periods). Leader et al. found a significant association between abnormal fetal movements and both stillbirths ($p<0.00001$) and poor neonatal condition ($p<0.013$). This well-controlled prospective study contributes additional support for a fixed-time daily fetal movement counting method. Once again, however, the precise method for having women count

and for determining a movement alarm signal is different from other studies.

Finally, Valentin et al. (1986) studied yet another protocol for fixed-time daily fetal movement counting. They conducted a large-scale prospective study using a clinic population in Sweden. Women (n=1,515) were asked to use a daily fetal movement counting method requiring counting for only 15 minutes each evening. MASs were calculated individually based on low-normal values over the first five consecutive days of counting. Using both the chi square and the Fisher's exact test, the researchers found a statistically significant association between a MAS and placental insufficiency, imminent preterm labor, congenital malformations, neonatal respiratory disturbances and hypoglycemia. In contrast to other reports in the literature, no significant association was found between a MAS and fetal distress in labor, low Apgar scores, stillbirth, or neonatal death.

Valentin et al. (1986) suggested that their data support the use of a daily fetal movement counting method requiring only a short counting period (15 minutes daily) for preselection of pregnancies at risk. Their results were strengthened by a large sample, but the study was limited by the use of a daily fetal movement counting method which was newly devised and had not been previously

tested. Moreover, the method was neither very sensitive (16-38%) nor specific (90%) and may yield many false positive results in a low-risk population. A longer counting period or lower limit for a MAS were suggested by the authors as remedies to this problem.

In summary, the number of fixed-time methods for counting fetal movements is almost as varied as the number of studies to support their use. However, a few generalizations can be drawn. A drop in the number of fetal movements below three to five per hour, below a total of ten per day, or more dramatically, cessation of fetal movement for a full day has been correlated with a compromised fetal condition. Most fixed-time methods have been developed as variations of Sadovsky's original work (Sadovsky & Yaffe, 1973) on fetal movement.

Cardiff-type Methods. Daily fetal movement counting techniques based on the early work of Pearson (1979) have also been evaluated empirically. The Cardiff "Count-to-ten" method of daily fetal movement counting requires women to begin counting fetal movements at 9am each day and to record the time when the tenth fetal movement is felt.

A recent analysis of the Cardiff method was described by Westgate and Jamieson (1986). They retrospectively analyzed perinatal outcome in patients over two

consecutive 20-month periods at the National Women's Hospital in New Zealand. During the first period, no daily fetal movement counting protocol was being used. During the second 20-month period, the Cardiff daily fetal movement counting method was introduced on a non-prescriptive basis for patients of 26-30 weeks gestation or greater. No formal record was available to document the number of clients using the method during the second time period. The definition of a MAS in this retrospective review (fewer than 10 movements in 12 hours for two consecutive days or no movements in 12 hours for one day) varied slightly from the standard Cardiff MAS (fewer than 10 fetal movements in 12 hours for one day). Both the perinatal death rate ($p<0.001$) and the stillbirth rate ($p<0.05$) were significantly lower in the 20-month period when Cardiff daily fetal movement counting was being used than during the period when no daily fetal movement counting was being done. Only one of the 27 unexplained stillbirths during the period when the Cardiff daily fetal movement counting tool was implemented occurred in a pregnancy in which the mother was using a fetal movement chart. This study has many limitations including the retrospective design, the inability of the researchers to document the number of women using Cardiff charts in the second time period, and most significantly,

the poor control for extraneous variables. However, the data do suggest that implementation of a Cardiff daily fetal movement counting tool may contribute to a reduction in unexplained stillbirths.

A more carefully designed prospective study was performed by Fischer et al. (1981) to evaluate the Cardiff "Count-to-ten" daily fetal movement counting method in a low-risk maternity-center population (n=664). Fifty percent (n=332) of the group who were originally taught the Cardiff method returned their daily fetal movement counting records and were included in the study. Data were analyzed using chi square, $\underline{t}$ test, and Fisher's exact test. Movement alarm signals (fewer than 10 fetal movements in 12 hours) were reported by 14.2% of the subjects as compared to a 2.5% MAS rate in Pearson's population. There was a significant correlation between MAS and large- or small-for-gestational-age infants while a nonsignificant association was found between MAS and the number of prenatal risk factors present. Both the absence of MAS and the presence of reactive NSTs were correlated with a good outcome in 92% and 90.5% of the sample, respectively. This study was limited by a large attrition rate (50% did not return their daily fetal movement counting records), but the authors found few significant demographic or outcome differences between those who

returned charts and those who did not. This data supplies evidence that the Cardiff method can be successfully implemented as a measure of fetal well-being in a low-risk maternity population.

Another study done to assess the practicality, acceptability, and reliability of the Cardiff method of daily fetal movement counting was conducted by Liston et al., (1982) using a high-risk, heterogeneous population. In 150 subjects recording daily fetal movement counts using the Cardiff method from 28 weeks until delivery, the perinatal outcome of those who experienced one or more MASs (n=11) was compared with that of women who reported no MASs (n=139). The group who had MASs experienced a higher perinatal mortality rate ($p<0.01$), greater fetal distress in labor ($p<0.05$), and a higher level of overall compromise ($p<0.001$) than the group with no MASs.

Non-stress testing was performed on 123 of the subjects. Of subjects who never experienced a MAS, fewer than 4% had non-reactive NSTs while over 65% of those who experienced MASs had non-reactive NSTs. In addition, the researchers discussed three case studies in which reduced activity precipitated intervention not indicated by conventional antepartum fetal heart rate testing. The authors suggested that reduced fetal activity may be at least as good a predictor of fetal compromise as the non-

stress test but they cautioned that this pilot study was neither randomized nor controlled so results must be viewed with caution. The data does provide additional support for the ability of the Cardiff method of daily fetal movement counting to successfully screen for women at-risk for poor perinatal outcome.

To summarize, studies designed to evaluate the Cardiff method of daily fetal movement counting are fraught with many of the same limitations as those found in studies evaluating fixed-time methods. However, Pearson's original Cardiff method (1979) is adhered to more often than the fixed-time method described by Sadovsky (1985). Prospective studies have provided convincing data to support the two types of methods, but more work is needed to determine the specific protocol most predictive of perinatal outcome.

Client Concerns and Compliance

Despite some of the difficulties noted with the data concerning the two major types of daily fetal movement counting tools, evidence supports implementing one of the two types of methods into antepartum plans of care (Davis, 1987). The impact of such an intervention on the clients who use daily fetal movement counting tools must be considered. Researchers have begun to evaluate women's perceptions of daily fetal movement counting and the

factors which contribute to their compliance in the use of different methods.

Draper et al. (1986) retrospectively surveyed women at six weeks postpartum (n = 132) about their experience with Cardiff daily fetal movement counting records. Overall, compliance was reported to be 98%. While 55% of the sample were reassured by doing daily fetal movement counting, 23% reported being worried due to confusion about fetal kicking patterns and their ability to perceive fetal movement. Active women found it difficult to find time to complete the counts. The authors stressed the importance of careful explanations of how to count fetal movements (i.e., kicks to include/exclude) and the need for flexibility in tailoring daily fetal movement counting methods to suit a woman's lifestyle.

A retrospective survey by Clark and Britton (1985) evaluated the factors associated with client nonuse of the Cardiff method of daily fetal movement counting. A convenience sample (n=102) of low- and high-risk women was surveyed postpartally about their pre-delivery experience with the method. Clark and Britton found that only 31% of the women were initiated on daily fetal movement counting four or more weeks before delivery and suggested that lack of exposure may contribute to poor understanding of how to use the method. Only 15% of care-providers asked for a

return demonstration after explaining use of the Cardiff recording chart and 36% of the clients reported they were never asked about their chart once having received it. Charts were filled out less than half the time by 27 (about 26%) of the clients. Of those women who had a MAS noted on their charts, 65% percent failed to contact the obstetrical resident as instructed. In evaluating the ability of the clients to complete the chart when counting did not start at 9am, Clark and Britton found 82% could not correctly record their counts. Common problems reported by clients included difficulty marking the chart, determining eligible fetal movements, and fitting the counts into their time schedule. Clark and Britton suggested that further research is needed with larger samples to determine what interventions can alleviate these problems of client nonuse of the Cardiff method.

Valentin and Marsal (1986) used the same sample as in their study described above (Valentin et al., 1986) to evaluate compliance and accurate use of their quick (15 minutes per evening), fixed-time method of counting fetal movement. Seventy-nine percent of their original population completed and returned their daily fetal movement counting records, and 98% of those returned were adequately completed. MAS were recorded by 161 women (11%), 63% of whom correctly reported the alarm signal to

maternity ward personnel. Women less than 20 and greater than 35 years old failed to complete their movement records significantly more often than those in the 20-35 year age range. Multiparas also completed daily fetal movement counting significantly less often than nulliparas. While most women were able to accurately complete the daily fetal movement counting records, the greatest difficulties revolved around when and how to report decreases in fetal movement. This finding is well-supported by other researchers. Although the method described in this study has not been widely used or studied, the results provide additional data on why women may have difficulty with fetal counting methods.

Gibby (1988) studied a low-risk pregnant population (n=33) to compare differences in maternal anxiety between women who were randomly assigned to a group who kept Cardiff daily fetal movement counting charts and a group who did not do daily fetal movement counting. The State-Trait Anxiety Inventory was used to measure maternal anxiety three times between 33 and 37 weeks gestation. Gibby reported no significant differences in maternal anxiety between those women who did daily fetal movement counting and those who did not. Although the study was limited by a small sample size, the results suggest that clinicians should not defer implementation of daily fetal

movement counting because of concerns about increasing maternal anxiety.

Gaps in the Literature

Although there is a large volume of research on the topic of fetal movement, the work done to date focuses on different methods of daily fetal movement counts using a variety of populations. Much of the research reported in medical journals is based in other countries making generalizability to this country limited.

With the exception of the study by Mathews (1978), most of the data reported supports the premise that a dramatic drop in or cessation of fetal activity is indicative of fetal compromise. More importantly, the presence of adequate levels of fetal activity has been shown to be predictive of a good perinatal outcome (Leader et al., 1981; Liston et al., 1982; Neldham, 1980; Pearson & Weaver, 1976; Rayburn & McKean, 1980; Sadovsky & Yaffe, 1973; Valentin et al., 1986).

Most researchers support the use of daily fetal movement counting as an adjunct to routine antenatal assessment. It is unclear, however, what method is most predictive and most acceptable to clients. The Cardiff "Count-to-ten" method devised by Pearson (1979) and a fixed-time method like the one described by Sadovsky (1985) which require counting for 30 minutes two to three

times per day are the most widely reported (Clark & Britton, 1985; Davis, 1987). For the most part, variations on the Cardiff "Count-to-ten" method are minor, whereas fixed-time methods vary in specific instructions about the number of times to count each day or week and the length of time to count (Leader et al., 1981; Neldham, 1980; Rayburn & McKean, 1981; Valentin et al., 1986). Further research is needed to more clearly establish the reliability and validity of all types of daily fetal movement counting methods.

Client understanding and compliance are issues which have come to the surface with the increasing use of daily fetal movement counting. Poor understanding and compliance by clients may compromise any advantage gained by using a highly-predictive daily fetal movement counting method. Failure to clearly explain the rationale for requesting patients to do daily fetal movement counting and inadequate teaching of the method were implicated in two studies (Clark & Britton, 1985; Draper et al., 1986). Many patients had difficulty understanding the significance of a MAS and failed to report it as instructed (Draper et al., 1986; Valentin & Marsal, 1986), or they reported a MAS when, in fact, the criteria were not met (Clark & Britton, 1985). Method convenience, especially when considering interference with the client's

daily routine, has been cited as an additional variable affecting client compliance (Davis, 1987; Draper et al., 1986). Unfortunately, there have been no controlled trials to investigate the effect of corrective interventions on client understanding and compliance.

Different client populations may find different types of daily fetal movement counting methods acceptable. Lehman and Estok (1987) asserted that the Cardiff method is easier for clients to use than fixed-time methods. However they supplied no data to support this claim. Several other advanced nursing practitioners also prefer the Cardiff method (Davis, 1987; Fischer et al., 1981). However, at least one nursing professional (Gantes, Schy, Bartasius & Roberts, 1986) and many physicians use the fixed-time methods (Leader et al., 1981; Neldham, 1980; Rayburn, 1982; Sadovsky, 1985). Some methods require a minimal amount of time counting (Valentin et al., 1986) while others emphasize mandatory rest during periods of fetal movement counting (Leader et al., 1981; Neldham, 1980; Rayburn & McKean, 1980). The latter may be beneficial for those patients considered high-risk. Client preference for method may be instrumental in compliance. Further research is needed to evaluate the factors which play a role in motivating clients to comply with daily fetal movement counting.

The purpose of this study is to explore the issue of compliance as its relates to women's use of daily fetal movement counting tools. Diverse individuals and antepartum populations may have distinctive values, health conditions, and abilities. This study seeks to analyze the differences in compliance between a low-risk birth-center-based antepartum population and a mixed-risk clinic-based antepartum population with respect to their use of a fixed-time fetal movement counting tool and Pearson's "Cardiff" daily fetal movement counting tool.

Conceptual Framework

This study is primarily concerned with compliance. A number of researchers have suggested that compliance is related to a variety of other variables. The major variables to be considered in this study are the convenience of the daily fetal movement counting method, the complexity of the daily fetal movement counting method, a women's perception of her vulnerability to a poor outcome, and educational level. In addition, the type of antepartum population and the type of daily fetal movement counting tool and their interactive impact on compliance will be considered.

For the purposes of the study, compliance will be defined by the degree of consistent completion of daily fetal movement charts (i.e., how often counts are done)

and by the degree of correct completion of daily fetal movement charts (i.e., how often counts are recorded correctly on daily fetal movement counting charts). As documented in the literature (Gettinger et al., 1978; Hertogs et al., 1979; Sadovsky, 1973), the reliability of maternal perception of fetal movements will be accepted and not measured.

There is evidence to support a relationship between convenience and compliance. The Health Belief Model, as utilized by Becker, Drachman, and Kirscht (1972), proposes that the motivation to perform health behaviors is fostered by the belief that a recommended health action will reduce the threat of disease without substantial inconvenience. It appears that the more inconvenient the behavior requested of the client, the lower the compliance.

Compliance has also been shown to be inversely related to complexity. The greater the complexity of the behavior requested of the client, the lower the compliance (Blackwell, 1973; Yoos, 1981).

Perceived vulnerability has also been associated with compliance. The Health Belief Model (Becker, et al., 1972) suggests that the motivation to perform health behaviors is related to the belief that one is vulnerable to a specific health problem. A similar relationship was

reported by Davis (1966) who found that mothers who believed their children were more susceptible to illness were more compliant with medication regimens. These results suggest that compliance increases as the client's perception of her (or her child's) vulnerability increases.

Typically, education has been thought to increase compliance. However, the literature has not supported this belief. Researchers have found that those with a higher educational level were, in fact, less likely to comply with medication recommendations than those who had a lower educational level (Charney et al., 1967; Maddock, 1967). However, education may play a role in the ability to accurately comply with health recommendations which vary in their difficulty.

This conceptual framework suggests relationships between compliance and four major variables. These relationships will be tested in a population of pregnant women. The first two hypothesized relationships to be tested are relationships between compliance and the type of behavior requested from the client:

1. Compliance increases as the convenience of the behavior requested from the client increases.
2. Compliance increases as the complexity of the behavior requested from the client decreases.

Two additional hypothesized relationships to be tested are between compliance and specific characteristics of the client:

1. When the client's perception of her vulnerability increases, her compliance increases.
2. When the client's educational level increases, her compliance decreases.

A final relationship to be tested is the interactive effect of antepartum setting and type of daily fetal movement counting tool on compliance. In this study two groups of pregnant women will be asked to participate and members of each will be taught one of two separate methods of fetal-movement counting. The first group of clients will be drawn from a private birth-center midwifery practice. It will be assumed that clients who seek birth-center delivery experiences are typically low-risk, motivated to take part in their own care, and are usually not of low socioeconomic status.

The second group of subjects will be recruited from a university-based nurse-midwifery practice. In contrast to birth-center clients, clients who seek care at this clinic-based site are typically of mixed medical risk, may be less motivated to participate in their own care, and are often of a lower socioeconomic status. Although these

generalizations may not hold true for all clients, for the purpose of this study it will be assumed that Oregon Health Sciences University subjects will represent a group whose perception of their vulnerability is higher, and whose educational level is lower than clients from private practice.

Differences in compliance when using either a fixed-time method of daily fetal movement counting or Pearson's Cardiff method of daily fetal movement counting will be examined for each of the populations described above.

Operational Definitions

Fixed-time method of daily fetal movement counting	=	a fixed-time method of counting daily fetal movements for 30-minutes twice a day (See Appendix A).
Cardiff method of daily fetal movement counting	=	a variable-time method of counting daily fetal movements involving the recording of the time it takes for 10 fetal movements to be perceived (See Appendix B).
Complexity Index =		The cumulative score on items 1 - 4 on the Final Questionnaire. (See Appendix C.)
Convenience Index =		The score on item 5 on the Final Questionnaire. (See Appendix C.)
Perceived vulnerability Index =		The average of the scores on items 9 and 10 on the Demographic Questionnaire. (See Appendix D.)

Proxy Variables for Compliance:

Consistent Chart Completion Index =	% of days the daily fetal movement counting charts are completed, regardless of accuracy.
Correct Chart Completion Index =	a) % of days the daily fetal movememnt counting charts are correctly completed. b) % of movement alarm signals correctly reported to the care provider.

Hypotheses

The following hypotheses are more direct tests of the relationships posited between compliance and the four major variables discussed in the conceptual framework. For the purposes of this study compliance will be measured by the proxy variables of consistent chart completion and correct chart completion of either the Fixed-time method of daily fetal movement counting or the Cardiff method of daily fetal movement counting.

1. Subjects with higher scores on the convenience index will score significantly higher on both the consistent chart completion index and the correct chart completion index than subjects with lower scores on the convenience index.

2. Subjects with higher scores on the complexity index will score significantly higher on both the

consistent chart completion index and the correct chart completion index than subjects with lower scores on the complexity index.

3. Subjects with higher scores on the perceived vulnerability index will score higher on the consistent chart completion index and the correct chart completion index than those subjects with lower scores on the perceived vulnerability index.

4. Subjects with a high school diploma or more education will score significantly lower on the consistent chart completion index and the correct chart completion index than those subjects with less education.

The final two hypotheses are designed to examine the differences between the two antepartum populations and their compliance with both daily fetal movement counting tools:

5. There is an interaction between the type of daily fetal movement counting method and the type of antepartum population and their effect on the consistent chart completion index.

6. There is an interaction between the type of daily fetal movement counting method and the type of antepartum population and their effect on the correct chart completion index.

CHAPTER II

Methods

Design

A descriptive design was used to explore the relationship between each of the major independent variables (i.e., convenience, complexity, perceived vulnerability, and education) and both the consistent chart completion index and the correct chart completion index.

In order to compare the compliance of two different antepartum populations, using one of two methods of daily fetal movement counting, a 2x2 factorial experimental design was used. Compliance was measured by its proxy variables -- the consistent chart completion index and the correct chart completion index.

Setting and Sample

Pregnant subjects were recruited from two settings - The Oregon Health Sciences University Women's Health Clinic - Midwifery Service (OHSU) and the Milwaukie Birth Center (MBC). The OHSU is affiliated with a tertiary care teaching/learning hospital. The MBC is a free-standing nurse-midwife owned and operated birth center.

In order to be eligible for inclusion in the study, subjects were required to be able to read, write and speak

English. They could not be diagnosed as high-risk (due either to maternal or fetal factors), could not be involved in other forms of antepartum testing, had to be 36-38 weeks gestation at the initiation of the study and had to voluntarily consent to participation in the study.

Of approximately 45 eligible subjects approached for inclusion in the study, 40 agreed to participate (25 at OHSU and 15 at MBC). The breakdown of subjects lost to voluntarily dropping from the study and lost to follow-up is detailed in Table 1. A total of 31 subjects were included in the final data analysis. Of these, three were included although they did not have complete data sets. One subject lost all the records of her daily fetal movement counting charts but returned the Final Questionnaire (FQ). She was excluded from the analysis done with daily fetal movement counting charts but included in the analysis of subjects' perceptions about daily fetal movement counting. Two subjects failed to return their FQs despite repeated telephone follow-up. They were excluded from the analysis of subjects' perceptions about daily fetal movement counting, but they were included in the analysis of compliance with counting.

Specific demographic data about subjects is presented in Table 2. The age range for participants was 18 - 38 years with a mean of 26.4 years (S.D. 5.71). All but two

Table 1

Number of Subjects in Study According to Method of Daily Fetal Movement Counting and Site of Antepartum Care

Site & Method	Number Recruited	ATTRITION		Total in Study
		Number Voluntarily Dropped	Number Lost to Follow-up	
Site				
MBC*	15	2	0	13
OHSU**	25	1	6	18
Method				
Fixed***	20	1	3	16
Cardiff****	20	2	3	15
Site and Method				
MBC/Fixed	8	0	0	8
MBC/Cardiff	7	2	0	5
OHSU/Fixed	12	1	3	8
OHSU/Cardiff	13	0	3	10
Total	40	3	6	31

Total Attrition
9

* Milwaukie Birth Center
** Oregon Health Sciences University
*** Fixed-time Method of DFMC
**** Cardiff Method of DFMC

Table 2

Subject Demographic Information

Subjects	n =	OHSU 18	MBC 13	Fixed 16	Cardiff 15
Age					
Mean	26.4	25.0	28.2	26.3	26.4
Range	18-38	18-35	18-38		
S.D.	5.571	5.179	5.747	5.288	6.045
Parity					
Primipara	17 (55%)	10	7	9	8
Multipara	14 (45%)	8	6	7	7
Helper at Home					
Yes	28 (90%)	16	12	15	13
No	3 (10%)	2	1	1	2
Race					
White	29 (93.5%)	16	13	14	15
Other	2 (6.5%)	2	0	2	0
Educational Level					
High School graduate or less	10 (32%)	7	3	4	6
Some College	13 (42%)	7	6	7	6
College Graduate or more	8 (26%)	4	4	5	3
Work Outside Home					
Yes	6 (19%)	3	3	4	2
No	25 (81%)	15	10	12	13
No hours	20 (64.5%)	12	8	9	11
1-30 hours	9 (29%)	6	3	6	3
30+ hours	2 (6.5%)	0	2	1	1
Income					
Below Mean	15 (53.5%)	10	5	8	7
Mean 18-24,999	7 (25%)	3	4	3	4
Over Mean	6 (21.5%)	2	4	4	2
Gestation at Recruitment					
36 weeks	11 (35.5%)	5	6	7	4
37 weeks	15 (48%)	10	5	7	8
38 weeks	5 (16.5%)	3	2	2	3
Children at Home					
None	15 (48%)	8	7	8	7
1-3	16 (52%)	10	6	8	8

subjects were caucasian. Fifty-five percent of subjects were having their first baby, while 45% had children from a previous pregnancy. About half of the subjects (52%) had one or more children at home to care for during this pregnancy. Most (90%) subjects had someone at home to help them on a daily basis. The majority (81%) did not work outside the home but for those who did work, at home or elsewhere (n = 11), only two reported that they were employed for 30 or more hours per week. Gestational age at recruitment varied from 36 weeks to 38 weeks. No significant demographic differences were found between groups when compared by site of antepartum care or by daily fetal movement counting method.

Subjects were assigned an identification number upon recruitment. MBC subjects were sequentially assigned numbers 1-15 and OHSU subjects were sequentially assigned numbers 51-75. For each setting, the first and subsequent odd-numbered subjects recruited were asked to blindly select a black or red checker piece out of a hat. Selection of black resulted in assignment to the Cardiff method and selection of red resulted in assignment to the fixed-time method. The second and subsequent even numbered subjects were assigned to the opposite method. Using this technique resulted in an even distribution of

subjects to each counting method at the time of recruitment.

Data Collection

Several instruments were used for data collection. Demographic information was obtained from a questionnaire completed by subjects and from chart review. Information requested from subjects included age, race, parity, partner status, number of children at home, working status, income, and educational level. Information collected from chart review and recorded on the demographic questionnaire included gestational age at initiation of the study and at delivery (Appendix D).

The second set of data collection instruments were the daily fetal movement count charts for the Fixed-time method and the Cardiff method (Appendix A & B). The daily fetal movement counting tools for each method were adapted from several sources. Each fetal movement counting tool was a double-sided form. One side included instructions for use (Lehman & Estok, 1987; AP Special Studies, personal communication, February 1988) and a description of eligible fetal movements (Rayburn & McKean, 1980). The reverse side included a chart for recording the number of fetal movements felt (Pearson, 1979; AP Special Studies, personal communication, February 1988) and space for recording MAS actions. Completed charts were collected at

antepartum visits and after delivery by the nurse-midwives or the researchers. They were analyzed for the number of days each subject completed and recorded the counts (consistent chart completion index), the number of days counts were correctly recorded, the incidence of MASs, and the incidence of calling a care provider when a MAS was recorded (correct chart completion index).

After the birth of their baby each subject was sent a Final Questionnaire (Appendix C). Questions focused on the complexity and convenience of the daily fetal movement counting methods and the subjects' satisfaction with and understanding of the methods and tools.

Procedures

Permission to approach subjects at the OHSU and the MBC was formally obtained from both organizations prior to initiation of the study. To ensure adequate protection of the rights of human subjects the research proposal was submitted to the Oregon Health Sciences University Human Subjects Review Committee and granted approval after exemption from full committee review.

Prior to initiation of the study the researchers met with the nurse-midwives at both OHSU and the MBC to review the research proposal and delineate responsibilities of the nurse-midwives. A teaching session protocol (Appendix E) designed to orient the nurse-midwives to the study

procedures included: a review of each daily fetal movement counting method and the charts for recording fetal movements; a presentation of the Weekly Follow-up Form (Appendix F) and procedures to be carried out by the nurse-midwife during each prenatal visit with the subjects; and a discussion of MASs and their management.

Antepartum clients at OHSU and MBC who were 36-38 weeks gestation and met the inclusion criteria were approached for participation in the study during a routinely scheduled prenatal visit in the Summer and Fall of 1988. Subjects were informed of the nature and purpose of the study and what was to be expected of them should they agree to participate. They were assured that participation was strictly voluntary and that they had the right to refuse. They were also assured that they could withdraw from the study at any time without jeopardy to their midwifery care. The privacy of the subjects has been protected by the use of identification numbers in all written reports. Subjects who agreed to participate were asked to sign a letter of informed consent which outlined the information discussed above (Appendix G).

Once informed consent had been obtained, participants were asked to complete the demographic questionnaire (Appendix D). Subjects were assigned to a counting method using the technique described in the discussion of

sampling. The rationale for doing daily fetal movement counts was explained to each subject along with information on the significance of decreased fetal movement.

Subjects were taught their assigned method on an individual basis by one of the researchers according to a standard teaching protocol (Appendix H). The client was presented with a copy of the appropriate daily fetal movement counting chart (Appendices A & B). The method was fully described verbally and in writing. Written instructions were included on each chart for recording fetal movements. Eligible fetal movements, as listed on the daily fetal movement counting chart, were described. The MAS criteria for each method was reviewed in detail. Subjects were instructed to contact their nurse-midwife if they experienced a movement alarm signal. Calls to the care provider were recorded on the daily fetal movement counting chart. Opportunities were provided for questions, presentation of standardized examples for recording, and return demonstrations (Appendix I & J).

Each subject was given four blank daily fetal movement counting charts (Fixed or Cardiff) to take home. They were instructed to complete the charts on a daily basis according to the instructions in the training session. Subjects were asked to bring their charts to

each weekly prenatal visit. Completed daily fetal movement counting charts were collected by a nurse-midwife. The Weekly Follow-up Form (Appendix F) was completed by the nurse-midwife at each visit. Subjects were told they would be given the opportunity to ask their nurse-midwife questions about their method as needed during their pre-natal visits.

Subjects were instructed to continue counting and recording fetal movements throughout the study until delivery unless advised otherwise. Approximately two weeks after delivery, the Final Questionnaire (Appendix C) was sent to the subject's home along with a letter of instruction for completion (Appendix K). The letter also encouraged subjects to return any daily fetal movement counting charts that were not already handed in. A stamped, self-addressed envelope was included to encourage subjects to return the questionnaires. After sufficient time had passed without a response, a second follow-up letter (Appendix L) was sent and a telephone call attempted to encourage return of missing data.

Analysis

The first four hypotheses which address the major variables related to compliance were analyzed using *t*-tests. As described in the hypotheses, the subjects with

higher scores for each index were compared to those with lower scores.

A two-way analysis of variance (ANOVA) was used to analyze the data related to the fifth and sixth hypotheses. This statistical technique allowed the consideration of two independent variables, client population and daily fetal movement counting method and their interactive affect on the dependent variables - consistent chart completion and correct chart completion for each daily fetal movement counting method.

CHAPTER III

Results

This chapter will present the findings of this investigation. It will begin with a discussion of the data relevant to each of the six research hypotheses. Additional data which was collected and analyzed will then be presented.

As discussed earlier, this study is primarily concerned with the issue of compliance in the use of two daily fetal movement counting tools by two antepartum populations. Compliance was indirectly measured by the proxy variables of consistent daily fetal movement counting chart completion and correct daily fetal movement counting chart completion. The consistent chart completion index is a value representing the percentage of days the subjects completed their daily fetal movement counting chart, regardless of accuracy. The correct chart completion index is a combined value reflecting: a) the percentage of days the daily fetal movement counting chart was completed accurately (Correct A); b) the percentage of movement alarm signals correctly reported to the care provider (Correct B); and c) a value representing the average of a and b ([a + b]/2) (Correct C). The

consistency with which subjects completed their daily fetal movement counting charts varied from 26.47% to 100% of the days requested with a mean consistent chart completion index of 66.5% (S.D. 0.257). The distribution of scores for Correct A, B, and C, however, were considerably more narrow. Subjects completed their daily fetal movement counting charts correctly (Correct A) an average of 94.7% of the time with a range of 62.5% to 100%. Twenty of the 30 subjects who recorded daily fetal movement counts did so correctly every day. The number of MASs experienced and/or reported by subjects was very low. Twenty-seven subjects experienced no MAS, three experienced a single MAS, and one subject had three MASs. Thus, the number of MASs reported by subjects (Correct B) contributed little variation to the calculation of the Correct chart completion index (Correct C). Therefore, calculations using Correct A and especially Correct B and C were of limited value and in most cases described below, Correct B and C were eliminated from the statistical analyses.

Hypothesis Testing

The first four hypotheses predict relationships between four independent variables - convenience of the daily fetal movement counting tools, complexity of the daily fetal movement counting tools, perceived

vulnerability of the subjects to a poor perinatal outcome, and educational level - and the dependent variable of compliance. The final two hypotheses predict an interaction between type of antepartum population (low-risk birth center subjects and mixed-risk university clinic subjects) and type of daily fetal movement counting tool (a fixed-time tool and the Cardiff tool) and their effect on compliance.

Hypothesis One

The first hypothesis predicted that subjects with higher scores on the convenience index would score significantly higher on both the consistent chart completion index and the correct chart completion index than those with low convenience scores. The convenience index was simply the response given by the subjects to Final Questionnaire item number five - "How easy was it to fit fetal movement counts into your daily schedule?" The distribution of scores is displayed in Table 3.

Table 3

Convenience - Ease of fitting daily fetal movement counting into schedule

Label	Value	Freq.	Percent
Not at all	1	1	3.45
	2	11	37.93
	3	7	24.14
	4	5	17.24
Very much so	5	5	17.24

Mean = 3.069 S.D. = 1.193

An independent groups t-test was done to compare the differences in compliance of those who rated their daily fetal movement counting tool as very convenient to those who rated their daily fetal movement counting tool as inconvenient. In order to create independent groups for comparison, scores on the convenience index were grouped as follows:

Scores of 1 and 2 ----> 1 (least convenient).

Scores of 4 and 5 ----> 2 (most convenient).

Scores of 3 were omitted from the analysis.

Two separate t-tests were done (Table 4). They measured the effect of the independent variable, convenience, on the dependent variables of consistent chart completion and correct chart completion (measured here by Correct A only).

The results of these t-tests partially support Hypothesis One. Those individuals who rated their assigned daily fetal movement counting tool as more convenient scored significantly higher ($P = 0.0075$) on the consistency index than those individuals who rated their tool as less convenient. However, no significant differences were found in scores on the correct chart completion index between those who scored high on the convenience index and those who scored low on the convenience index.

Table 4

Effect of Convenience on Compliance

Dependent Variable	Least Convenient	Most Convenient		
Consistency (% of days chart completed)				
N	11	9	T	-3.01
Mean	0.552	0.826	DF	18.00
S.D.	0.221	0.176	P	0.0075
Correct A (% of days done correctly)				
N	11	10	T	-1.27
Mean	0.901	0.965	DF	19
S.D.	0.130	0.097	P	0.2203

Hypothesis Two

The second hypothesis predicted that subjects with higher scores on the complexity index (the sum of items one through four on the Final Questionnaire - Appendix C) would score significantly higher on both the consistent chart completion index and the correct chart completion index than those with lower scores on the complexity index.

The complexity index was a measure of the subjects' perception of the difficulty and complexity of the daily fetal movement counting tool to which they were assigned. High scores reflect a tool which was easy for subjects to

Table 5

Responses to Complexity Index Items

	Not at all easy				Very Easy
	1	2	3	4	5
Item 1					
Ease of learning method	-	1	-	3	25
Mean 4.793					
Item 2					
Ease of using chart	-	-	1	1	27
Mean 4.897					
Item 3					
MAS instruction clarity	-	1	-	4	24
Mean 4.759					

	never	2 weeks	1-2 weeks	3 days-1 week	1-2 days
	1	2	3	4	5
Item 4					
Length of time to learn method	-	-	-	1	28
Mean 4.966					

	Scores						
	4-14	15	16	17	18	19	20
Complexity Index							
(Items 1+2+3+4)	0	1	-	2	2	2	22

Mean 19.414
S.D. 1.240

learn and understand while low scores suggest a tool was difficult to learn and understand. The possible scores on the complexity index ranged from four to twenty.

This second hypothesis was not statistically analyzed because the range of values for the complexity index was very narrow (Table 5). Of the 29 subjects who responded to the final questionnaire, 22 had the highest possible score (20) which reflected their perception that the daily fetal movement counting tools were very easy to learn and understand. In evaluating the responses to the four individual items which make up the complexity index, all four items were given the highest score for ease of the method by at least 24 of the 29 respondents. The lack of variance in the complexity scores makes statistical analysis inappropriate. Therefore, the second hypothesis was rejected.

Hypothesis Three

The third hypothesis suggested that subjects who perceived themselves or their fetuses to be vulnerable to a poor outcome as a result of this pregnancy would be more compliant in their use of daily fetal movement counting tools than those who did not feel vulnerable. Thus, those with a high vulnerability index (feel very vulnerable) would score higher on both the consistent and the correct

chart completion indices than those with low vulnerability scores (did not feel at all vulnerable).

The vulnerability index was calculated by averaging the ratings given by subjects of their perception of their own vulnerability and their babies vulnerability as assessed in Demographic Questionnaire Items 9 and 10 (Appendix D). Each item had a possible range of responses from 1 (least vulnerable) to 5 (most vulnerable).

The range of responses to the item which assessed perceived vulnerability of self was very narrow. Of the 31 subjects, 26 responded that they did not feel at all vulnerable (response 1) while the other five (5) subjects rated self-vulnerability with a 2. Thus, none of the subjects perceived themselves to be highly vulnerable during this pregnancy. The range of responses to the item assessing the subjects' perception of their babies vulnerability during this pregnancy was slightly broader. Twenty-two (22) indicated that they felt their baby was "not at all" vulnerable (response 1), whereas nine (9) subjects perceived their baby to be vulnerable to some degree with ratings from 2 to 5 . The mean score for perception of vulnerability of the baby was 1.645 (S.D. 1.142).

Due to the skewed range of scores described above, the data were analyzed in two ways (Table 6). First, as

mandated by the original hypothesis, a t-test was done to determine if there were any significant differences in compliance between those who had a low average score on the vulnerability items (average score = 1; n=20) and those who had a higher average score on the vulnerability items (average score = 2.0-5.0); n=8). Those whose average score was 1.5 (n=3) were excluded from the analysis. The results of the t-test showed no significant differences between vulnerability groups on any of the compliance proxy variables (Consistent or Correct Chart Completion Indices). Therefore, the third hypothesis was rejected.

The effect of the perceived vulnerability of one's baby in isolation from perceived vulnerability of self on compliance was also analyzed. Those who responded that they did not feel their baby was at all vulnerable (response 1; n=21) were compared with those who indicated some degree of vulnerability (responses 2-5; n=8). No significant differences were found between the mean scores on the compliance proxy variables when compared for each of the perceived vulnerability of baby groups.

Despite the non-significant findings reported above, it is interesting to note that the mean score on the consistency index was slightly higher for both those subjects who had a higher vulnerability index score (self

Table 6

Effect of Perceived Vulnerability and Educational Level on Compliance

	Low Vulnerability	High Vulnerability	
Vulnerability of Baby			
Consistency (% of days counted)			
N	21	8	T -0.57
Mean	0.648	0.710	DF 27
S.D.	0.270	0.230	P 0.5720
Correct A (% of days correct)			
N	21	9	T 2.60
Mean	0.986	0.858	DF 8.46
S.D.	0.038	0.146	*P 0.0304
Vulnerability Index (Self + Baby/2)			
Consistency (% of days counted)			
N	19	7	T -0.56
Mean	0.614	0.676	DF 24
S.D.	0.261	0.227	P 0.5830
Correct A (% of days correct)			
N	19	8	T 2.30
Mean	0.990	0.887	DF 7.41
S.D.	0.033	0.125	*P 0.0529

	High School Graduate or Less	College Graduate or More	
Educational Level			
Consistency (% of days counted)			
N	9	8	T -0.25
Mean	0.636	0.669	DF 15
S.D.	0.311	0.229	P 0.8046
Correct A (% of days correct)			
N	9	8	T 1.20
Mean	0.975	0.912	DF 8.31
S.D.	0.046	0.141	*P 0.2634

*Note: F test of equal variances rejected at alpha of 0.05

and baby combined) and a higher vulnerability of baby score. A larger sample may have yielded significant results.

Hypothesis Four

Educational level is examined in the fourth hypothesis. Subjects with a high school diploma or more were expected to be less compliant than subjects with less than a completed high school education. Upon examination of the data, the educational level of most subjects was higher than originally anticipated. Therefore the formation of two distinct educational groups for comparison using a *t*-test was adjusted accordingly.

Only four (4) of 31 subjects had not obtained a high school diploma. The most common level of educational achievement was "some college." For the purposes of data analysis, those subjects with a high school diploma or less (n=10) were compared to those with a college degree or more (n=8). Those with some college were excluded from the analysis. No significant differences (at the level of $P < 0.05$) were found between the two educational groups in mean scores on the consistent or correct chart completion indices (Table 6). Therefore, Hypothesis 4 was rejected.

Hypothesis Five

All of the results discussed above have dealt with the variable of compliance irrespective of the daily fetal

movement counting tool used by a subject or the antepartum population which the subject was a member of. The final two hypotheses are designed to examine the interactive effect of daily fetal movement counting tool and antepartum population on compliance. The daily fetal movement counting methods were:

1. Fixed-time daily fetal movement counting tool - requires the subject to count fetal movements for one-half hour in the morning and the evening (n = 16).
2. Cardiff daily fetal movement counting tool - requires the subject to record the time it takes to feel 10 fetal movements each day (n = 15).

The antepartum populations were:

1. Milwaukie Birth Center clients - low-risk antepartum clients cared for by nurse-midwives; clients deliver primarily in a birth center setting (n = 13).
2. Oregon Health Sciences University Nurse-Midwifery Service clients - mixed-risk (low/moderate risk) clients cared for by nurse-midwives; clients deliver in a tertiary care hospital (n = 18).

The first interactive hypothesis predicted an interaction between the method of daily fetal movement

counting tool assigned to a subject and the type of antepartum client and their interactive affect on consistent chart completion (i.e., how often the subject completed and recorded her daily fetal movement counts).

As described in the introduction to this chapter, the consistency index is a value which shows the percent of days the subject actually recorded daily fetal movement counts out of the possible number of days she could have recorded them. A two-way ANOVA was calculated to determine if the findings supported this fifth hypothesis. The results of this analysis are presented in Table 7.

Although no interactive effect of method and site on consistent chart completion was found, as predicted in Hypothesis 5, an interesting main effect of type of daily fetal movement counting method alone on consistent chart completion emerged. Subjects who used the Cardiff tool completed their charts significantly more consistently than subjects who used the Fixed-time tool ($P < 0.0001$). There was no significant difference in consistent chart completion between the MBC sample and the OHSU sample when considered apart from method.

In calculating the consistency index for those subjects who used the Fixed-time method, credit was given for a completed day only if both the morning and evening count were done according to the requirements for the

method. Twelve of the 15 subjects assigned to the Fixed-time method had at least one day disqualified from the consistency index because only one of the two required counts were done. One subject had as many as 10 days disqualified because only a single count was done. In order to investigate whether elimination of all half days was the source of the significant difference between the two methods, another two-way ANOVA was done with the following recoded consistency index:

$$\text{Consistency} = \frac{(\#\text{ whole days} + \#\text{ of half days completed})}{\#\text{ days possible to complete chart}}$$

No significant interactive effect of method and site was found with this new consistency index (Table 7). In addition, no significant differences (at $P < 0.05$) were found between the mean consistency scores when evaluated by method or site. Although the differences in means for the two methods were not significantly different, there was a visible tendency for those subjects using the Cardiff method to be more consistent in their daily fetal movement counts (78.5% of the time) than the Fixed-time group (63.3% of the time) even when the Fixed-time group was given the advantage of getting credit for half days of counting.

Table 7

Interactive Effect of Method and Site on Compliance Variables

	Method		Site		MxS	Within Groups
	Fixed*	Cardiff**	MBC***	OHSU****		
Dependent Variable						
Consistency (% of days counted)						
Mean	0.4998	0.8415	0.6480	0.6784		
MSS	0.834		0.0068		0.0000	0.0399
F	20.891		0.171		0.001	
P	0.0001		0.6828		0.9782	
Correct A (% of days correct)						
Mean	0.9407	0.9539	0.9316	0.9593		
MSS	0.0031		0.0031		0.0572	0.0092
F	0.338		0.338		6.235	
P	0.5662		0.5662		0.0192	
Recoded Consistency (% of half and whole days counted)						
Mean	0.6328	0.7854	0.7568	0.6704		
MSS	0.2152		0.0975		0.0000	0.0751
F	2.865		1.298		0.000	
P	0.1020		0.2645		0.9947	

* Fixed-time method of DFMC
** Cardiff method of DFMC
*** Milwaukie Birth Center
**** Oregon Health Sciences University

Hypothesis Six

The final hypothesis proposed in this study suggested that daily fetal movement counting method and antepartum population have an interactive effect on the second proxy variable for compliance, correct chart completion. To review, correct chart completion is made up of three parts: the percentage of counts correctly recorded on the daily fetal movement counting chart (Correct A); the percentage of MASs correctly reported to a nurse-midwife (Correct B); and the average of the two [(Correct A + Correct B)/2 = Correct C].

As discussed earlier in this chapter, the number of MASs experienced by this sample was extremely small (only four subjects experienced from one to three MASs). Therefore, for the purposes of this analysis, MAS data was excluded and the interactive effect of method and antepartum population upon Correct A, alone, were examined.

A two-way ANOVA revealed a significant interactive effect ($P = 0.0192$) of method and site on the percentage of days when subjects correctly completed their daily fetal movement counting charts (Correct A). But no significant differences were found between the mean number of correct days recorded when comparing method or antepartum population alone (Table 7).

The significant interactive affect reported above must be viewed with caution, however. As noted at the beginning of this chapter the distribution of scores on the Correct A index was highly skewed. Twenty of the 31 subjects correctly recorded their counts 100% of the time and the mean Correct A score was 0.947 (94.7% correct). This sample had little difficulty filling out daily fetal movement counting charts and made few errors. Thus the significant interactive effect shown in this two-way ANOVA may not be clinically meaningful.

Additional Data Analysis

A variety of data was collected in addition to that required for analysis of the six research hypotheses. This additional data may contribute to our understanding of compliance in the use of daily fetal movement counting tools. Upon a review of the analysis of these additional findings, several things appear meaningful to report. First, the variable of perceived convenience of assigned daily fetal movement counting tool was further evaluated and the analysis will be presented here. Then, the duration of time subjects recorded daily fetal movements (date of recruitment until date of last recorded count) and the duration of time from last recorded count until delivery will be considered as they relate to other

variables. Finally, responses to questions six through ten on the Final Questionnaire will be presented.

Convenience Ratings for the Fixed-time and Cardiff Tools

Thus far the variable of convenience has only been analyzed as an independent variable. It was reported above that those subjects who rated their daily fetal movement counting method as very convenient were significantly more consistent in performing and recording their daily counts (P = .0075) than those who rated their tool as inconvenient. It was also reported that those subjects who were assigned to the Cardiff method of daily fetal movement counting were significantly more consistent (P = .0001) than those who were assigned to the Fixed-time method of daily fetal movement counting. It might reasonably be assumed, therefore, that the Cardiff method would be rated as more convenient than the Fixed-time method.

Table 8

Convenience Ratings for the Fixed-time and Cardiff Daily Fetal Movement Counting Tools

	Fixed	Cardiff		
Convenience - Ease of fitting daily fetal movement counting into daily schedule. (1=not at all conven; 5=very convenient)				
N	14	15	T	-2.34
Mean	2.571	3.533	DF	26.96
S.D.	1.089	1.125	P	0.0270

In order to test this assumption, a t-test was done to determine if the mean convenience index rating for those subjects assigned to the Cardiff method was greater than that for the Fixed-time subjects. As is shown in Table 8, the Cardiff method was, in fact, rated significantly more convenient than was the Fixed-time method ($P = 0.0272$).

Duration of Daily Fetal Movement Counting

Study subjects were asked to do their assigned method of daily fetal movement counting every day from recruitment until the day of delivery. The length of time subjects were requested to count varied, depending on the gestational age at recruitment and at delivery, and ranged from four (4) to 51 days (Mean 23.2 days, S.D. 9.894).

In reviewing the data, it became apparent that most subjects began the study by recording daily fetal movement counts fairly regularly. However, many began to stop returning daily fetal movement counting charts some time before they delivered their babies suggesting that they were no longer doing daily fetal movement counts. In order to examine this phenomenon, two additional variables were calculated from the data:

1. Duration of counting = # of days from recruitment date to date of last recorded count.

2. Period of no counts = # of days from last recorded count to date of delivery.

The mean duration of counting performed by subjects was 17.87 days (S.D. 8.205) with a range of zero to 31 days. A two-way ANOVA was done to determine any differences in mean duration of counting as a function of daily fetal movement counting method or antepartum population. No significant individual or interactive effect was found. Interestingly, the Cardiff method did have a longer mean duration of counting (19.67 days, S.D. 7.017) than the Fixed-time method (16.19 days, S.D. 9.079) which is consistent with the results reported earlier showing that subjects were significantly more consistent in completing the Cardiff method than the Fixed-time method. Lack of a significant difference between the two in this case may be a function of the small sample size or the large standard deviations.

The mean period from last recorded count to date of delivery was 5.1 days (S.D. 6.06) with a range of zero to 25 days. More than 50% of the subjects stopped counting two or more days prior to delivery. More than 25% stopped counting one week or more prior to their date of delivery. Neither method nor antepartum population, individually or interactively, had a significant effect on this variable.

Additional Items on Final Questionnaire

Items 1 - 5 on the Final Questionnaire are included in the analysis of the complexity index and the convenience index. Items 6 - 10 were incorporated into the Final Questionnaire (Appendix C) in the hopes of gathering additional descriptive data about subjects' learning, understanding, and use of daily fetal movement counting tools. See Table 9 for complete data on the responses to items six through eight.

Item 6a. Subjects were asked whether they perceived the written instructions on each of the daily fetal movement counting tools to be helpful to their learning and understanding of their assigned method. More than 72% gave the instructions the highest score (5) for ease of understanding. All ratings were three or greater. Although written instructions for each tool were different, no significant differences in mean score on Item 6a were found between the Fixed-time and Cardiff groups.

Item 6b. The training session (Appendix H), provided for each subject at recruitment, was evaluated by asking subjects to rate their perception of the helpfulness of the session. Over 78% of the 28 subjects who responded rated the training session as very helpful.

Item 6c. Subjects were asked to indicate whether they found the list of fetal movements eligible for recording on daily fetal movement counting charts to be helpful in using the daily fetal movement counting tools (Appendix A & B). There was a greater variety of responses on this teaching/learning item than the two noted above, however the majority of subjects (> 65%) gave the list of fetal movements the highest rating. However, close to one third of the subjects rated the list as not very helpful (1 or 2).

Item 6d. Subjects were told at the initiation of the study that their CNM would be available at weekly clinic visits to answer questions about their daily fetal movement counting method and to collect their completed charts. Although the most frequent rating (37.5%) was a five (very helpful), over half of the subjects rated the CNM visits as three or less. No significant differences were found in the rating of the helpfulness of CNM visits between the two antepartum sites.

Item 7. As a part of the training protocol for subjects (Appendix H) the rationale for doing fetal movement counts on a daily basis was explained to each participant. At the completion of the study, subjects were asked to rate to what extent they perceived the explanation of the rationale for daily fetal movement

Table 9

Effect of Teaching/Learning Methods and Other Factors on Subjects' Perceptions About Daily Fetal Movement Counting

	Not at all.....Very much so					Total
	1	2	3	4	5	Number
Item 6						
Helpfulness of teaching/learning methods						
(a) Written instructions						
Mean 4.621						
(frequency)	-	-	3	5	21	29
(%)	-	-	10.34	17.24	72.41	
(b) Training session						
Mean 4.714						
(frequency)	-	-	2	4	22	28
(%)	-	-	7.14	14.29	78.57	
(c) List of fetal movements to count						
Mean 4.154						
(frequency)	1	3	4	1	17	26
(%)	3.85	11.54	15.38	3.85	65.38	
(d) Weekly CNM visits						
Mean 3.458						
(frequency)	4	2	6	3	9	24
(%)	16.67	8.33	25.00	12.50	37.50	
Item 7						
Explanation of rationale for daily fetal movement counting						
Mean 4.037						
(frequency)	-	2	9	2	14	27
(%)	-	7.41	33.33	7.41	51.85	
Item 8						
Extent to which daily fetal movement counting was reassuring						
Mean 4.107						
(frequency)	-	2	6	7	13	28
(%)	-	7.14	21.43	25.00	46.43	

counting encouraged them to do their fetal movement counts on a regular basis. Over 50% of the subjects responded "very much so" suggesting that the rationale for daily fetal movement counting played a strong role in encouraging them to count regularly. A third of the subjects rated the rationale as a 3 (midpoint on the scale), while only two subjects did not feel the rationale contributed to their compliance.

Item 8. Subjects rated the extent to which they found fetal movement counting to be reassuring. Over 70% responded on the high end of the scale (4 or 5) reflecting their perception that they found the counting reassuring. Only two subjects responded on the lower end of the scale (2) suggesting few participants found the counting made them anxious.

Items 9 and 10. The final two items on the Final Questionnaire were open-ended queries to determine what subjects perceived as the most difficult or worst thing about doing daily fetal movement counts (Item 9) and what they perceived to be the easiest or best thing about doing daily fetal movement counts (Item 10). Responses were reviewed and categorized into common groups. The response categories were:

Best/Easiest:

1. Increased attachment to/awareness of baby because of counting.
2. Ease of counting because of very active baby.
3. Reassurance that baby was healthy because it was active.
4. Ease of completing chart.
5. Enforced rest during counting.
6. Flexibility of method.

Difficult/Worst:

1. Finding the time to do fetal movement counting.
2. Remembering to do fetal movement counting.
3. Keeping track of number of fetal movements once counting had begun.
4. Nothing was difficult/worst.
5. Other (responses which were mentioned by only one subject).
6. Frustration that baby's active time did not coincide with assigned counting time.
7. Felt worried/anxious when fetal movement seemed less than usual.

The frequency with which a response fit into each category is presented in Table 10. The most common complaint (37.93%) about daily fetal movement counting was finding the time to count. This data provides additional support for the results reported previously which show that many subjects rated daily fetal movement counting as

Table 10

Subjects' Perceptions About the Best and Easiest / Worst and Most Difficult Aspects of Daily Fetal Movement Counting

	Frequency	Percent
Best/Easiest thing about Daily Fetal Movement Counting		
Increased attachment	11	37.93
Active Baby	7	24.14
Reassuring	5	17.24
Chart easy to complete	3	10.34
Enforced Rest	2	6.90
Method Flexibility	1	3.45
Worst/Most Difficult thing about Daily Fetal Movement Counting		
Finding Time	11	37.93
Remembering to do count	5	17.24
Tracking baby during count	3	10.34
No Worst thing	3	10.34
Other	3	10.34
Baby inactive at count time	2	6.90
Worry/Decreased movement	2	6.90

inconvenient on the convenience index. Another common response was the difficulty of remembering to do the counts (17.24%). The remainder of the replies were fairly evenly distributed among the response alternatives.

The increased attachment to their baby which subjects felt was the most frequently cited (37.93%) best/easiest thing about doing daily fetal movement counts. Other common responses were that their active baby made counting easy (24.14%) and that daily fetal movement counting was a reassuring sign that the subject had a healthy fetus (17.24%).

Summary of the Results

In conclusion, this chapter has presented the data collected in order to address six research hypotheses and several additional exploratory analyses. Of the first four hypotheses positing direct relationships between compliance and four independent variables, three were rejected. Compliance was not found to increase as a function of decreased complexity, increased perception of vulnerability, or lower educational level.

Hypothesis Two was partially supported. Compliance, measured by its proxy variable of consistent chart completion, was significantly higher among those subjects who rated daily fetal movement counting as very convenient. However, no significant differences were

found in compliance, measured by the proxy variable of correct chart completion, between those subjects who rated DFMC convenient and those who did not.

The fifth hypothesis was also rejected. The interaction of method and site did not significantly affect consistent chart completion. However, the data did show that those subjects who used the Cardiff method were significantly more consistent in completing their daily fetal movement counting charts than those who used the Fixed-time method. Site of antepartum care did not have an effect on consistency.

The results of the analysis for the final hypothesis suggest it should be accepted; however, the data should be viewed with caution. The interaction of method and site had a significant effect on correct chart completion (measured only by Correct A - % days charts completed correctly); however, the narrow and highly skewed range of scores for Correct A make the implications of this result difficult to interpret. Further data are needed before Hypothesis 6 can be accepted with any degree of confidence.

Finally, in the exploratory analysis it was found that those subjects who used the Cardiff method of daily fetal movement counting rated their tool as significantly more convenient than those who used the Fixed-time tool.

The mean duration of counting and period from last recorded count to date of delivery did not vary significantly as a function of method or site of antepartum care. The majority of subjects rated the teaching/learning methods (Final Questionnaire Item 6) to be very helpful with the exception of the weekly CNM visits. Responses to the questions seven and eight on the Final Questionnaire had a broader range of responses. Increased attachment to one's baby was most frequently cited as the best thing about daily fetal movement counting while finding time to do counts was most frequently listed as the worst.

CHAPTER IV

Discussion of the Results

This chapter contains a discussion of the results of this study. The relationship of the findings to relevant literature will be addressed along with implications for theoretical conclusions.

Compliance with Daily Fetal Movement Counting

The results of this study suggest that compliance is indeed an issue among women asked to count and record daily fetal movements during their pregnancy. Both the degree of consistency in recording daily fetal movements and the ability to correctly record counts on fetal movement charts were evaluated as measures of compliance.

Consistency in completing charts on a daily basis varied considerably more than correct chart completion. The mean rate of consistency was 66.5%. Draper et al. (1986) reported a 98% compliance rate among his population of daily fetal movement counting users while only 79% of Valentin and Marsal's (1986) sample completed and returned their charts. It is unclear, however, how these researchers' compliance figures were calculated. Compliance may have been defined simply as the rate of return of daily fetal movement counting charts to the care

provider with no calculation of the actual number of days counting was done. Thus, it is difficult to compare those figures to the consistency figures reported here. The data reported in this study also revealed that about 25% of subjects counted less than half the required time. These results support Clark and Britton's (1985) data which also reflected a less than 50% chart completion rate for about a quarter of their subjects.

Compliance was very high when considering correct chart completion as a proxy variable. Daily fetal movement counting charts were accurately filled out 94.7% of the time. Valentin and Marsal (1986) reported a similar rate (98%) in their sample. In contrast, Clark and Britton reported that completing charts accurately was a common difficulty of clients in their study. The rate of correct reporting of MASs was another variable included in the measure of correct chart completion. The rate of MASs in this study was consistent with the low rate reported in the literature (Clark & Britton, 1985; Fischer et al., 1981; Leader et al., 1981; Liston et al., 1982; Neldham, 1980; Pearson & Weaver, 1976). However, this value contributed little to the analysis in this study because the absolute number of MASs was too low to allow analysis of the rate of reporting MASs to care providers. Accurately responding to MASs has been reported to be a

critical part of compliance with daily fetal movement counting (Clark & Britton, 1986; Valentin & Marsal, 1986). The data in this study failed to contribute any knowledge in this area of compliance because of the low number of MASs.

Hypothesis One

The results of this study partially supported the hypothesis that clients who perceive daily fetal movement counting to be very convenient will be more compliant in adhering to a daily fetal movement counting method than clients who find daily fetal movement counting inconvenient. Subjects were significantly more consistent in performing daily fetal movement counting when they rated their daily fetal movement counting tool as highly convenient than when they found that use of their assigned tool did not fit easily into their daily schedule.

These results support the premise of the Health Belief Model, discussed in the conceptual framework, which proposes that motivation to perform health behaviors is fostered by the belief that a recommended health action will reduce the threat of disease without substantial inconvenience (Becker et al, 1972). The contentions of other authors who posited that convenience plays a critical role in compliance with daily fetal movement counting methods (Davis, 1987; Draper et al., 1986;

Rayburn, 1980) were also supported. The ability to correctly complete daily fetal movement charts does not appear to be a function of convenience among the subjects in this study.

Hypothesis Two

Complexity of daily fetal movement counting tools as a predictor of compliance was neither supported nor refuted by the data. Overall, subjects found the daily fetal movement counting tools to be very uncomplicated. Both learning the assigned daily fetal movement counting method and using the appropriate chart were rated as very easy by the vast majority of the sample. Most reported they clearly understood their method within one to two days of recruitment into the study. These results do not support the suggestion by Clark and Britton (1985) that clients may need early exposure to daily fetal movement counting so they can have adequate time to learn the method before an at-risk period. The instructions for reporting MASs were also perceived as very easy to understand, however, it was not possible to test this perception against the actual rate of correct reporting of MASs because so few subjects experienced them. The statistical relationship between perceived complexity of the daily fetal movement counting methods and compliance

was not tested because of the narrow range of complexity scores.

Hypothesis Three

Perceived vulnerability was not found to be associated with a significant increase in compliance with daily fetal movement counting. However, there was a small (6%), non-significant increase in consistent chart completion among those subjects who reported a higher degree of vulnerability for both their babies, alone, and for themselves, in combination with their babies. A larger sample size is necessary to determine if this small difference is random or truly suggestive of an increase in compliance as a result of feeling vulnerable to a poor health outcome as suggested by both Becker et al. (1972) and Davis (1966).

Hypothesis Four

Educational level did not affect compliance among this sample. Neither consistency nor the ability to correctly complete daily fetal movement charts was significantly different between those who had completed college or those who had never attended college. This hypothesis was difficult to analyze because the educational level of the majority of subjects was reported as "some college," leaving a relatively small number of subjects at either end of the education continuum to

compare for differences in compliance. A much larger sample is necessary to adequately examine this hypothesis.

Hypothesis Five

The interaction of type of daily fetal movement counting method and antepartum site were not found to have an interactive effect on the consistent chart completion aspect of compliance with daily fetal movement counting. But, method alone had a highly significant effect on consistency. Those subjects who were assigned to the Cardiff group completed their daily fetal movement counting charts significantly more consistently ($p = 0.0001$) than those who used the Fixed-time method. Even when Fixed-time counters were given credit for completing days when they had done two counts (as required by the instructions) and days when they had done only one of the two counts required, they still had a 15% (statistically non-significant) lower consistent chart completion rate than those who used the Cardiff method.

Similar results reporting a comparison between the two major daily fetal movement counting methods have not been reported in the literature to date. These results suggest that compliance with daily fetal movement counting will be greater when using the Cardiff method of daily fetal movement counting than when using the Fixed-time method of daily fetal movement counting described in this

study. These findings should be regarded as preliminary because of the small sample and the use of only one protocol among many for Fixed-time methods of daily fetal movement counting.

Hypothesis Six

The results of the study showed that type of daily fetal movement counting method and type of antepartum client interact such that they have a significant effect on clients' correct completion of daily fetal movement counting charts. This statistically significant finding may not be clinically meaningful, however. As mentioned above, daily fetal movement counting charts were completed correctly 94.7% of the time. The differences between means among various combinations of groups analyzed in the ANOVA ranged from a rate of 89% to 100% correct chart completion. Thus, all groups of subjects completed charts at least 89% of the time which may be sufficiently accurate for clinical purposes. Neither subjects in the Fixed or Cardiff, nor subjects in either antepartum population showed any differences in the degree to which they accurately completed daily fetal movement counting charts.

Additional Data Analysis

Perceived Convenience of the Each Daily Fetal Movement Counting Tool

Thus far, the data suggest that clients who perceive a daily fetal movement counting method as convenient will do it consistently and the Cardiff method was done more consistently than the Fixed-time method. It would follow, therefore, that the Cardiff method would be rated as more convenient than the Fixed-time method. The data support this assumption. Subjects using the Cardiff method found daily fetal movement counting significantly easier to fit into their daily schedule than subjects using the Fixed-time method.

In brief summary, the results reported thus far have suggested that antepartum clients will perform daily fetal movement counting more often when they perceive it as convenient. Further, it appears that they find the Cardiff method more convenient than the Fixed-time method and subsequently perform the Cardiff method on a more regular basis than the Fixed-time method.

Duration of Daily Fetal Movement Counting

Daily fetal movement counting is implemented in antepartum populations at many different points in pregnancy. Members of high-risk populations may be asked to begin counting fetal movements as early as 26 weeks

gestation (Leader et al., 1981) while low-risk populations may not have daily fetal movement counting implemented until 36 weeks (Clark & Britton, 1985; Fischer et al., 1981) or later (i.e., when clients become postdates). Thus, clients may be required to count for a few days, in the postdates pregnancy, or for 14 or more weeks in the high-risk pregnancy.

In this study's sample of essentially low-risk antepartum clients, three-fourths of the subjects stopped counting two or more days before delivery, and 25% stopped counting over a week before delivery. The reason for discontinuing is unclear, however, it is possible that women became tired of doing counts on a daily basis. Clark and Britton (1985) suggest that low-risk women should be initiated on daily fetal movement counting prior to 36 weeks so they will have ample time to become versed in the method. This idea would be defeated, however, if women became weary of counting and subsequently stopped by the time they were most at-risk (i.e., during the postdates period). The data reported in this study are by no means definitive. The day of the last recorded count was calculated based on available chart information and may not reflect the actual last day of counting. Further research is needed to determine if clients, in fact, have a threshold for duration of counting. This information

could be used to determine an optimal gestational age to implement daily fetal movement counting among low-risk women so they will be counting during the periods when they are most at risk for fetal compromise.

Additional Items on Final Questionnaire

Several interesting findings were gleaned from responses to items six through ten on the Final Questionnaire. These items were intended to determine what teaching/learning methods used in this study were most helpful, the extent to which daily fetal movement counting was perceived to be reassuring or anxiety producing, and what facets about daily fetal movement counting subjects found to be positive and negative.

The written instructions included on each daily fetal movement counting chart used in this study were specifically adapted by the researchers based on both a review of common problems with chart understanding reported in the literature (Clark & Britton, 1985; Draper et al., 1986) and anecdotal problems reported with charts. A majority of subjects found the written instructions very easy to understand. This perception was supported by a high level of correct completion of daily fetal movement counting charts at the time of analysis. It is hoped that the written format used on both the Cardiff and Fixed-time chart will be used again in other studies to document

their success in helping clients to learn and understand their assigned method of daily fetal movement counting.

Most subjects also found the training session, provided for each study participant at recruitment, very helpful. The researchers used a standard teaching protocol which required subjects to do a return demonstration showing they could correctly complete their daily fetal movement counting charts given a variety of counting scenarios. They were also required to describe how they would respond to a count which qualified as a MAS. Clark & Britton (1985) reported that 82% of their sample could not accurately complete their Cardiff chart when their count did not begin at 9am. This problem was virtually eliminated by this study's revised charts. During the training session, Cardiff subjects were able to correctly record their fetal movement counts regardless of the time when counts began. The value of the training session and return demonstrations was supported by a high rate of correct chart completion and by subject's subjective rating that the daily fetal movement counting methods were not complex to learn and understand.

The list of fetal movements which were eligible to include on the daily fetal movement counting chart was found to be helpful for a majority of subjects. This information provides support for researchers who have

suggested that describing the types of fetal movements which should be counted will help patients perform their daily fetal movement counts (Clark & Britton, 1985; Rayburn, 1980). In addition, informing patients to eliminate fetal hiccoughs and uterine contractions from the count are thought to yield a more accurate record of fetal movement in utero (Hertogs et al., 1979; Rayburn, 1980). This study did not evaluate the accuracy of maternal perception of fetal movement.

The ability of weekly CNM visits to aid in subjects' learning and understanding of their assigned daily fetal movement counting tool was not well evaluated in this study. The Final Questionnaire item which assessed this issue was not sufficiently sensitive to determine if visits were not consistently helpful because subjects did not need help or because their CNMs were unable to provide help with the methods. Regular follow-up with clients doing daily fetal movement counting has been cited as a key factor in increasing compliance (Clark & Britton, 1985; Davis, 1987; Gantes et al., 1986). The researchers in this study were unable to monitor the adequacy of follow-up closely because of limitations in time and woman-power. Additional research is needed to determine if regular follow-up can, indeed, contribute to increased compliance in daily fetal movement counting.

Researchers have anecdotally reported that an explanation of the rationale for doing fetal movement counts may encourage clients to count on a more regular basis (Rayburn, 1980). Over half of the subjects in this study reported this to be true. However, there appeared to be a variety of opinions among subjects. This item on the final questionnaire was also not sufficiently sensitive to determine how the rationale for doing daily fetal movement counting affected subjects' compliance.

The eighth item on the final questionnaire was designed to assess whether subjects found daily fetal movement counting to be reassuring or anxiety producing. Almost one-half found the process reassuring, but over one-quarter of the respondents did not feel very reassured as a result of counting. These results are similar to those of Draper et al. (1986) who reported 55% of their sample were reassured by daily fetal movement counting, while 23% expressed concerns about counting related to confusion about kicking patterns and the ability to perceive fetal movement. Gibby (1988) reported no differences in anxiety between women who did daily fetal movement counting and women who did not. The data reported in this study does not directly support or refute Gibby's findings because no control group of non-counting women was used.

The final two items on the Final Questionnaire were designed to elicit unprompted responses about what subjects perceived to be the best or easiest thing and the worst or most difficult thing about daily fetal movement counting. Perhaps the most encouraging and unexpected result was the response by close to 40% of the subjects that daily fetal movement counting allowed them to feel a closer bond with their baby before its birth. It has been suggested that maternal-fetal attachment may be an important part of adaptation to pregnancy and future motherhood (Cranley, 1981). The results reported above suggest that some women may find that daily fetal movement counting facilitates that attachment process which supports the claim to that effect made by Gantes et al. (1986).

The most commonly cited negative aspect of daily fetal movement counting was difficulty in finding time to do counts. This qualitative data provides yet another piece of support for the previous findings reported which show that subjects may not comply with a daily fetal movement counting method which is inconvenient.

CHAPTER V

Conclusions

In this chapter a summary of the study will be presented, followed by a review of the limitations of the study. Implications for nursing practice and recommendations for future research will then be discussed.

Summary

Daily fetal movement counting is a low-cost, non-invasive method of ongoing maternal assessment of fetal well being. Methods of daily fetal movement counting involve counting fetal movements and recording the number of movements felt over a fixed or variable amount of time. A dramatic drop in fetal movement has been correlated with poor perinatal outcome. Compliance on the part of the pregnant woman is necessary to ensure the successful implementation of daily fetal movement counting. The purpose of this study was to evaluate compliance with two widely used methods of daily fetal movement counting by two distinct antepartum populations.

The conceptual framework upon which this study was based came from medical and nursing literature examining several factors that affect compliance. An inverse

relationship exists between compliance and complexity. The greater the complexity, the lower the compliance. Motivation to perform health behaviors may be related to the convenience of performing the health action and the perceived vulnerability to a specific health problem. Education is thought to influence compliance in an inverse fashion. The higher the educational level, the lower the compliance. And, compliance with daily fetal movement counting may also be a function of type of antepartum population and type of counting tool assigned.

Six research hypotheses were formulated:

1. Subjects with higher scores on the convenience index will score significantly higher on both the consistent chart completion index and the correct chart completion index than subjects with lower scores on the convenience index.

2. Subjects with higher scores on the complexity index will score significantly higher on both the consistent chart completion index and the correct chart completion index than subjects with lower scores on the complexity index.

3. Subjects with higher scores on the perceived vulnerability index will score higher on the consistent chart completion index and the correct chart completion

index than those subjects with lower scores on the perceived vulnerability index.

4. Subjects with a high school diploma or more education will score significantly lower on the consistent chart completion index and the correct chart completion index than those subjects with less education.

5. There is an interaction between the type of daily fetal movement counting method and the type of antepartum population and their effect on the consistent chart completion index.

6. There is an interaction between the type of daily fetal movement counting method and the type of antepartum population and their effect on the correct chart completion index.

The sample consisted of 31 subjects from two different antepartum populations. Subjects from the Milwaukie Birth Center were primarily low-risk and cared for by nurse-midwives who deliver in a birth center setting (n=13), while those subjects from the Oregon Health Sciences University were of both low and moderate risk and cared for by nurse-midwives who deliver in a tertiary care hospital (n=18). Participants were recruited between 36 and 38 weeks gestation. Each subject was randomly assigned to one of the methods of daily fetal movement counting. The Fixed-time method of daily fetal

movement counting involved counting and recording daily fetal movements for 30-minutes twice a day. The Cardiff method of daily fetal movement counting required recording the time it took for women to feel 10 fetal movements each day. Demographic information was collected at initiation into the study. No significant demographic differences were found between groups when compared by site of antepartum care or by daily fetal movement counting method.

Subjects were taught their assigned method of daily fetal movement counting individually and were instructed to complete the charts on a daily basis until delivery. The daily fetal movement counting charts were examined for the percentage of days the they were completed, regardless of accuracy, and the percentage of days the charts were correctly completed. The first four hypotheses were analyzed using *t*-tests. A two-way analysis of variance was used to analyze the fifth and sixth hypotheses.

The first hypothesis, although not accepted in its entirety, was partially supported by the finding that subjects who rated their daily fetal movement counting tool as highly convenient were significantly more consistent in daily fetal movement counting chart completion than subjects who found their tool to be inconvenient ($P=0.0075$). Hypotheses 2 - 5 were rejected,

however a significant main effect of method type on consistent chart completion was found. Subjects who used the Cardiff daily fetal movement counting tool were significantly more consistent in chart completion than subjects who used the Fixed-time tool (P=0.0001). Although statistical analysis dictates acceptance of the sixth hypothesis, the results are not clinically meaningful because the mean percentage of correct chart completion was very high and the range of scores was very narrow.

Additional data from the daily fetal movement counting charts and Final Questionnaire were analyzed with the following interesting results. Three-fourths of the subjects stopped counting fetal movements two or more days before delivery, and 25% stopped counting over a week before delivery. The women may have tired of doing the counts on a daily basis during the period when monitoring of fetal well-being may be most critical. A majority of the subjects found the written instructions very easy to understand and the training session and list of fetal movements to count very helpful. Almost 50% of the subjects found daily fetal movement counting reassuring but, over one quarter did not feel very reassured as a result of counting fetal movements. Close to 40% of the subjects responded that daily fetal movement counting

allowed them to feel a closer bond with their baby before its birth.

Limitations

This study is limited by several factors. A small sample size, flaws in some of the measurement tools and data collection methods, and limitations to generalizability all must be considered when attempting to use these findings.

The small sample size made statistical analysis difficult for some of the hypotheses. The low number of MASs experienced by this population made it impossible to assess the compliance of the sample with respect to reporting MASs. Although a larger sample size may produce a similar rate, the absolute number of MASs would most likely rise to a level high enough for statistical analysis. Insufficient variance in the values obtained for some variables, such as educational level and perceived vulnerability, may have also been a function of the small sample size.

Most of the measurement tools used for this study were developed or newly revised by the researchers specifically for the purpose of this study. A number of flaws discovered in the course of the investigation limited the results of the study. Items used to measure perceived complexity and convenience of the daily fetal

movement counting tools were not designed to be sufficiently sensitive to differences in these variables among subjects. A high proportion of subjects always responded on the high end of the scale. Other items on the Final Questionnaire also failed to produce much variance in subject response possibly due to poor scale design.

The study was also limited by some of the methods of data collection. Due to the large number of people (eight nurse-midwives) involved in the day to day collection of daily fetal movement counting data, it is unclear whether failure to return some daily fetal movement counting charts was due to poor patient compliance or inconsistent collection of charts.

The restriction of this study's sample to nurse-midwifery clients of essentially low-risk status limits generalizability of these findings to similar populations. However, the homogeneous make-up of the sample, as evidenced by the demographic data, reduced the number of extraneous variables in the study.

Implications for Nursing

Nursing professionals can provide a valuable contribution to the care of antepartum women by implementing daily fetal movement counting as an auxiliary method of fetal assessment. A number of factors may

affect compliance in the use of daily fetal movement counting tools. This study suggests that convenience of a daily fetal movement counting tool may play a role in improving compliance among women asked to count daily fetal movements. Antepartum clients similar to the sample included in this study may find the Cardiff daily fetal movement counting method more convenient than a Fixed-time method of counting. It is important to consider the lifestyle of individual clients when asking women to do daily fetal movement counting as a means of increasing compliance.

In addition, careful teaching about the importance of daily fetal movement counting and tools for counting, including return demonstrations and detailed instructions, may be helpful. Consistent follow-up by care-providers may be important in improving compliance among women doing daily fetal movement counting.

Recommendations for Future Research

Several recommendations for future research emerge from this investigation. A replication of this study with a larger sample size is needed. First, however, further refinement of the measurement tools used to measure compliance, convenience and complexity are necessary. In addition, the methodological problems associated with data collection procedures discussed above must be addressed.

Second, a study to compare clients' use and understanding of the revised Cardiff chart utilized in this study as compared with the traditional Cardiff chart, would provide additional data to support the use of the revised chart used in this investigation. The ability of simplified method instructions and charts to increase patient compliance may be able to contribute to the increased use of daily fetal movement counting as a method of fetal assessment.

Finally, because clients may tire of doing daily fetal movement counting, a study to determine the optimal gestational age for initiation of daily fetal movement counting is needed. However, prior to making any clinical management decisions, the effect of varied initiation times on perinatal outcome must be assessed.

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LIST OF APPENDICES

APPENDIX

Appendix A

Subject # _____

FETAL ACTIVITY CHART

We would like you to help us check the health of your baby by keeping a record of the number of times your baby moves during the day. Some babies are more active than others, and each baby tends to have its own pattern of activity.

At two times during the day, preferably 12 hours apart (for example, 9am and 9pm), lie on your LEFT side and for 1/2 hour count the baby's movements. Place your hands on your stomach and watch your stomach so that you will be able to see or feel most of the baby's movements. Record the number of movements you feel in that 1/2 hour on this sheet next to the time of day you counted.

1. If you feel 4 or more movements during your 1/2 hour count, record the number you felt in the appropriate space on the count sheet. Proceed to count again at your next regularly scheduled count time (in about 12 hours).

2. If the number of movements is fewer than 4 - do another 1/2 hour count on your left side after about an hour has passed.

   -- If movements are still fewer than 4 in this second 1/2 hour of counting, this is a Movement Alarm Signal and you must call the nurse midwife on call.

   -- If you count 4 or more movements, record them in the second count space and proceed to count again at your next regularly scheduled count time (in about 12 hours).

Movements of your baby which should be counted:

1) stretching movements
2) rolling movements
3) balling up
4) kicks
5) jabs
6) punches

Movements which should not be counted:

1) flutters
2) hiccups
3) contractions

FETAL ACTIVITY CHART

DAY OF WEEK								
DATE								
Morning count (1/2 hour)								
Second Morning Count (1 hour later, if needed)								
Evening count (1/2 hour)								
Second Evening Count (1 hour later, if needed)								

REMEMBER - if at any count session you feel fewer than 4 fetal movements, do another 1/2 hour count on your left side after about an hour has passed. If the movements are still fewer than 4, this is a Movement Alarm Signal and you must **call the nurse midwife on call.**

Record your Movement Alarm Signals (fewer than 4 movements in 1/2 hour after you have waited an hour and counted a second time) and what you did about them (for example, called the nurse midwife, counted for additional time, ignored it):

DATE ACTION

____ _____

____ _____

____ _____

____ _____

Appendix B

Subject # _____

THE CARDIFF "COUNT-TO-TEN" FETAL ACTIVITY CHART

We would like you to help us check the health of your baby by keeping a record of the number of times your baby moves during the day. Some babies are more active than others, and each baby tends to have its own pattern of activity.

Starting early in your day count the number of movements your baby makes until the total equals 10. Record the time you begin counting and the time you feel the tenth movement. Then fill in the block which matches how many hours you counted. For example, on Monday if you begin counting at 9:00am and finish at 11:20am, you counted for a total of 2 hours and 20 minutes (round that off to the nearest 1/2 hour = 2-1/2 hours). Color in the square next to 2-1/2 hours under the Monday column.

If you feel fewer than 10 movements within a 12-hour period, this is a Movement Alarm Signal. Record the actual number of movements felt and call the nurse midwife on call immediately. Also, call immediately if you feel no fetal movements in eight hours.

Movements of your baby which should be counted:

1) stretching movements
2) rolling movements
3) balling up
4) kicks
5) jabs
6) punches

Movements which should not be counted:

1) flutters
2) hiccups
3) contractions

REMEMBER TO CALL THE NURSE MIDWIFE ON CALL IF YOU FEEL FEWER THAN 10 BABY MOVEMENTS IN 12 HOURS OR NO MOVEMENTS IN 8 HOURS

THE CARDIFF "COUNT-TO-TEN" FETAL ACTIVITY CHART

Day of Week								
Date								
Start time								
Finish time								
30 minutes								
1 hour								
1 1/2 hrs								
2 hours								
2 1/2 hrs								
3 hours								
3 1/2 hrs								
4 hours								
4 1/2 hrs								
5 hours								
5 1/2 hrs								
6 hours								
6 1/2 hrs								
7 hours								
7 1/2 hrs								
8 hours								
If you have felt no fetal movements after eight hours of counting - call the nurse-midwife on-call.								
8 1/2 hrs								
9 hours								
9 1/2 hrs								
10 hours								
10-1/2 hrs								
11 hours								
11-1/2 hrs								
12 hours								
IF YOU HAVE NOT FELT 10 FETAL MOVEMENTS IN TWELVE HOURS OF COUNTING, CALL THE NURSE-MIDWIFE ON CALL.								
Actual # of movements felt in 12 hrs. (if less than 10)								

Record your Movement Alarm Signals (fewer than 10 movements in 12 hours) and what you did about them (for example, called the nurse midwife, counted for additional time, ignored it):

DATE ACTION

____ _____

____ _____

____ _____

Appendix C

Subject # _____

FINAL QUESTIONNAIRE

		Not at all				Very much so
1.	How easy did you find the method you were using to learn and understand? ----------	1	2	3	4	5
2.	How easy did you find the chart to fill out?	1	2	3	4	5
3.	Were the instructions describing when to call your nurse-midwife for a movement alarm signal clear and easy to understand?	1	2	3	4	5
4.	How long did it take for you to feel that you completely understood how to do your fetal movement counts and could perform them without difficulty? (check answer)	1-2 days ____ 3d - 1 wk ____ 1-2 wks ____ 2 wks + ____ Never ____				
5.	How easy was it to fit fetal movement counts into your daily schedule? -------	1	2	3	4	5
6.	Which of the following teaching methods were helpful in learning/understanding the method?					
	Written instructions on the forms? --	1	2	3	4	5
	Training Session at the start of study?	1	2	3	4	5
	List of fetal movements to count? ----	1	2	3	4	5
	Weekly clinic visits during which the nurse-midwife answered questions?	1	2	3	4	5
7.	To what extent did the explanation of why fetal movements are important encourage you to do your counts on a regular basis?	1	2	3	4	5
8.	To what extent did you find it reassuring to do fetal movement counts? ----------	1	2	3	4	5

9. What was the most difficult or worst thing about doing daily fetal movement counts?

_____

10. What was the easiest or best thing about doing daily fetal movement counts?

_____

Appendix D

Subject # _____

DEMOGRAPHIC QUESTIONNAIRE

We would like to ask a few questions about you for statistical purposes.

1. What is your age? _____ years.

2. How many children have you given birth to? _____

3. How many children live with you at home? _____

4. Is there another person in your house to help you with daily household activities?

   1 Yes
   2 No

5. What is your ethnic or racial identification? (please circle the number of the correct answer)

   1 White
   2 Black
   3 Hispanic
   4 Asian
   5 American Indian
   6 Other (please identify)

   _____

6. Schooling completed by yourself (please circle the number of the correct answer)

   1 Some grade school
   2 Some Junior high school
   3 Some high school
   4 High school graduate
   5 Some college
   6 College or university graduate
   7 Graduate degree

DEMOGRAPHIC QUESTIONNAIRE (con't) Subject # _____

7. Do you work outside the home? 1 Yes 2 No

If yes, what kind of work do you do?

_____

How many hours do you work each week?

1 Less than 10 hours
2 10 - 20 hours
3 20 - 30 hours
4 30 - 40 hours
5 Greater than 40 hours

8. Yearly Family Income (please circle the correct number)

1 Less than $6,000
2 $6,000 - 11,999
3 $12,000 - 17,999
4 $18,000 - 24,999
5 $25,000 - 34,999
6 $35,000 - 49,999
7 More than $50,000

9. Do you feel there are threats to your health as a result of this pregnancy? (please circle the appropriate number below)

Not at all ---> Very much so

1 2 3 4 5

10. Have you felt threats to the health of your baby during this pregnancy? (please circle the appropriate number below)

Not at all ---> Very much so

1 2 3 4 5

Area below this line is to be completed by the researchers.

Gestational age at initiation of study. _____

Gestational age at delivery. _____

Appendix E

TRAINING PROTOCOL - NURSE-MIDWIVES

1. Provide a copy, in advance, of the formal research proposal to a representative of the nurse-midwives participating in the study for review.

2. Distribute a copy of both the Cardiff and the fixed-time DFMC sheets to each of the nurse-midwives. Allow time for review and questions. Demonstrate the procedures for completion of each DFMC sheet using the standardized examples to be used for teaching subjects.

3. Review the procedures for the study as outlined in the research proposal.

4. Distribute the "Weekly Follow-up Form for Nurse-Midwives." Allow for review and questions.

5. Review procedure for each prenatal visit:

   a. Weekly Follow-up form and blank DFMC sheets will be placed in the subject's prenatal chart prior to each visit by the researchers.
   b. Ask subject for completed DFMC sheet. Place in envelope provided by researchers.
   c. Distribute new copies if needed.
   d. Ask if subject has any questions or problems.
   e. Complete Follow-up Form and add comments prn.
   f. Check to see if subject has current call schedule.

6. Review procedure for movement alarm signals described to subjects. Management of subject calls regarding MASs will be left to the discretion of the nurse-midwife on call. Encourage CNMs to remind the subject to record the MAS action on their DFMC sheets.

Appendix F

Subject # _____

WEEKLY FOLLOW-UP FORM FOR NURSE-MIDWIVES

Week # _____

1. COLLECT DAILY FETAL MOVEMENT COUNT SHEET.

   (Give new one if necessary)

   Subject did not bring DFMC sheet to this visit _____

   Comments: _____

   _____

2. PROBLEMS OR QUESTIONS

   1. No problems or questions stated.

   2. Problems or questions managed by nurse-midwife.

   Comments: _____

   _____

MAKE SURE SUBJECT HAS CURRENT CALL SCHEDULE

Appendix G

OREGON HEALTH SCIENCES UNIVERSITY

INFORMED CONSENT FORM

You are being asked to participate in a study entitled, "Daily Fetal Movement Counts - A Method of Antepartum Fetal Assessment." This experimental study is being conducted by Rebecca Wilson, RN, BSN and Deborah Duran-Snell, RN, BSN, graduate students in the Department of Family Nursing/Nurse-Midwifery at the Oregon Health Sciences University under the direction of Marie Scott Brown, RN, PhD. The purpose of the study is to investigate the factors that help women to learn and use daily fetal movement count tools.

If you agree to participate, you will be asked to complete a demographic questionnaire. You will then be assigned by chance to one of two daily fetal movement counting methods. A researcher will instruct you how to perform and record the daily fetal movement counts. You will be asked to count and record fetal movements every day until you deliver your baby for a period of no more than six weeks. At your weekly prenatal visit your nurse-midwife will collect your completed fetal movement count sheet for the previous week. Nurse-midwives will answer questions you have at that time. Once you have delivered you will be asked to complete a final questionnaire about how you liked the fetal movement counting method you used.

==========

I understand that I may be inconvenienced by the time required to do daily fetal movement counts. In addition, I understand that my nurse-midwives and/or the researchers are available to me to address any concerns I may develop as a result of doing daily fetal movement counts. I have been informed of the advantage of learning daily fetal movement counting as a means of becoming an active participant in the assessment of my baby.

I understand that I may refuse to participate or withdraw from the study at any time without affecting my relationship with my nurse-midwives at the Oregon Health Sciences University or the Milwaukie Birth Center. Neither my name nor my identification number will be used for publication or publicity purposes.

The Oregon Health Sciences University, as an agency of the state is covered by the State Liability Fund. If you suffer any injury from the research project, compensation would be available to you only if you establish that the injury occured through the fault of the University, its officers or employees. If you have further questions, please call Dr. Michael Baird at (503)279-8014.

Ms. Wilson, RN, BSN or Ms. Duran-Snell, RN, BSN have offered to answer any questions I might have.

I have read the foregoing and agree to participate in this study.

DATE: _____ _____
(Signature)

_____
(Witness)

Appendix H

TRAINING PROTOCOL - SUBJECTS

1. Significance of fetal movement -

   - Research supports the correlation of fetal activity with fetal well-being.
   - A decrease in fetal movement below a certain level may be associated with fetal distress.

2. Rationale -

   - Participation of the mother in antepartum fetal assessment.
   - Daily fetal movement counts enable the mother to regularly assess the well being of her baby.
   - Daily fetal movement counts allow the mother to identify a drop in fetal activity.
   - Daily fetal movement counts are inexpensive, require no equipment, are safe and can be done at home.

3. Teaching the Method

   - Give a copy of the appropriate DFMC chart to the subject.
   - Allow her to review the form and read the written instructions.
   - Review the written instructions and allow for questions.
   - Clarify eligible fetal movements to be included in counting.
   - Clarify movement alarm signals and reinforce importance of contacting nurse-midwife on call if a MAS is experienced.
   - Present the first standardized example and demonstrate how the fetal movements should be recorded.
   - Present the second standardized example and ask the subject to record the fetal movements.

4. Distribute four blank DFMC sheets to the subject.

5. Remind the subject to bring their DFMC sheets to each prenatal visit. The completed sheet will be collected by the nurse-midwife. The subjects will be given the opportunity to ask questions at that time.

6. Instruct the subject to continue counting and recording daily fetal movements throughout the study until delivery, unless advised otherwise.

Appendix I

Fixed Count Examples

Example # 1:

Monday	-	morning count from 9:30 to 10:00am; 6 movements are felt
	-	evening count from 10:00 to 10:30pm; 20 movements are felt
Tuesday	-	morning count from 8:15 to 8:45am; 15 movements are felt
	-	evening count from 9:00 to 9:30pm; 7 movements are felt
Wednesday	-	morning count from 10:00 to 10:30am; 3 movements are felt
	-	second morning count from 11:30 to 12:00pm; 3 movements felt
	-	this is a movement alarm signal - call the nurse midwife on-call; record your actions

==========

Example # 2:

Saturday	-	morning count from 9:30 to 10:00am; 12 movements felt
	-	evening count from 9:45 to 10:15pm; 8 movements felt
Sunday	-	morning count 8:00 to 8:30am; 2 movements felt
	-	second morning count from 9:30 to 10:00am; no movements felt
	-	What do you do?
	-	Arrive home at midnight; too tire to count
Monday	-	morning count from 7:00 to 7:30am; 14 movements felt
	-	evening count from 8:00 to 8:30pm; 10 movements felt

Appendix J

CARDIFF COUNT EXAMPLES

Example # 1:

Monday	-	begin at 8:30am, feel 10 movements by 9:30am
Tuesday	-	begin at 9:00am, feel 10 movements by 11:20am
Wednesday	-	begin at 8:00am, have only felt 7 movements by 8:00pm; this is a movement alarm signal; call the nurse-midwife on-call; record your actions

==========

Example # 2:

Saturday	-	begin at 10:00am, feel 10 movements by 3:00pm
Sunday	-	begin at 8:30am, have only felt 8 movements by 8:30pm
	-	What do you do?
Monday	-	begin at 7:30am; feel 10 movements by 8:30am

Appendix K

Dear Daily Fetal Movement Counting Study Participant:

Congratulations! We understand that you recently had your baby. We hope all is going well at home.

We would like to finish up your part in the fetal movement counting study by asking you to complete the enclosed Final Questionnaire. It includes questions about your experience with the daily fetal movement counting method you used during the last weeks of your pregnancy. This information will help us to determine if you and others who participated in this study found the method you used easy or difficult and convenient or inconvenient. We hope you will take five minutes to complete it and return it to us. For each question, simply circle the number which most accurately describes your response.

We have enclosed a stamped self-addressed envelope for you to return the questionnaire in and ask that you also enclose any daily fetal movement charts that you have not already handed in to one of the nurse-midwives. All of this information is important so that we can get some helpful knowledge from this study.

Thank you for taking part in the study. We hope that, as a result of your and others' participation we can begin to understand what fetal movement counting methods are most easy and efficient for women to use during their pregnancies.

Enjoy your new baby!

Sincerely,

Becky Wilson, RN, SNM
Debbie Duran-Snell, RN, SNM

Appendix L

Dear

We're sending another copy of the final questionnaire for the fetal movement count study you participated in during the last part of your pregnancy because we have not received the original we sent to you. It's very urgent that you complete the questionnaire and return it to us as soon as possible. Without your final questionnaire we won't be able to finish up our study.

Also, please send any remaining completed or partly completed fetal movement count charts which you still have. We're anxious to be able to take advantage of all those hours you spent counting your baby's movements before birth by including your counts in the study.

Thanks again for taking part. We hope your baby is bringing much joy to your life!

Sincerely,

Becky Wilson & Debbie Duran-Snell

AN ABSTRACT OF THE THESIS OF

Rebecca A. Wilson and Deborah Duran-Snell

For the MASTER OF SCIENCE IN NURSING

Date of Receiving this Degree: June 9, 1989

Title: A STUDY OF NURSE-MIDWIFERY CLIENT COMPLIANCE IN THE USE OF TWO DAILY FETAL MOVEMENT COUNTING TOOLS

Approved: [redacted]

Marie Scott Brown R.N., PhD., Thesis Advisor

Daily fetal movement counting is a low-cost, non-invasive method of ongoing maternal assessment of fetal well-being. A dramatic drop in fetal movement has been correlated with poor perinatal outcome. This study evaluated the compliance of 31 pregnant women (36 to 38 weeks gestation) randomly assigned to use either the Cardiff method or a fixed-time method of daily fetal movement counting. Subjects were recruited from a mixed-risk, university-based clinic nurse-midwifery service and a low-risk, birth center nurse-midwifery service.

Using their assigned method, subjects counted and recorded fetal movements daily on fetal activity charts until delivery. Compliance was measured by the percentage of days the charts were completed, regardless of accuracy, and the percentage of days the charts were correctly

completed. Data were analyzed using both t-tests and two-way analysis of variance.

In contrast to hypothesized relationships, compliance was not found to increase as a function of decreased complexity of counting tools, increased perception of vulnerability, or lower educational level. However, compliance (% of days charts were completed) was significantly greater among those subjects who rated their counting method as more convenient ($p=0.0075$) and among those subjects who used the Cardiff method of counting as opposed to the fixed-time method ($p=0.0001$). Further, the Cardiff method was rated significantly more convenient by subjects than the fixed-time method ($p=0.0270$).

The study was limited by a small sample size and newly developed measurement tools. However, it provides data suggesting that convenience of a daily fetal movement counting tool may play a role in improving compliance among women asked to count daily fetal movements.