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# Fetal Movements in late Pregnancy

*Categorization, Self-assessment, and Prenatal  
Attachment in relation to women's experiences*

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### **Abstract**

Malm, M.-C. 2016. Fetal Movements in late Pregnancy. Categorization, Self-assessment, and Prenatal Attachment in relation to women's experiences. *Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Medicine* 1171. 73 pp. Uppsala: Acta Universitatis Upsaliensis. ISBN 978-91-554-9446-9.

*Aim:* To explore how pregnant women experience fetal movements in late pregnancy. Specific aims were: to study women's experiences during the time prior to receiving news that their unborn baby had died in utero (I), to investigate women's descriptions of fetal movements (II), investigate the association between the magnitude of fetal movements and level of prenatal attachment (III), and to study women's experiences using two different self-assessment methods (IV).

*Methods:* Interviews, questionnaires, and observations were used.

*Results:* Premonition that something had happened to their unborn baby, based on a lack of fetal movements, was experienced by the participants. The overall theme "something is wrong" describes the women's insight that the baby's life was threatened (I). Fetal movements that were sorted into the domain "powerful movements" were perceived in late pregnancy by 96 % of the participants (II). Perceiving frequent fetal movements on at least three occasions per 24 hours was associated with higher scores of prenatal attachment in all the three subscales on PAI-R. The majority (55%) of the 456 participants reported average occasions of frequent fetal movements, 26% several occasions and 18% reported few occasions of frequent fetal movements, during the current gestational week. (III). Only one of the 40 participants did not find at least one method for monitoring fetal movements suitable. Fifteen of the 39 participants reported a preference for the *mindfetalness* method and five for the *count-to-ten* method. The women described the observation of the movements as a safe and reassuring moment for communication with their unborn baby (IV).

*Conclusion:* In full-term and uncomplicated pregnancies, women usually perceive fetal movements as powerful. Furthermore, women in late pregnancy who reported frequent fetal movements on several occasions during a 24-hour period seem to have a high level of prenatal attachment. Women who used self-assessment methods for monitoring fetal movements felt calm and relaxed when observing the movements of their babies. They had a high compliance for both self-assessment methods. Women that had experienced a stillbirth in late pregnancy described that they had a premonition before they were told that their baby had died in utero.

*Keywords:* Fetal movements, pregnancy, prenatal attachment, self-assessment, stillbirth

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# List of Papers

This thesis is based on the following papers, which are referred to in the text by their Roman numerals.

- I Malm M-C., Lindgren H., Rådestad I. (2010-2011). Losing contact with one's unborn baby. Mother's experiences prior to receiving news that their baby has died in utero. *OMEGA*, 62(4):353-367.
- II Malm M-C., Hildingsson I., Rubertsson C., Rådestad I., Lindgren H. (2014). Development of a tool to evaluate fetal movements in full-term pregnancy. *Sexual & Reproductive Healthcare*, 5(1):31-35.
- III Malm M-C., Rubertsson C., Hildingsson I., Rådestad I., Lindgren H. (2015). Prenatal attachment is associated with fetal movements during pregnancy– a population based survey. *(Submitted)*
- IV Malm M-C., Rådestad I., Rubertsson C., Hildingsson I., Lindgren H. (2014). Women's experiences of two different self-assessment methods for monitoring fetal movements in full-term pregnancy. A Crossover trial. *BMC Pregnancy and Childbirth*, 14:349.

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*To all the women who participated  
in this research*



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# ABBREVIATIONS

ANOVA	Analysis of variance
CTG	Cardiotocography
IBM	International Business Machines
PAI	The Prenatal Attachment Inventory
PAI-R	The revised Prenatal Attachment Inventory
OR	Odds ratio

# INTRODUCTION

Fetal movements are unique for each individual fetus as are women's experiences of movements. Fetal movements have long been of interest as a possible measure of fetal wellbeing. The most common reasons for unscheduled visits to antenatal care centres are concerns regarding decreased fetal movements and an uncertainty of what is considered as normal fetal movements. For this reason, more knowledge of fetal movements in late pregnancy is necessary.

Three different methods of data collection were used in this thesis: interviews, questionnaires, and observations, with the overall aim being to explore how pregnant women experience fetal movements in late pregnancy.

# BACKGROUND

## The fetal period

According to international convention the length of a pregnancy is counted in terms of completed weeks and days and is further divided into three periods known as the first, second, and third trimester. In this thesis, the third trimester will be named as late pregnancy. The first trimester lasts up to 13 weeks and 6 days (13+6), the second trimester lasts between 14+0 until 27+6 and the third trimester lasts from 28+0 until birth. Before 37+0 weeks of gestation the pregnancy is considered to be preterm and after 42+0 weeks of the gestation the pregnancy is referred to as a prolonged or post-term pregnancy. From the eighth week of gestation, the developing baby is called a fetus. It is during this stage that the facial features become distinguishable, the genital organs start to develop, and the digits on the limbs start appearing. At 12 weeks of gestation, the fingers and toes are distinct and the organ systems are completed. This is when the bones start to develop, as well as the circulatory system, and the sex of the fetus can be determined by ultrasonography. At this stage, the development of all body systems is completed. At full-term pregnancy, i.e. 37+0 weeks of gestation, the fetus has increased its weight to approximately 3500 grams and birth generally occurs after approximately 38-40 weeks of gestation (1-3).

## Placenta, amniotic fluid and the umbilical cord

The second trophoblastic invasion, during which the muscular coats of the spiral arteries are stripped, ensures that the placental circulation causes the lowest level of impedance possible in the fetoplacental circulation. Growth restriction, attributed to uteroplacental insufficiency, occurs where this process is presumed to have failed and is usually detected during late pregnancy. Normal placental vascular maturation is usually completed by 20 weeks of gestation. The placenta is an incomplete endocrine organ as well as the means through which the fetus obtains its needs and the efficiency of many functions depends on adequate uterine blood flow. The placenta selects and transports the nutrients necessary for life and growth from the mother's blood and changes the properties of the mother's blood so that the fetus receives the nutrients it requires. In a healthy placenta, the copious villous bed allows the

exchange of oxygen and metabolic products. The fetal sac consists of a double membrane; the outer, chorion, and the inner, amnion, where the fetus floats in the amniotic sac that is filled with a clear pale amniotic fluid that increases through a dynamic process. This process essentially involves diffusion of the fetal urine and lung fluid along with maternal fluid through the membranes into the amniotic cavity. By the time 38 to 39 weeks of gestation have been completed, the amount of fluid is 900-1000 ml, however, that amount will subsequently decrease. The umbilical cord extends from the fetal umbilicus to the fetal surface of the placenta. At birth, the mature cord is about 50–60 cm in length and 12 mm in diameter (4). It is composed of an embryonic form of connective tissue, intermingled with a gelatinous substance, and is covered with amnion. It carries two arteries containing impure blood to the placenta and one umbilical vein containing pure blood returning to the fetus after having been oxygenated and replenished in the placenta (1-3).

## Fetal movements

The development of fetal movement patterns can be followed through pregnancy with the use of obstetric ultrasound examinations of the fetus. The earliest spontaneous fetal movements can be observed at seven weeks of gestation. Early fetal movements are sparse, simple, uncoordinated, or extremely quick twists. The movements gradually show a progressive development in their complexity, and become more sophisticated, stronger, regular, coordinated, complex, and sustained and they increase with gestational age (5). Researchers have described and classified the onset and development of fetal movements. The categories of movements show the development and maturation of the fetal central nervous system. The strength with which they are performed as well as the duration of the movements increases with the increase in muscle mass (6).

Eye movements are the physical expression of upper fetal brainstem function and at 28 weeks of gestation the pupillary membrane disappears and the eyes can open and close. Four fetal eye movement patterns were initially characterized based on early ultrasound observations (7) and have been further modified (8). Fetal breathing is thought to originate from the medullary respiratory centers and is a part of the process of respiratory development. In early fetal life, breathing movements tend to be erratic but they develop a more regular pattern with advancing gestational maturity. At times these movements are perceptible to the mother (9). At 32 weeks of gestation the phenomenon known as fetal behavioral states represented by combinations of quiet or active sleep or quiet or active periods of being awake are possible to detect. In late pregnancy, fetal movement maturation is continuous until about 36 weeks of

gestation when behavioral states, according to Nijhuis et al. (1982), are established in 80 percent of normal fetuses. The original article by Nijhuis et al. stated explicitly that gross movements consist of various patterns that are classified into four behavioral states. This was introduced as a concept based on fetal heart rate and movement classification and information was discovered about the development of the autonomic nervous system during pregnancy. This is the coordination of state parameters as an expression of neurological maturation (10). Later studies indicate that this is a valid approach for fetal state detection. The definition is based on observations made with ultrasound regarding the occurrence and timing of the relationships of general movements of the body, eyes, as well as respiratory movements, with simultaneous registration of variations in the fetal heartbeat as measured by CTG or biomagnetometer (11).

As pregnancy advances, the type of fetal movement might change, weak movements decrease and are superseded by more vigorous movements, which increase over a period of several weeks. Reduced amniotic fluid volume and increased fetal growth appears to be one of the reasons for the change in fetal movements, but it is primarily caused by improved fetal coordination due to fetal brain maturation (12). The intensity and frequency of the movements increase from gestational week 22 until gestational week 32 after which a plateau phase is described (13, 14). In contrast, after the peak of increasing frequency in the second trimester, the type of movements changes as the pregnancy progresses (15-17).

## The fetus's cycles of rest, sleep and activity

Between 20 and 30 weeks of gestation, general body movements become routinized and the fetus demonstrates rest and activity cycles that become prolonged with gestation age (18). The normal range of movement incidence is unclear (19) since individual differences exist (20) but periods of alertness last about 20-40 minutes and the average number of body movements observed at term has been reported to be in the range of 16-45 movements per hour (13). Periods of inactivity have been described to vary from 20-75 minutes with a mean length of 23 minutes. Sometimes, inactive periods last for over an hour, but they rarely exceeded 90 minutes for a healthy fetus (21-24). Fetal movements exhibit significant circadian patterns and diurnal rhythms have been found to develop in late pregnancy, with peak values occurring late in the evening and during the night (13, 25, 26). There is no evidence that fetal movements decline during the active periods in late uncomplicated pregnancy, although they may be experienced differently by different women (24).

## The fetal physical environment and setting

Fetal movements are affected by aspects of the physical environment and they are essential for development (27). It is, however, unclear if gender influences fetal movements and there have been conflicting reports with regard to gender differences (28). The inherent neuromuscular functions of the fetus, the amount of free intrauterine space, the location of the amniotic fluid, and fetal positioning are the major physical influences that have been shown to affect fetal movement (29). The quality and quantity of general fetal movements reflect the integrity of the nervous system and require that neuromuscular functions are intact. To provide this, adequate provisions of oxygen and nutrients to the central nervous system are necessary (30). Fetal movements change as the pregnancy advances due to improved fetal coordination and reduced amniotic fluid volume, coupled with the increased size of the fetus (14, 31, 32). Amniotic fluid volume can be an important determinate of fetal movements as restricted intrauterine space due to diminished amniotic volumes might physically limit fetal movements (33). Furthermore, the fetus's ability to move may be influenced by maternal and fetal diseases as well as factors related to maternal lifestyle (29, 34-37). The pressure on maternal blood vessels increases, accompanied by increased supply of blood to the fetus with subsequent maternal cardiac output and fetal oxygen saturation, causing pressure on blood vessels if the woman lies on her back or on her right side during late pregnancy (38, 39). Fetal movements may be stimulated by acoustic stimulation, vibration (40-42), and light (43), as well as maternal ingestion of glucose (31). Ingestion of any kind of food or juice is the most frequently given practice advice to stimulate fetal movements in an outpatient setting although it does not seem to have any effect (44).

## Technical procedures for recording fetal movement

Many variables may influence fetal movements with gestational age being the most significant factor. However, one single test of the fetus's wellbeing cannot predict with certainty if the fetus's health is compromised (45). Early research of fetal movements has been conducted by monitoring pressure changes transmitted through the maternal abdominal wall (46, 47). These complex registration procedures were replaced by the ultrasound evolution in the late 1960s. Initially, fetal movements were measured with a Doppler fetal activity monitor with a transducer designed to detect and register fetal movements as spikes on standard monitor paper. Measurements of fetal activity were conducted by passing the unprocessed Doppler signal through a band-pass filter that characterized different fetal activities. The development of ultrasound techniques may detect fetal movements before the woman herself

perceives them and may provide an opportunity for the investigators to compare observed fetal moments by ultrasound with those that are perceivable by the women (48). After gestational week 20, it is no longer possible to visualize the entire fetus in its completeness with ultrasound and small movements might go unnoticed, however, advanced imaging via a fetal magnetic resonance imaging (MRI) offers a tool for visualizing the entire fetus and thus obtaining extended information (49).

## Women's perceptions of fetal movement

Maternal perception of fetal movements arises as a result of pressure against the body-wall and signs of fetal life that are perceivable by the woman. Initially, movements are short and weak and can be difficult to distinguish from intestinal activity. In late pregnancy, the perceptions of fetal movements are related to the power of the movements (50, 51). Women expecting their first baby (primiparas) usually feel the first fetal movements in gestational week 18 to 20 (50). Women with prior pregnancies (multiparas) generally feel movements earlier, from about 16 weeks of gestation (52), but parity has not been found to affect maternal perception of fetal movements in late pregnancy (53). For women with an anterior placenta seen in early second trimester ultrasound screenings, there are conflicting findings regarding if this causes any association with a perceived decrease in fetal movements (53-55). The majority of fetal movements are perceived when the woman lies down. Fewer movements are perceived while sitting, and the least number of movements are perceived when the woman is in a standing position (32, 56). The ability of women to perceive fetal movements is influenced by several physical, psychological, and social factors (19). The agreement between examinations conducted using ultrasound simultaneously with a woman's recorded perception of movement has been examined in several studies, and ranges from 4 to 94 percent of movements that are detectable using current sonography scanning technology (57). When body parts were specified, women felt 82 percent of the movements. Trunk and limb movements lasting 1-3 seconds were felt 84 percent of the time (58) both when the movements encompassed the entire fetal body or only the extremities (50). Based on these criteria Rayburn et al. divided fetal movements into four categories; "general body movements", "single trunk and limb movements", "movements of the lower extremities", and "hiccups" (50). Maternal perception of fetal hiccups is of interest although hiccups are not considered to be a fetal movement. However, there seems to be a strong association (OR 3.25) between maternal perceptions of fetal hiccups and a reduced risk of stillbirth in late pregnancy (39). Classification of fetal movements has partly been based on women's perceptions and described by the researchers in terms of magnitude and speed of the movement, that is, if the movements are weak or strong, short-term or persistent. De Vries et al.



(1982) were the first research team to classify fetal movements in the first and second trimester using ultrasound observations (59). Rådestad and Lindgren (2012) suggest a classification according to the power level of the movements. Furthermore, they suggest a division of the data into seven different types of fetal movements for analysis according to the women's own real-time descriptions in late pregnancy (60).

## Fetal movements as an indicator of fetal wellbeing

There is a previously known association of decreased fetal movements with a range of adverse pregnancy outcomes including the associated conditions of fetal growth restriction, and fetal death. These conditions are more probable if the fetus's movements are reduced or weak (39, 61, 62). In contrast, a woman's perception of the frequency and strength of fetal movements during the second and third trimester of pregnancy is a sign of the fetus's wellbeing. The most important factor for neurological assessment is the quality of fetal movements, in particular of general movements (63). The presence of a vigorous fetus is reassuring and an overall increased and sustained frequency and strength of movements in addition to the amount of movements during late pregnancy is associated with a healthy pregnancy outcome (39, 50). No remarkable decrease has been recorded in fetal movements, unless subsequent perinatal distress occurs. Each fetus has its own pattern and frequency which do not change significantly as gestation progress (64). Hence, there is no consensus with regard to what is considered as positive fetal movement rhythm and normal fetal movement patterns, nor is there is consensus regarding what can be considered as normal fetal movements (51, 65). Among caregivers, normal frequencies and types of movement include everything that falls between 25 kicks per hour and three kicks per 24 hours and there is no clinical instrument for evaluation (35). There is limited information in relation to fetal tactile manipulation but the procedure is not recommended since its benefits have not been demonstrated (66). Still, a gentle variant through poking and nudging the belly is used in a clinical context by women to get response from and contact with their unborn babies (67).

## Decreased fetal movements

A perception of decreased fetal movements is known to be significantly associated with adverse pregnancy outcomes such as restricted fetal growth, pre-term birth, and stillbirth (68). Decreased fetal movements, which are also known as reduced fetal movements, can be a sign of dysfunction as well as placental pathologies. The lack of fetal movements may be an important symptom that reflects changes in the central nervous system and fetal health,

and be a sign of fetal compromise (52, 69-71). The rationale is that a fetus will respond to reduced uteroplacental blood flow and hypoxia by decreasing the amount of movements. Fetal movement observations have been suggested as a screening tool to identify impaired placental function. The reactive fetus responds to severe uteroplacental insufficiency by reducing flow to non-essential areas such as the lower limbs and abdominal organs and increasing flow to the cerebral circulation, heart, and the adrenal gland at the expense of the lower body (72, 73).

There is no consensus on the definition of decreased fetal movements (51). Midwives and obstetricians have different ideas, and practices vary for women who express concern regarding their baby's movements and decide to contact health care providers (65). It is difficult to specify a quantitative alarm limit for the minimum number of fetal movements (61). Signs of reduced fetal movements tend to be normalized by the pregnant women (67). Heazell and Frøen (2008) suggest that there is no evidence of a better definition for decreased fetal movements than the mother's own perception to identify a baby at risk (57). The fetus may be affected by a lack of oxygen, which may result in reduced fetal movements. Hence, women should receive information regarding the importance of fetal movements in late pregnancy as well as paying daily attention to them. The most common procedure is to inform pregnant women that they need to be alert to changes in the nature and frequency of fetal kicks as the absence or reduction of fetal movements can indicate a risk of fetal hypoxia. However, this occurs late in the chronic oxygen starvation process and requires judgment along with other monitoring methods because the woman's subjective sense of decreased fetal movements often raises a false alarm. Reduced fetal movements can be an indicator of impending fetal death (47) and women should be instructed to contact an obstetric clinic if a reduction in the number of movements is perceived or if they cease completely. Other studies have subsequently demonstrated similar results (51). Nijhuis (45) and Vindla and James (5), suggest that the perception of reduced fetal movements may be the first signals of ill health in the fetus and propose that the development of appropriate methods for the analysis of fetal behavior should be a high priority in clinical research. Overall, several studies show that the frequency and intensity of fetal movements can predict the outcome of a pregnancy. There is limited knowledge regarding the perception of fetal movements by women in late pregnancy prior to receiving news that their baby has died before birth. Additionally, there is a lack of knowledge in how women interpret any changes in fetal movements which may indicate that their expected baby is unwell (67, 74-76). There is a lack of research into pregnant women's own descriptions of their experiences with regard to different types of fetal movements in late uncomplicated pregnancy (17, 77). Knowledge of pregnant women's experiences of fetal movements might result in improved

opportunities to identify fetuses that are at risk and thus, in the long term, reduce the proportion of stillborn babies.

## Morbidity and mortality

A reduction in fetal movements is associated with a wide variety of pregnancy pathologies as well as an increased risk of adverse pregnancy outcomes and incidences of fetal distress, pre-term labor and stillbirth (57, 68, 78).

While perinatal mortality rates have declined in high-income countries where the reduction is mostly attributed to advances in neonatal care, the rate of stillbirths worldwide has remained constant in recent decades (79). Approximately 2.6 million stillbirths occur worldwide every year. Ninety-eight percent of these deaths take place in low-income countries (80). According to Statistics Sweden (SCB), 456 babies were stillborn in Sweden in 2014 (81). In high-income countries, maternal overweight and obesity is the highest-ranking modifiable risk factor for stillbirth. Primiparity and advanced maternal age contribute as pregnancy disorders, and smoking, pre-existing diabetes, and hypertension remain contributors to stillbirth (79). Fetal growth restriction is the most common known cause of stillbirth (80), however, a number of deaths have been reported as unexplained. In 55 percent of cases of stillbirth, women perceived a reduction in the number of fetal movements or an absence of fetal movements prior to stillbirth (74, 75).

## Attachment

Attachment theory is based on the work of Bowlby and Ainsworth in the 1980s and is widely used across several disciplines (82). In this thesis, the term “prenatal attachment” is used to refer to the emotional tie between a pregnant woman and her unborn baby with particular reference to the increasing attachment following women’s experience of fetal movements during late pregnancy (83). Maternal awareness of fetal movements is desirable and may positively influence maternal-fetal interaction. Thus, when a positive influence on maternal-fetal interaction occurs, the pregnant woman’s awareness of fetal movements might influence the outcome of the pregnancy (84, 85). In contrast, a low level of maternal awareness with regard to fetal movements is associated with an increased risk of a poor perinatal outcome (84).

### Maternal fetal attachment

Maternal fetal attachment (MFA) has been defined by Cranley (1981) as “the extent to which women engage in behaviors that represent an affiliation and

interaction with their unborn child". MFA is manifested in behaviors that demonstrate care and commitment to the unborn baby and include nurturance, comforting, and physical preparation. These maternal behaviors have been identified to indicate maternal fetal interaction. The woman's ability to communicate with her baby e.g. familiarity with and awareness of the characteristics of the unborn baby's movements as well as sleep and wake cycles, is of importance for the maternal-fetal attachment. Cranley created the theoretical construct of MFA based on the first antenatal attachment scale, the Maternal-Fetal Attachment Scale (MFAS) (86).

## Prenatal attachment

A pregnant woman's relationship with her baby and the status of prenatal attachment can be influenced by a variety of factors (87, 88). Since its origin, prenatal attachment has been described as sensitivity in how a woman learns to recognize and develop love for her unborn baby and her relationship with the baby (82). Women can differ in the degree of attachment to their babies and most women have a complex mix of feelings towards the baby. This may vary at different stages of pregnancy and fluctuate at times in accordance with bodily experiences and external conditions. A woman with positive prenatal attachment invests herself in the baby. Some women have passive feelings or are preoccupied with negative thoughts and fantasies, a sense of internal emptiness and sensations that can take the form of worries about the normality or viability of the baby (89). Muller (1990) defined prenatal attachment as "the unique, affectionate relationship that develops between a woman and her fetus" and developed the Prenatal Attachment Inventory (PAI). The PAI is an instrument that measures prenatal attachment and the instrument was designed to measure affectionate attachment. Originally the instrument consisted of 21 items (90), but was later further developed and revised (the PAI-R) with an three-factor structure in 2014 by Pallant et al. The terms "Anticipation" (fantasy and imagination regarding the baby), "Differentiation" (a mother's sense of differentiation from the unborn baby), and "Interaction" (a mother's sense of interaction with the unborn baby) refer to the three subscales. Six of the items in the 18-item scale are clearly connected to thoughts, feelings, and situations women may experience which are connected to fetal movements during pregnancy (91).

## Self-assessment methods

Before the mid-1970s, maternal perception of fetal movements was the most common antepartum surveillance tool used for the assessment of fetal wellbeing during a wakeful period of the fetus. The fact that qualitative monitoring

of fetal movements is considered as feasible is illustrated by the fact that almost all women can, and without difficulty, feel fetal movements (92). However, since there is uncertainty regarding the definition and management of self-reported assessments, this leads to a variation in clinical practices (93). Additional national guidelines and recommendations also vary (94, 95). After approximately 32 weeks of gestation, different types of fetal movements can be distinguished (12, 58). As with the quantification of fetal movement, the qualitative assessment is also subjective and difficult to evaluate due to the variety of different individual fetus movement patterns which are characterized by a wide variability in speed, amplitude, force, and intensity (14).

### Counting fetal movements

Two methods for the monitoring of fetal movements in order to measure fetal wellbeing were introduced in the 1970s. The first study was presented by Sadowsky and Yaffe in 1973. It found that recording and assessing fetal movement by counting fetal movements daily helped prevent adverse health events for the fetus (96). Subsequently, Pearson & Weaver's (1976) method *Count-to-ten* was regarded as more user-friendly, since it takes less time within normal pregnancies (34). Both methods were considered to be economical, easy, self-assessment methods. However, a weakness of these techniques was that the ability of women to accurately perceive fetal movements varies widely (97). A variety of subsequent studies were modified from the initial methods with different "alarm signals" that were designed to signify insufficient fetal movements. Heazell and Frøen (2008) considered these modified methods to be of questionable value that could even be potentially harmful, as they were never developed to be used as screening tools (57).

### Mindfetalness

Rådestad (2012) suggested a concept for monitoring fetal movements in a structured manner, and named the self-assessment method *mindfetalness*. The method is built on women developing an awareness of the fitness of their baby and taking notes of the quality of the movements perceived. Women in late pregnancy may devote 15 minutes daily, when the baby is awake, to focus on the characteristics, intensity, duration, and frequency of fetal movements without counting them (98)

### Antenatal care in a Swedish context

The objective of antenatal care is to deliver effective appropriate screening as well as preventive or treatment interventions (99). A document to support the daily work of professionals in maternity care, regardless of the organization

of care, has been produced by experts from the Swedish association of midwives and the Swedish society of obstetrics and gynecology (100). Swedish registered midwives work in the area of sexual and reproductive health and perinatal care and the midwives' medical responsibility is regulated under separate agreements. According to such an agreement, physicians and midwives have a mutual mission to promote health care for women and their children (100). Each health care center that offers an antenatal clinic has a general practitioner whose responsibility includes the general medical health of pregnant women. A senior physician who is a specialist in obstetrics and gynecology is responsible for the overall antenatal care within a local county or district. The duties of the specialist include overseeing policies pertaining to maternity health, in collaboration with a coordinating midwife and together with the midwives working at the antenatal clinics. Midwives have an exclusive responsibility for the health care of pregnant women as well as the on-going possibility to consult a physician. There is an obligation to give pregnant women the opportunity to contact the midwife at the antenatal clinic on short notice in the event of any worrying symptoms or other problems. The midwife makes the first assessment and, if it is deemed necessary, refers the pregnant woman to other health care professionals (100).

### The antenatal standard visiting schedule

Every year, approximately 110 000 babies are born in Sweden (101) and all pregnant women are offered antenatal care free of charge – all the financial expenses are paid through general taxes. Almost all pregnant women attend. The purpose of the national proposal for the antenatal standard visiting schedule is to prevent serious consequences for mother and baby through the identification of risk factors that may lead to complications. Visit frequency and a woman's actual schedule are based on medical opinion and designed to minimize risk to the mother and baby. The recommended number of visits is six to eight during an uncomplicated pregnancy (100). Factors that could influence the number and frequency of visits include the woman's medical and psychosocial risk factors, lifestyle issues, as well as any other needs specific to an individual.

On the basis of a lack of evidence referring to the NICE guidance from the United Kingdom (102), screening of fetal movements does not occur as part of a routine checkup within antenatal care. Still, due to regional guidelines it is common for midwives to write notes that fetal movements have been noticed by the women. However, this is not possible to explore without an in-depth review of the midwives' written health records due to the fact that there is no specific area in which to record fetal movements on the standard form

that is used by the Swedish National Pregnancy Register. Women who experience a decrease in perceived fetal movements are urged to contact a specialized maternity care unit (100).

A decrease in perceived fetal movements is a common reason for unplanned obstetric service consultations. A bothersome situation occurs when women in some way perceive a reduction in fetal movements in late pregnancy since there is neither a widely accepted definition of normal fetal movements nor of “alarm limits” and pregnant women are given a wide range of non-evidence-based advice (93). A maternally sensed reduction in the number of fetal movements falls within a wide range from four to sixteen percent reported as being the reason for unplanned consultations with obstetric services in late pregnancy (22, 62, 103). Still, Frøen (2004) reported that 50 percent of all women affected by stillbirth waited more than 24 hours before contacting healthcare providers and a third waited more than 48 hours without feeling any fetal movements (56). Similar results were reported by Neldam in 1978. The women reported that they had felt fewer fetal movements, and some no fetal movements, for two to five days before they contacted the unit. They explained that they did not contact healthcare providers immediately because they wanted to “wait and see”, or because they were too busy (104). Normalizing appears to be a containing mindset, many women do not want to be thought of as being unnecessarily worried despite having had a premonition that something was wrong with their baby (67, 74, 105).

## Rationale

There is a link between a woman’s connection to her unborn baby, experience of decreased fetal movements, and negative pregnancy outcome. There is no consensus regarding what should be considered as normal fetal movements, how fetal movements should be measured both quantitatively and qualitatively, and at which stage women should contact an obstetric service due to experiencing abnormal patterns of fetal movement. Different forms of self-assessment need to be developed. Self-assessment methods should be based on an increase in knowledge regarding both the intensity and frequency of fetal movements in late pregnancy. Such a development could provide support to women and health care professionals in the event that the fetal movements begin to differ from the usual pattern. Women’s perceptions of fetal movements in late pregnancy, fetal movement categorization, self-assessment, and prenatal attachment is still an unexplored arena, both from an epidemiological and medical point of view as well as the women’s own experience. Normal fetal movements, their clinical value, and possible practical applications are not yet established.

# AIMS

The overall aim of this thesis was to explore how pregnant women experience fetal movements in late pregnancy. The specific aims were:

- I. To study women's experiences during the time prior to receiving news that their unborn baby had died in utero.
- II. To investigate if women's descriptions of fetal movements could be sorted with regard to intensity and type of movements, using a matrix under development to be a tool for evaluating fetal movements in clinical praxis.
- III. To investigate the association between the magnitude of fetal movements and level of prenatal attachment within a 24-hour period in the third trimester.
- IV. To study women's experiences using two different self-assessment methods for monitoring fetal movements and to determine if the women had a preference for one or the other method.



# MATERIALS AND METHODS

## Study design

Three methods for collecting data were used in this thesis. Data from interviews were used in study I, data from questionnaires were used in studies II and III, and data from observations were used in study IV. An overview of the studies is presented in Table 1.

Table 1. *An overview of the studies within the thesis*

<b>Title</b>	<b>Design</b>	<b>Data collection method</b>	<b>Partici- pants</b>	<b>Data analysis</b>
<b>I.</b> Losing contact with one's unborn baby – Mothers ex- periences prior to re- ceiving news that their baby has died in utero	Descriptive qualitative study	Individual inter- views	26 mothers whose babies died prior to birth in late preg- nancy	Content analysis with inductive approach
<b>II.</b> Develop- ment of a tool to evaluate fetal move- ments in full-term pregnancy	Population-based survey	A study-specific postal question- naire	393 women with a full-term, uncompli- cated pregnancy	Content analysis with deductive approach, Chi-square test
<b>III.</b> Prenatal attachment and its association with fetal movement during pregnancy	Population-based survey	A study-specific postal questionnaire	456 women with a full-term, uncompli- cated pregnancy	Descriptive statistics, independent- samples, t-test, one-way between group ANOVA, two-way between groups ANOVA
<b>IV.</b> Women's experiences of two dif- ferent self- assessment methods for monitoring fetal move- ments in full-term pregnancy	Crossover trial	80 observations with two differ- ent self-assess- ment methods, questionnaire	40 women during full-term, uncompli- cated pregnancy	Descriptive statistics, Fisher's exact test, thematic analysis

# Study I

## Study design

A descriptive qualitative interview study.

## Sample

Recruiting initially took place at a hospital in central Sweden in 2006. With the help of a staff member who served as a contact at the hospital, an information letter and an application form were sent to women who had given birth to a stillborn baby at that hospital within the previous year. In order to reach all possible participants and to come in contact with women from different parts of Sweden, contact was made with The Swedish National Infant Fund, a national association for parents who have lost babies through death (106). Information about the study was posted on the Swedish National Infant Fund website in 2007 with an invitation to participate in the study regardless of how much time had passed since the stillbirth. After five weeks, the invitation was removed since a sufficient number of interested women had made contact. At the same time, three participants were recruited at the hospital while 23 women were recruited from those who had responded to the information on the website. The inclusion criterion was that the woman had experienced stillbirth after 28 full weeks of pregnancy. The exclusion criteria were that the interviewer had been involved in providing care for the participating woman in connection with the birth of her stillborn baby or was acquainted with the woman in any other way.

## Data collection

Heads of units and the director of the department of woman's health i.e. obstetric services at the county hospital were given written and oral information about the study. The women who had agreed to take part were contacted in order to obtain additional verbal information and to set the time and place for the interview on the basis of the woman's own wishes. In most cases ( $n=22$ ) the women chose to meet in their homes. The remaining four women, in part for practical reasons, chose to have their interviews carried out at a location other than their homes, and this wish was met by meeting three women in a café or office, and another at the home of another participant.

Each interview began with a general conversation on the overall subject in order to establish good contact. By initially establishing confidence in the interviewer it was possible to create a relaxed atmosphere prior to carrying out the actual interview. The length of the initial conversation varied. The introductory conversation for the women who were interviewed in their homes

took between 15 and 60 minutes. All the women who were interviewed in their homes showed pictures of their dead baby and other mementos as well as gifts that had been given to the women and their families in connection with the stillbirths. Some women even invited the interviewer to share a meal, or walk around the neighbourhood and visit the baby's grave. The interviewer was introduced to the other family members, friends close to the family, and pets.

Before starting, the interviewer waited until each woman had found a comfortable position and encouraged her to give a simple signal if she wanted to take a break or even end the interview for emotional or other reasons. When the woman was ready to start the interview, a digital recorder was placed between the woman and the interviewer. A question guide based on clinical experience and on studies of the literature (107) had been designed to contain questions ranging from open to semi-structured in character. The guide consisted of five main questions with five to 15 follow-up questions. Three trial interviews were carried out but are not included in those used and are not part of the results. The question guide and the interview were tested during the trial interviews but no changes were seen to be needed. Each woman was invited to talk about her experiences before she was informed that her baby had died. The initial question was: *"Can you please describe what it was like when you learned that your baby was no longer living?"* and the first follow-up question was: *"Did you have any suspicion that your baby was no longer living?"*. The interviews were carried out as conversations where each woman was encouraged to talk freely about her experiences prior to being told that her unborn baby had died. The question guide served to provide a framework and structure for the conversation.

Each woman's experiences from the point in time prior to receiving news that her baby had died in utero until the point when a year had passed since the stillbirth were discussed. Not all the reported experiences are included in this thesis but they have been reported in other studies (108-110). If a woman seemed to be in need of a pause, the interviewer suggested taking a break to make it possible for the woman to recover herself. Usually the woman did not see any need for this so the interview was able to continue as the woman wished, but sometimes 5 to 10 minute breaks were taken. If needed, the interview was stopped for a while in order to restore a sense of order in the interview situation. The presence of family members, visitors, pets, and other external environmental factors such as noise or room conditions could to a greater or lesser degree risk disturbing the woman's concentration or adversely affect the quality of the recording. After any pause the interviewer restarted the interview by summarizing what the woman had described just before the pause. In the event that the woman began to talk about other related factors and events, the interviewer could ask her to return first to the subject at hand by posing questions such as: *"You said that you felt all alone when*

*you no longer could make contact with your baby, what do you mean by that?"* or if the woman did not offer a temporal perspective the interviewer could ask the woman, for example: *"If we go back to the time just before you got confirmation that your baby was no longer living, can you describe what you were thinking before you called the delivery department?"*. The interview was ended with the question: *"What advice do you have for the staff who meet women in similar situations?"* When the interviewer understood that the woman had said all that she was prepared to say, the interview was ended and the recorder was turned off. Following the interview, a further conversation took place during which it was possible for the interviewer to make sure that the woman felt satisfied. The recorded interviews were transcribed completely and every interview was given a code number. After the audio files had been transferred to separate USB memory sticks, the audio files were deleted from the digital recording device.

## Data analysis

The material was subjected to qualitative content analysis following the procedure outlined by Lundman and Graneheim (111). Each of the printed interviews constituted analytical units. The process of analysis began by printing all of the texts and then having each unit read completely by all members of the research team. The text was then divided into major structural and content units by identifying similarities and differences, and these units were underlined and highlighted. Content units were then condensed and made more abstract by removing text for certain kinds of sounds such as clearing one's throat or coughing, but not removing sounds such as sighs, sniffles, or crying. Some repeated phrases and words such as "right eh" were removed when they were not used in any specific context but simply to fill out the sentence. The same procedure was followed with other sentence units that could not be placed in relation to the study, for example a sibling's school situation or a complaint filed against a health care provider. Personal names or place names were replaced with NN and XX respectively to protect confidentiality.

Following this, the material was coded by formulating a very short description or by identifying one or more words in the unit that could be used as the code. All codes with the same content were studied so that subcategories could be created. Using these subcategories, it was possible to create categories. Finally, an all-embracing theme was formulated on the basis of interpreting the categories and subcategories. During this entire inductive process the content units were re-read and discussed and then condensed and made more abstract in several iterations by the research team. As a final step, all of the content units were subjected to a final review in order to produce a satisfactory set of codes and categories.

## Study II

### Study design

A population-based survey.

### Sample

In order to study the women's descriptions of fetal movements during late pregnancy, data was collected in one county in central Sweden between March 2011 and October 2011. The antenatal care in the county at that time was conducted by approximately 70 midwives at 23 clinics where the number of pregnant women registered annually ranged from 26 to 629 at each clinic. Approximately 3000 pregnant women registered at one of the antenatal clinics in the county during the year and 2809 births took place at the county's only hospital equipped with a delivery ward. Of the 1977 women giving birth at the county hospital during the data collection period, 1962 of them were registered at a county antenatal clinic. The remaining 15 women had been registered at clinics outside the county.

The inclusion criteria for participation in Study II were: women with an uncomplicated, singleton, and late pregnancy in gestation weeks 37+0 - 42+0, who were enrolled at an antenatal clinic in the county council, and who were considered to follow the standard visiting schedule for antenatal care as specified in the Swedish national guidelines (100). In addition, the woman had to be able to understand, speak, and write Swedish. Exclusion criteria were: pregnancy complications, rupture of the membranes, or contractions due to labour while answering the questionnaire.

### Data collection

The senior physician responsible for the overall antenatal care and the midwife with coordinating responsibility for antenatal clinics in the county received written information about the study. In addition, all of the currently active midwives working in the antenatal clinics and heads of the midwives were given the same printed information. Oral information was given at two different joint meetings in two different parts of the county with the midwives, the coordinator and the senior physician. In addition, written information had been sent to those in charge of health centres connected with an antenatal unit. Heads of the units and the director of the department of woman's health i.e. obstetric services, at the county hospital were informed both orally and in writing. Carry bags with information for prospective participants were personally distributed to every individual midwife at each antenatal unit. While distributing this material at each location, the midwives were further informed either

individually or in groups. A personal letter containing additional information and instructions as well as information concerning making contact with the research team was given to every individual midwife.

Data collection began after every antenatal unit had been visited and after all of the midwives had been seen and given oral and written information. If a midwife needed more information, material was handed over in person or was sent to the unit. All of the material that was handed over was registered in a matrix in order to compare this with how many women had answered the questionnaire. All pregnant women at a planned visit during gestational week 35 or later and who met the inclusion criteria were told about the study in a brief conversation with the midwife. Following that conversation, the women who would be taking part in the study were given an envelope containing information about the study, a reply form, a questionnaire, and a return envelope. The midwife was instructed to note which women had received oral information and printed information and also which women had been excluded from participation and the reasons for exclusion, for example if the woman did not meet the inclusion criteria, and, if she did not, if the woman did not have a sufficient command of Swedish or if she did not want to receive the information material. The midwife was encouraged to record this information in the printed matrix that was to be sent to the research team on request directly after the end of the data collection period. A representative of the research team made repeated spontaneous visits to the antenatal centres or made telephone contact in order to find out if the midwives had questions about the study or data collection, or if they needed additional material. The midwives always had the possibility of reaching the research team via telephone or e-mail if they had questions. A total of 554 women received information from the midwives about the study.

Approximately 11 per cent of the eligible pregnant women were not reached. This may partly be due to data collection not beginning simultaneously and because not all of the centres had been reached since they were visited successively over a period of two months. If a woman had agreed to participate, she sent a completed questionnaire and reply form in two separate envelopes to the research team. The 457 women who agreed to participate in the study were asked to complete the questionnaire at the time when they had reached a fully developed pregnancy, that is, when they had completed gestational week 37 (37+0) but before delivery had begun. The questionnaire was designed specifically for this study and was based on the prior experience of the research team as well as previous studies (37, 112) and literature (113). The open question (question no. 6) in the questionnaire is the foundation of the study: "Describe how you experienced the way your baby is moving during the present week of your pregnancy (describe both how much your baby is moving and what kinds of movements can be observed). Please feel free to write on the reverse

side of this questionnaire if you need more space". The women were free to write as much as they wanted to and without any restrictions on the extent of what they wrote. The questionnaire was tested by two personally recruited women with full-term uncomplicated pregnancies. A few small adjustments were made after this. When a sufficient number of questionnaires had been received by the research team, data collection was ended at all the antenatal units. The midwives were informed of this and were asked to record the number of remaining envelopes containing information and they were then instructed to destroy this material. At the same time, the midwives were asked to send the research team all the matrixes with information about the letters that had been distributed and about the number of excluded candidates.

## Data analysis

The written replies were analysed by using content analysis with a deductive approach (111). In order to sort the different types of fetal movements described by the women, an existing matrix was used. This matrix was developed based on interviews with 40 women with full-term uncomplicated pregnancies. The matrix consisted of seven predefined categories of movements sorted into two domains; "Powerful movements" including; "strong and powerful", "large", "slow", "stretching", and "side to side". "Non-powerful" movements including; "light" and "startled" movements (60).

All written material was read through thoroughly. All statements describing movements were marked, coded according to type of movement, and then sorted into appropriate categories in the matrix. The analytical framework initially contained the categories from the original matrix (60). New codes were successively added to the framework during the work on analysis since new expressions were identified and these were assigned codes as well. Between eight and 23 new codes per category were identified on the basis of the women's answers. The categories were developed further and then revised and divided into the two existing domains.

During this deductive process a limited modification of the analytical instrument was made through the identification of new codes that were then assigned to specific categories on the basis of the description of fetal movements as experienced by the women. Every category was assigned its own colour and each separate code in every reply was marked with a colour depending on the category to which the code belonged. When these markings were recorded in the analytical framework the colour was translated using the identification code for that colour. Every individual questionnaire's code for identification was noted one (1) time per code in the framework in the seven different categories in the matrix. This procedure was used even if the code for the ex-



pressed movement in the analytical instrument occurred several times in a single answer. As a result the same code for one or more different movements that were included in the category “strength and pressure” was encountered several times in the text, but only one code per category was counted. This was performed to ensure that the number of women who reported movement belonging to a particular category was registered. The total sum of all codes in each answer was registered and finally all of the codes in each separate category were counted. During the entire deductive process, the text was repeatedly re-read and the coding was discussed several times by the research team. Finally, all of the texts were checked one last time to ensure that the coding and categorisation were correct.

Data handling was performed using the IBM statistical software package for the Social Sciences (SPSS) for Windows, version 20.0. Armonk, NY: IBM Corp.

## Study III

### Study design

A population-based survey.

### Sample

The study was based on the same data collected for Study II and the same procedures for information and selection apply in Study III that were followed in Study II. The aim of Study III was to investigate the association between the magnitude of fetal movements and level of prenatal attachment within a 24-hour period among women in late pregnancy.

The inclusion criteria for participation in Study III were: women with an uncomplicated, singleton, and late pregnancy (gestation weeks 34+0-42+0), enrolled at an antenatal clinic in the county council, who were considered to follow the standard visiting schedule for antenatal care as specified in the Swedish national guidelines (100). In addition, the woman had to be able to understand, speak, and write Swedish. Exclusion criteria were: pregnancy complications, rupture of the membranes, or contractions due to labour while answering the questionnaire.

## Data collection

Unlike study II, this study also included women who answered the questionnaire before entering gestational week 37+0.

The revised-PAI (PAI-R) scale was used to assess prenatal attachment (91). The three subscales; *Anticipation*, *Differentiation*, and *Interaction* consist of eighteen Likert-type items. A four-point response scale was used as a guide for the identification of a woman's prenatal attachment (90).

Two questions (question no. 5 and question no. 9) in the questionnaire are the basis for study III. The closed question (question no 5.) was: "Check the answers that best indicate how you experienced movements from your baby during the current week of your pregnancy". Four alternatives were offered: "My baby is moving a lot in the morning", "My baby is moving a lot during the daytime", "My baby is moving a lot during the evening", and "My baby is moving a lot during the night". All four questions were to be answered using these three reply alternatives for each: "Yes", "No", or "Do not know".

Question no. 9 in the questionnaire consisted of PAI, an instrument for evaluating the woman's prenatal attachment (90) and the first question was: "The following sentences describe thoughts, feelings, and situations that a mother-to-be can feel or experience during pregnancy. Read each statement and put an x in the box next to the statement that best describes how you have felt during the preceding month".

In order to be able to measure and compare variations in fetal movements during a 24-hour period with the results from the statements in PAI-R, both with our own data and with measurements in other studies, a new variable was created.

From the variable "My baby moves a lot", the variable "firm movements" was constructed. The interpretation was developed in the context provided by the women's descriptions of the intensity of the movements while the follow-up question concerning frequency is not used in the questionnaire. In the answers to the open question in the questionnaire (question no. 6) "describe how your experience of how the baby is usually moving during your current pregnancy week" as presented in study II (17), 98 percent of the women experienced fetal movements that they described as firm. The three answer alternatives from question 5 were coded and points were assigned as follows: "on one or several occasions" (0-1 points), "regularly" (2 points), and "often" (3 points). Three movement groups were created: "day", "evening", and "night".

## Data analysis

Descriptive statistics were used to present background data. Independent-samples t-tests and a one-way between-group ANOVA were used to compare background characteristics and the magnitude of fetal movements with the PAI-R subscales. Finally, to explore the impact of parity and the magnitude of fetal movements on the PAI-R subscales a two-way between groups ANOVA was performed. Data handling was performed using the IBM statistical software package for the Social Sciences (SPSS) for Windows, version 20.0. Armonk, NY: IBM Corp.

## Study IV

### Study design

A cross-over trial.

### Sample

The midwife centres located in two communities in a county in central Sweden were used in the data collection for seven months in 2013-2014. Antenatal care in these regions was at this time carried out by approximately 19 midwives at six separate centres. The inclusion criteria for participation in the study were: women with an uncomplicated, singleton, and full-term pregnancy (gestational weeks 37+0 - 42+0), who were enrolled at an antenatal clinic in one of the two communities in the county council, and who were considered to follow the standard visiting schedule for antenatal care as specified in the Swedish national guidelines (100). In addition, the woman had to be able to understand, speak, and write Swedish. Exclusion criteria were: pregnancy complications, rupture of the membranes, or contractions due to labour while performing the observations or answering the questionnaire.

### Data collection

The senior physician responsible for the overall antenatal care and the midwife with coordinating responsibility for antenatal clinics in the county received written information about the study. Furthermore, all of the currently active midwives working in the antenatal clinics and heads of the midwives were given the same written information. Oral information was given at one joint meeting with all the midwives in the county, their coordinator, and the senior physician. In addition, written information had been sent to all those in charge of health centres connected to the six antenatal clinics and head of the midwives. Furthermore, heads of units and the director of the department of

woman's health i.e. obstetric services at the county hospital were informed both orally and in writing.

Carry bags with written information for prospective participants were personally distributed to every individual midwife at each antenatal unit. While distributing the material at each location the midwives were further informed either individually or as a group. A personal letter containing additional information and instructions as well as information concerning making contact with the research team was given to every midwife. All of the material that was handed over was registered in a matrix by the research team, in order to be able to compare this with how many women had participated in the study.

Providing confirmation of informed consent was carried out in two steps. Women at a scheduled appointment with a midwife to have an examination during gestational week 34 or later and who met the inclusion criteria were given a brief verbal presentation about the study by the midwife. They were then asked about consent for their telephone numbers to be given to the research team so further information could be given via the telephone. Furthermore, the midwife gave each woman an envelope containing written information about the study, a reply form, and a reply envelope that the woman would take home with her. Women who agreed to participate in the study after receiving the telephone call were given an appointment for the first observation and asked to send the reply form to the research team. In order to report the number of available women, the midwives made a note in a matrix when women had received information, and when women did not receive information they made an explanatory note. The women then chose where they wanted carry out the observation; in their own home, in a quiet location at the county hospital or the university, or in a room at the antenatal unit.

The first 20 participants began the first session by using the self-assessment method *count-to-ten* and then at the second and final session using the self-assessment method *mindfetalness*. Participants 21 to 40 carried out the self-assessment methods in the reverse order, first using the self-assessment method *mindfetalness* and then the self-assessment method *count-to-ten*.

Before the participants began their observational sessions, they were given brief additional oral and written information about the self-assessment methods that had previously been sent out as enclosures in the information letter. The participants were able to raise questions and then prepare themselves for their observation sessions.

The participants were asked to lie down on their left side and feel if the baby was awake. The same observer carried out all 80 observations sitting about

four meters from the women but able to observe them. When a woman signalled that she was ready to begin the session, the observer started a digital recorder. When the participant began to talk, a stop watch was started. When the self-assessment method *count-to-ten* was used the woman counted and described the movements simultaneously. The observer sat quietly, observed the woman, and made short observation notes every successive minute. When the woman had experienced ten fetal movements, the session was ended, the watch was stopped, and the participant was informed that the observation had ended. The time was noted and the digital recorder was turned off. When the self-assessment method *mindfetalness* was used, the same basic procedure was followed with the only difference being that the participants were asked to describe in detail how they experienced the nature of the fetal movements without counting the movements. The watch was stopped after 15 minutes and the women were informed that the observation period was ended.

After the first observation session using either of the two self-assessment methods, the participants received a questionnaire to be completed in private before leaving. After the second and final session, each woman received a second questionnaire to again be completed in private before leaving. These questionnaires were designed specifically for this study and were based on clinical experience, previous studies (17, 98), and literature (113). Both questionnaires contained questions about age, length of the pregnancy, location of the placenta in utero, and which self-assessment method had been used at the time. The participant was asked to indicate what types of movements she had experienced during the observation session using a matrix presenting ten categories of movement including hiccups as a guide. The participant was furthermore asked to describe in her own words how she had experienced the fetal movements during the session. Next was a question with seven statements: 1) I felt calm, 2) I felt worried, 3) I felt relaxed, 4) I felt stressed out, 5) I felt mentally present, 6) I felt focused, 7) I felt tense. Three reply alternatives were provided for each of these statements: 1) I completely agree, 2) I partly agree, or 3) I disagree.

In addition to the same questions found in the first questionnaire, the final questionnaire also included the instrument for evaluating prenatal attachment PAI-R (91). The question preceding the 18 items in PAI-R was: "The following sentences describe thoughts, feelings, and situations that a mother-to-be may feel and experience during pregnancy. Please read each sentence and place a cross in the box next to the statement that best describes how you have felt during the preceding month". Furthermore, there was a question asking the participant to indicate which of the two self-assessment methods she preferred with the alternatives being *count-to-ten* or *mindfetalness*, "No preference", "Both methods are acceptable to me", and "Neither of the methods is suitable for me". If the last answer was checked, the woman was asked to

please explain why she felt that neither method was suitable for her. The completed questionnaire was handed over to the observer in a sealed envelope.

When the 40 women had completed both observation sessions and had submitted the completed questionnaires, data collection was ended since it was concluded that a sufficient number of women had left the information needed. The midwives at the antenatal clinics were informed and were instructed to destroy or send back any remaining information material to the research team.

## Data analysis

Descriptive statistics were applied in order to present the material and Fischer's exact test was used to analyse Relative risk with a 95% confidence interval. The participants' feelings in PAI-R were measured using the Likert scale that was dichotomised and the "Cut off" was set between "completely agree" and "partly agree", or "disagree". The notes recorded in the 80 observation documents were subjected to thematic text analysis and coding according to the procedure presence-absence (114). Data handling was performed using the IBM statistical software package for the Social Sciences (SPSS) for Windows, version 20.0. Armonk, NY: IBM Corp.

## Ethical considerations

The project was subjected to ethical evaluation and all four studies were approved by the ethics review board. The research ethics committee at Dalarna University approved study I (Reg. No. 2005-05-07), and the Regional ethics review committee in Uppsala approved study II and study III (Reg. No 2010/338), as well as study IV (Reg. No 2013/092).

In addition, the research team has continued to discuss ethical considerations during the entire period during which the research project was being carried out. At the beginning, the participants were given written and oral information about the studies by the research team (study I) or from the midwife when the participants visited their midwives (studies II, III, and IV), and additional oral information by the interviewer (study I) and observer (study IV). All the women who expressed interest in participating in studies I, II, and III, as well as study IV, received an information letter with a form on which the participant could indicate her informed consent to be part of the study, as well as an addressed pre-paid reply envelope. After informed consent had been received from the participants, the participants were informed in person prior to study I and study IV that their participation was completely voluntary and they were

free to withdraw at any time and take back their informed consent without any explanation.

All of the material was processed anonymously, coded, and placed in a secure archive at Dalarna University. Personal information about the participants was processed following confidential procedures. No data can be traced to a specific individual and the results are presented anonymously. The questionnaires (study II and study III as well as study IV) were completed anonymously and cannot be traced to any individual.

The women who indicated their interest but who did not meet the inclusion criteria for participation in study I were contacted personally and orally informed. Extra time was made available both before and after the interviews (study I) and before and after the observations in study IV, in the event that the woman wanted to pose questions, leave comments, or talk about anything else. Questions concerning current or completed monitoring of the pregnancy etc. were to be answered by posing them to health-care providers. All participants as well as midwives (studies II, III, and IV) were offered continuous contact possibilities via telephone, text messaging, or email in connection with data collection. Participants in study I were told about a contact person at the Swedish National Infant Fund. In addition, all participants in any of the four different studies were told that they could contact the persons responsible for each project. After participation in study IV the participants were encouraged to submit anonymous comments on their own experiences during the two observation sessions with self-assessment of fetal movements. Most women reported that their baby was most active before they go to sleep but bedside observations were not considered to be appropriate in this study.

# RESULTS

## Study I

Twenty-six women were interviewed. All but one were born in Sweden and all participants spoke Swedish. The women ranged in age from 22 to 39 years at the time of the stillbirth and one participant was single at the time of birth and at the time of the interview. Another woman had separated from the baby's father after the stillbirth and was single at the time of the interview. All the other women were either married or cohabitating with the baby's father at the time of the stillbirth and at the time of the interview.

For 19 women, the stillborn baby was their first baby, while seven participants had given birth to one or more living babies before the stillbirth. One participant had previously lost a baby before birth and one participant had given birth to twins of which one was born alive while one was stillborn.

The stillbirths had occurred between gestational weeks 30 to 42 at 15 different hospitals in Sweden. Two of the participants had given birth to their dead babies at a hospital located a long distance from their home due to visiting another county when receiving news that their baby had died. One participant had given birth to the dead baby via Caesarean section while the other women had experienced vaginal deliveries. In twelve cases, the women were told that it had not been possible to determine the cause of the baby's death; the other women had been informed of the cause of death.

The interviews were carried out in 11 different counties, and in 21 different towns and rural areas in Sweden. Twenty-two of the interviews were carried out in the participants' homes. The period between the stillbirth and the interview varied; for eight participants less than a year had passed between the stillbirth and the time of the interview.

Twenty-two of the 26 women had a premonition that something had happened to their unborn baby prior to receiving the information that the baby had died in utero. The women had experienced a loss of contact with the baby and suspected that something was wrong. The insight gradually developed that the baby might not be well. In most cases it took at least one and sometimes several days before the women understood that the situation was serious and that



they needed information on how the baby was doing. The overarching theme “There is something wrong” was formulated and describes the path followed by the women to recognition that something had happened to their baby. The women’s premonition may be described as a process leading from a vague to growing feeling that something was wrong. The women described how they themselves or the people around them normalised their worry. For just a few women, the feeling was quickly transformed into the insight that their baby’s life was threatened, but for most of them it was inconceivable that the baby would die before birth. In the analysis, six categories were identified that describe the women’s experiences before they received information that the baby was dead: “Not feeling in touch with the baby”, “Worry”, “Feeling something is wrong”, “Not understanding the unbelievable”, “Wanting information”, and “Being certain that their baby had died”. The results are presented by using a model: “The staircase to insight”, illustrated by a descending staircase with six steps that lead the mother from a vague feeling that something is wrong to the definite confirmation that the baby is no longer living. At differing paces, alternating between going up and down, the women spent varying lengths of time on each step toward insight.

### Not feeling in touch with their baby

The women’s premonition that something was wrong was often based on their initial perception due to a decrease in or absence of fetal movements. The women felt that they had lost contact with the baby and described how they knew when, how much, and in what way their baby usually moved. The women explained that they had become familiar with their baby’s habits due to the baby’s pattern of movements, level of activity, periods of rest, sleep, and awakesness. The lack of movements and the stillness when the women did not expect it was interpreted as a change in the baby’s behaviour. The women actively tried to make contact with the baby by trying to communicate and expecting a response in the form of movements from the baby after nudging their belly, changing their body position, or drinking cold water.

### Worry

When there was no response from the baby and the women did not succeed in restoring contact with the baby, they became worried. The women described a diffuse, slowly developing feeling of unease that grew in intensity. Several women tried to dismiss their worry as being exaggerated. Some women had difficulty in verbalising their concern, and held their thoughts and worry to themselves, sometimes to spare their partner or others related to the women in order to avoid making others worry. Other women felt a need to talk about their worry.

## Not understanding the unbelievable

In spite of the growing feeling that something was wrong, the women said that they did not understand that something very serious might have happened to the baby. That a baby can die in utero was something they had never thought could happen, in any case at least not to them. If the women observed some kind of deviation, most of them believed this deviation was part of the normal condition; they did wonder about the baby's wellbeing, but did not understand that the baby had died. The women assumed that what was happening was normal and even those around them tried to treat this as normal. The women tried to persuade themselves that what they felt was, in spite of everything, just normal even as they experienced a continuously growing feeling that something was wrong. As this growing insight became tangible they tried in different ways to protect themselves from the insight that the baby was dead. They got information and advice from those around them and even from their caregivers that said that what they were experiencing was normal. The women did not want to be seen as unnecessarily worried, so they adopted a wait-and-see approach and wondered what they should do.

## Wanting information

The growing feeling that something was wrong increased the women's needs to obtain professional information regarding the wellbeing of the baby from a midwife or physician. Most of the women felt uncertain and did not know what they should think but just hoped that maybe the baby was sleeping. Some women expected to receive more information than "your baby is alive" and they wanted something definite so they could return to their ordinary everyday life. All of them contacted obstetric services, such as an antenatal clinic or a maternity unit at a hospital, because they expected to receive something definite. In two cases the general condition of the women required emergency care.

## Being certain that their baby had died

Most of the women in the study did not reach the last step in the staircase since they did not understand that their baby had died. Three women were quite certain that their baby had died. Two of them who were completely convinced that the baby had died developed very serious pregnancy-related complications that called for emergency care for their own survival.

## Feeling something is wrong

The insight that something might be wrong developed from a vague premonition into a stronger and more intense feeling of suspicion that according to the

women was difficult to describe. Knowledge and experience from previous pregnancies could get the women to react in response to the feeling that something was wrong. Most of the women did not experience physical symptoms but felt nevertheless a growing suspicion that something was different, that something was wrong.

## Study II

A total of 393 women (78%) answered the specific open question about their experience of fetal movements. According to the birth register, 28 (7.1%) of the women who took part in the study experienced pregnancy complications that required that they deviate from the standard antenatal visiting schedule.

Of the 393 participants, 257 (65%) were parous and 136 (35%) nulliparous; 57 (15%) were aged 25 years old or younger, 278 (70%) were aged 25 to 35 years, and 58 (15%) were older than 35 years. A total of 173 women (44%) completed the questionnaire during gestational week 37, while 141 women completed the questionnaire during gestational week 38. Sixty-two women (16%) were in gestational week 39, twelve women (3%) were in gestational week 40, 4 women (1%) in gestational week 41, and one woman answered the open question in the questionnaire in gestational week 42.

The length of the written answers varied. Some of the women wrote short and concise answers while others wrote long, descriptive narratives. Most of the women reported movements that corresponded with several different types of movement. All of the movements they described could be sorted into the previously defined categories in the matrix (112) that were used in the analysis process. Examples of the women's descriptions of fetal movements could be used and represented between six and 23 new codes per category on the basis of the women's descriptions.

### Powerful movements

A total of 383 women (96%) described movements that could be assigned to the domain "powerful movements", i.e. one type in the categories of movements: "firm", "slow", "stretching", "large", and "side to side".

"Firm movements" were reported by a total of 315 women (78%). These movements were described by the women as determined, powerful movements that are hard and distinct. The women experienced that the baby is pushing, boxing, striking, nudging, and kicking hard with vigour and substantial pressure.

“Slow movements” were reported by a total of 93 women (24%). These are experienced as more extended movements and experienced as smooth and wavy, sweeping over the abdominal wall as if in “slow motion”.

“Stretching movements” were reported by a total of 91 women (23%). These movements are described as if the baby is spanning out and stretching its body. The baby’s body parts sprawl in different directions and the women describes these movements as if the baby is twisting and drilling downwards into her pelvis.

“Large movements” were reported by a total of 66 women (18%). These movements are described as voluminous movements experienced when someone does somersaults and resembling an earthquake.

“Side to side movements” were reported in a total of 65 women (18%). These comprise movements described as occurring when the baby changes position by twisting, turning, or wobbling its body from one side to the other in utero.

### Non-powerful movements

A total of 10 women (4%) described movements that did not meet the criteria to be sorted as “Powerful movements”. These descriptions could be assigned to the domain “Non-powerful movements”, i.e., one type in the categories of movements “Light” and “Startled”.

“Light movements” were experienced by 53 women (13%). These movements are described as small, rather diffuse, tentative, scratchy movements. The women further described these movements as tickling and as if the baby is picking at or poking the abdomen.

“Startled movements” were experienced by 7 women (2%). These movements are described as quick and lightly shaking movements that sometimes felt like spastic pulsations. The baby lightly shakes but not as a result of hiccups.

## Study III

In total, 456 women answered the study-specific questions in the questionnaire, which is to say 81 per cent of the available women. The mean age of the participants was 30 years. Most women (n=382, 84%) completed the questionnaire in gestational weeks 37-39. The majority (n=299, 66%) were multiparas while 157 (34%) were primiparas. Most women (96%) experienced a lot of movement in the evenings.

Age and parity showed the strongest association with the three sub-scales of PAI-R. Women aged under 25 years reported higher than average values for the sub-scales “Anticipation” and “Interaction”. Primiparas women had higher average values than multiparas women for “Anticipation” and “Differentiation”. No statistically significant difference was found between gestational weeks in relation to the sub-scales of PAI-R.

Eighty-four women (18%) reported few occasions of frequent fetal movements, 253 women (55%) reported an average amount of occasions of frequent fetal movements, and 119 women (26%) reported several occasions of frequent fetal movements during their current week of pregnancy. Women who reported fetal movements on several occasions during a 24-hour period had higher mean scores for the sub-scales “Anticipation”, “Interaction”, and “Differentiation”, and these differences were statistically significant.

A two-way between-group analysis of variance was performed to explore the impact of the magnitude of fetal movements and parity at the levels of the three sub-scales in PAI-R, with age as a covariant. No interaction effect was found in any of the sub-scales in PAI-R.

## Study IV

A total of 40 healthy women in gestational weeks 37 to 39 without any known complications during their pregnancies participated in the study. The participants ranged in age from 21 to 38 years with a mean age of 31.5. Each woman participated in two separate self-assessment sessions of her baby’s movements. The time between the two sessions ranged from one to ten days. The mean value of the interval between the observations was two days. Twenty-six of the women were in gestational week 37, thirteen women were in gestational week 38, and one woman was in gestational week 39 at their first self-

assessment session. When the women participated in the second self-assessment session, 20 women were in gestational week 37, 19 women were in gestational week 38, and one woman was in gestational week 39.

The time required for the women to notice and count 10 movements using the self-assessment method *count-to-ten* varied from one and a half minutes to 21 minutes. The median time was eight minutes and the mean was nine minutes and 52 seconds.

### The women's emotions during self-assessment

In the 80 self-assessment sessions, none of the women indicated "Disagree" with the following statements: "During the assessment I felt: 1) Calm, 2) Relaxed, 3) Mentally present, 4) Focused." When comparing those who "Agreed completely" with those who "Agreed partly" regarding these four states of being, no significant differences were found between the two methods.

When comparing those who indicated "Disagree" with those who indicated "Agree partly" and "Agree completely" regarding the measured states of being: "Calm", "Worried", "Relaxed", "Stressed out", "Mentally present", "Focused", and "Tense", no statistically significant differences were found between the methods.

One woman reported that she completely agreed with the statement "During the assessment I felt worried" when she performed the self-assessment method *count to ten*. The same woman took the longest time (21 minutes) to perceive ten movements. Furthermore, the same woman completely disagreed with the statement "During the observation I felt worried" when she performed the self-assessment method *mindfetalness*.

Another woman reported that she completely agreed with the statement "During the observation I felt stressed out" after she had performed the self-assessment method *mindfetalness*. Yet at the same time she completely agreed with the four statements about feeling calm, relaxed, mentally present, and focused, and completely disagreed with the statements: "I felt worried" and "I felt tense". The same woman partially agreed with the statement "During the evaluation I felt stressed out" when performing the self-assessment method *count to ten*.

### Women's preference of method

Thirty-nine of the 40 women (98%) said that one or both of the self-assessment methods *count-to-ten* and *mindfetalness* were suitable methods for them. Only one woman indicated the neither method was suitable for her. Of the 20

women who preferred one of the methods, 15 (75%) preferred the self-assessment method *mindfetalness* and five (25%) preferred *count-to-ten*.

The woman who found neither method satisfactory gave an explanation for her opinion: “*Unfortunately, I do not think my baby demonstrated its true self. Usually I experience my baby as being much more active*” (Woman no. 34)

## Researchers observations

The observer noted that during 27 of the 80 observation sessions (12 sessions using the self-assessment method *count-to-ten* and 15 sessions with self-assessment method *mindfetalness*), the women changed their body position from one or two times up to four times. The women changed from the initial position – lying on the left side to half sitting up, lying on the right side, or lying on the back. One woman preferred sitting upright during both of her two sessions. During 33 of the sessions, the women remained motionless and during the remaining 47 of the 80 sessions it may be said the women simply made small adjustments. During 25 of the sessions (15 self-assessment *count-to-ten* and 10 *mindfetalness*), the women stroked their bellies while during the other 55 self-assessment method sessions (25 *count-to-ten* and 30 *mindfetalness*) the women gently left their hands at rest, often with one hand on the upper abdomen and the other on the lower. It was also evident that the women moved their fingertips lightly over the belly and during four sessions pressed their fingers lightly against different parts of the belly.

Twenty-five of the women kept their eyes closed during the entire time or during a large part of their self-assessment sessions (12 *count-to-ten* and 13 *mindfetalness*), while the other 55 women had their eyes open and looked around. In 16 of 80 self-assessment sessions (nine *count-to-ten* and seven *mindfetalness*), the observer noticed that the women smiled and during 15 sessions (seven *count-to-ten* and eight *mindfetalness*) the women sometimes laughed.

Fourteen women described how they experienced movements during the self-assessment sessions. Three women described their experience after having performed the self-assessment method *count-to-ten* as a positive experience during which they were in contact with their unborn baby. Eleven women described their experience of using the self-assessment method *mindfetalness* as safe and reassuring and as a moment for communication with their unborn baby.

# DISCUSSION

This thesis is based on four original articles with the overall aim to explore how pregnant women experience fetal movements in late pregnancy.

## Categorization of fetal movements

The majority of women (study II) described the fetal movements as powerful, they perceived the fetal movements as firm, pushing, and pressing movements. Slow, stretching, large, and side-to-side movements were also frequently described. Only 10 out of 393 women (4%) described movements that did not include any of the categories of movements that could be classified as powerful. This description of fetal movements as being powerful appears in other studies as well (115, 116). Being able to experience fetal movements varies among pregnant women but between 59 and 100 percent of women experience movements as powerful according to Rayburn and McKean 1980 (64).

Carmichael et al. (117) studied 28 healthy pregnant women in gestational week 38 to 40. The authors found that the fetal movements presented a pattern of powerful movements that was constant until birth, however, the fetus's breathing movements decreased during the same period. In addition, the authors concluded that the intensity of the fetal movements is an indicator of fetal wellbeing until labor (117). Similar findings reported in a study carried out in New Zealand (2011) indicate that women who experience intensive fetal movements have a lower risk of negative pregnancy outcomes, compared with those who do not experience intensive fetal movements (39). The women who did not experience intensive fetal movements had a seven-times higher risk that the baby would die before birth and powerful fetal movements can be a predictor for a healthy-born baby according to the author's conclusions (39). These results are in line with earlier studies (103).

Findings in a Norwegian prospective cohort study indicate that the frequency of fetal movements is constant during uncomplicated late pregnancy (35). The occurrence of rolling movements increases, however, in late pregnancy, and these fetal movements can be understood to differ from the distinct kicks that occur from earlier in pregnancy (35). A study (1982) based on observations



and conducted by using ultrasound reported that a fetus could make up to 130 intensive movements per hour (21). In order for a fetus to be able to make movements that are experienced as powerful, the neuromuscular functions of the fetus need to be intact. This, in turn, requires an adequate flow of oxygen and nutrients to a healthy central nervous system (51). However, it has not been clarified if the fetus's position in utero is of importance for the fetal movements (39).

In this thesis, no difference was found between the experiences of fetal movements reported by primiparas and multiparas women in late pregnancy (study II). Several studies have previously described that parity does not affect the frequency of fetal movements perceived by women (27, 64, 118). Valentin and Maršál reported, however, that multiparas women to some extent noted more fetal movements and the authors consider this as a probable result of the ability to detect fetal movements based on the women's prior experience of previous pregnancies (48).

Most of the women who had lost their babies (study I) reported that fetal movements had become weaker and less frequent before they were told that their baby was no longer living. In a study by Frøen et al. (2004), it was reported that half of the participating women whose babies had died in utero had experienced gradually decreased fetal movements (103). According to the authors, the woman's subjective interpretation of the fetal movement patterns has been proven to be a superior method for identifying fetuses at risk for illness and intrauterine deaths (61). Furthermore, the authors consider that vigilance and knowledge could contribute to reducing negative pregnancy and intrauterine deaths. If the women receive sufficient information about the importance of observing the individual fetal movement pattern, they may be able to act in a manner as to protect their unborn baby (56). It has been shown that in addition to frequency, the intensity of fetal movements is important as an indication of the state of wellbeing of the fetus (84, 85). The findings from study II could provide guidance for how to describe the intensity of fetal movements.

## Fetal movements and prenatal attachment

Women who perceived frequent fetal movements on several occasions within 24 hours had significantly higher attachment scores (study III).

The results in study III showed that women who reported perceiving a lot of fetal movements on several occasions within a 24-hour period had higher scores on all three subscales of the PAI-R; "Anticipation", "Differentiation", and "Interaction". Primiparas women generally had higher total scores on the

PAI-R than multiparas women. Women who felt a lot of fetal movements several times during a 24-hour period had higher scores for “Anticipation” than women who reported less magnitude of fetal movements during late pregnancy. “Anticipation” refers to the woman’s ability to fantasize about the unborn baby; what the baby looks like and about the baby’s personality. This is a part of the psychological process that a woman is expected to go through by society during the transition in becoming a parent (89). Condon (1997) found that 10-15 percent of all pregnant women have minimal prenatal attachment in late pregnancy, a period when the awareness of fetal movements is considered to be important by the author (83). It can be assumed that frequent fetal movements perceived on several occasions during the day and night enable women to develop a greater sense of attachment since it is a reminder of the baby’s existence. On the other hand, it can be a strong sense of natural prenatal attachment that makes women more sensitive to their baby’s activity.

Furthermore, the women who reported perceiving a lot of fetal movements on several occasions within a 24-hour period in late pregnancy also had higher scores for “Interaction” when compared with women who reported less occasions of fetal movements within a 24-hour period (study III). Siddiqui et al. (1999) emphasized the importance of women sharing emotional feelings with other people since this has a positive effect on prenatal attachment (119).

If the baby is alert and if the movements are visible, the development of prenatal attachment might be facilitated. Women who perceive less occasions of fetal movements within a 24-hour period can be encouraged to turn their focus inwards in order to capture fetal movements when the baby is awake (119). By softly touching, stroking, and gently poking the belly, women can make contact and be more aware of their baby’s habits (120). The women’s actions send supportive messages to the caregiver, that the woman is concerned about and cares for her unborn baby (121).

The women who reported perceiving a lot of fetal movements on several occasions within a 24-hour period also had higher scores for “Differentiation” when compared with women who reported fewer occasions of fetal movements during late pregnancy (study III). “Differentiation” concerns those behavioral concepts related to fetal movements, for example the woman’s awareness of if the baby is sleeping and if the woman can make the baby move. The results from study III are in line with a randomized Norwegian study (122). Women in an intervention performing self-assessment with a systematically counting method of fetal movements reported that they could almost always get the baby to move (122).

Women are often confident that they can predict the unborn baby’s cycle of being asleep and awake, the fetal movements status, their intensity, and the

degree to which the baby responds to different stimuli (123). Pallant et al. (2014) suggest that women with low scores of prenatal attachment can be carefully asked about their emotions for the unborn baby. This is important since the degree of prenatal attachment can be related to the risk of depression during pregnancy (120) and can be associated with poor attachment after the baby is born (119).

Almost all of the women (96%) (study III) felt a lot of fetal movements during the evening, which is in line with previous studies (25). It can be assumed that the women are more observant during the evening than during the day. Age and parity were associated with the number of occasions of fetal movements and prenatal attachment as reported in study III. Furthermore, women who were older than 35 years appeared to have a lower level of prenatal attachment which contradicts results from a meta-analysis (2009) that found that the woman's age as well as parity only had a low-level effect on prenatal attachment (124). Women expecting their first baby may be viewed as having more free time to devote themselves to concentrating on fetal movements and their relationship with the unborn baby. This appears to agree with Condon and Corkindale (1997) who maintain that the energy the women devotes to being pre-occupied with the unborn baby appears to be affected by external forces such as other children, daily events, and degree of fatigue (125).

When the women felt different fetal movements compared to previous experiences in the current pregnancy, they felt something was wrong and they became worried (study I). A woman recognizes her baby's movement pattern and she has a contact with her unborn baby. She communicates, makes contact, and gets responses from her baby by softly touching, stroking, and gently poking the belly, all of which a healthy baby responds to. When the response is missing and the woman loses contact with her baby she feels that something is wrong. In a previous study (105), including twelve women who had lost their babies before birth, it was reported that even these women had a premonition that something was wrong. Before they contacted any antenatal or obstetric care services they had felt decreased fetal movements. Some women had felt an absence of any movements and experienced heaviness in utero. In line with the women in study I, these women report that it was difficult to communicate their emotions and concerns when they contacted a midwife. It could be assumed that the women did not want to be considered as being unnecessarily worried (105). This is supported by results from a survey with 614 participating women who answered a questionnaire regarding their premonition prior to receiving information that their baby had died before birth (74). Several participants reported that they had heard and read that it is normal that fetal movements are reduced in late pregnancy (study I). During the period in which the interviews were conducted, the Swedish textbook for midwives as well as booklets for soon-to-be parents included the information that reduced

fetal movements in late pregnancy was regarded as normal and this provides support for the women's description of normalization of decreased fetal movements (126, 127). This could be one of several reasonable explanations for the fact that women who had verbalized their concern but received comforting advice and explanations from family and friends as well as from health care providers. A Norwegian study reported that almost 50 percent of the women whose babies died in utero waited 24 hours or longer and one third of the women waited more than 48 hours before they contacted any antenatal or obstetric care services (78).

The results from study I can be understood as part of a normalization process since the women interpret the decrease and change in character of the fetal movements as part of normal physiological change in late pregnancy. This normalization process and the women's concern of being considered as unnecessarily worried may have caused that some women contacted any obstetric care services too late to be of help. Another factor contributing to this negative outcome can be the way in which the written information given to the women presents facts about fetal movements. In addition to this, there are the general difficulties faced in communicating women's symptoms and worry concerning the wellbeing of the baby.

## Self-assessment methods

Most of the women considered that both the self-assessment methods *count-to-ten* and *mindfetalness* were suitable for self-assessment of the fetal movements (study IV). Among women who reported that they preferred one of the methods over the other, most of the women chose *mindfetalness*. In general, the women reported that they had positive emotions during their assessment and it was noted by the observing researcher that the women seemed to be relaxed and focused during their self-assessments. The women described the assessment of the movements as safe and reassuring and a moment for communication with the unborn baby. Furthermore, the women reported that they were comfortable performing either of the self-assessment methods.

Other studies confirm that there is generally a high acceptance among pregnant women regardless of techniques chosen for using self-assessment of fetal movements (116, 122, 128-131). Draper et al. (1986) argue that self-assessment of fetal movements may cause concern and anxiety among women if they are not sure of the instructions. Due to a lack of correct information, women may feel uncertain about which fetal movements are to be counted and when it is the most suitable time to perform self-assessment (132). Thoroughly informing the women about the method and checking their understanding of the aim would probably strengthen the woman's motivation to perform self-

assessment of fetal movements (23). Thus, a lack of information regarding the performance and value of awareness of fetal movements can become a considerable problem for the women.

When the women in this study were given the chance to choose which of the self-assessment methods *count-to-ten* or *mindfetalness* they preferred, most of the women chose *mindfetalness* (study IV). One explanation for this is that for this method the woman focuses her attention on her unborn baby as an individual, without having to carry out the summation and the documentation of the fetal movements. It is possible that counting the frequency of fetal movements by *count-to-ten* is perceived as more demanding and therefore not preferred to the same extent as *mindfetalness*. In addition, there is a risk that the women become concerned before the ten required fetal movements have been noticed using the self-assessment method *count-to-ten* (132). Few studies have compared women's experiences on different self-assessment methods. Freda et al. (1993) compared the *count-to-ten* method with the "Sadovsky method". It emerged in the findings of that study that 80 percent of the participants preferred the self-assessment method *count-to-ten* and the women reported the method as being easy to perform (133).

Findings from previous studies present results that verify that pregnant women's awareness of their unborn baby's wellness has a positive effect on prenatal attachment (119, 120). The participants in study IV described the sessions of observations with the two different self-assessment methods as safe and calming and as opportunities for contact and communication with their unborn baby. Mikhail et al. (134) also reported that counting fetal movements was experienced as a chance to make contact with the unborn baby and improve prenatal attachment (134). In contrast, Saastad et al. (2011) could not report any differences in the scores concerning the self-assessment using the PAI between women who performed systematic fetal movement counting (n=473) and the women who did not (n=478) in a randomized controlled study (122). Previous studies had focused on quantitative methods while there is a lack of studies on the effect of qualitative self-assessment methods.

## Methodological considerations

Three different methods of data collection and two methods of self-assessment of fetal movements were used and are discussed below.

### Interviews

The results in study I are based on data collected from in-depth interviews with 26 women who had lost an unborn baby in late pregnancy. Women who

participated in the study were self-recruited and contacted the interviewer for further information. Only one woman was of another origin than Swedish. However, the sample was representative and the result could probably be generalized to women who had lost their baby in utero in a similar context.

The time from the death of the baby to the interview varied from one month up to, in one case, six years. Memory problems related to the time that had passed between the baby's death and the interview could have affected the results but the potential risk for this is probably marginal. Previous studies have shown that women have a detailed memory of events where strong emotions are in action and traumatic memories are easily aroused and always current (135-137).

The interviewer had no established relationships with the participants before the interviews took place. While an established relationship could help participants to feel secure and comfortable, it may simultaneously increase the risk of the interviews becoming therapeutic. When carrying out the interviews, it was important to differentiate between a therapeutic and research situation and maintain the research identity (138). In order to get close to the women and get the best overview of what they had experienced, interaction was needed and a wide range of professional skills and social competence must be used. When doing this, reflections over personal pre-understandings and pre-theoretical knowledge is important in order to prevent making an experience complete by tending to fill-in gaps in the narratives. In qualitative interviews, the influence of the researcher during the interview as well as during the process of analysis, needs to be taken into consideration and the quality of the analysis is dependent on the quality of the interviews. To ensure accuracy and increase the credibility of the data collected, the interviews were audio recorded and transcribed by the interviewer i.e. the first author. The other three researchers in the team analyzed the data independently and together. The results were discussed in research-seminars with other researchers. The trustworthiness of the qualitative data has been considered through a description of the context, data collection, and samples, and by describing the analysis process (study I) (139).

## Questionnaires

One study-specific questionnaire was developed (study II) on the basis of experiences from a previous study (60). From the developed questionnaire, one open-ended question was used on a larger population in study II and study-specific questions were used in study III. In addition, another two-part questionnaire was developed (study IV) on the basis of experience in the previous joint questionnaire (studies II, III).

In order to reach the number of women that was estimated to be sufficient to answer the research question, a time period for data collection was based on the number of pregnant women enrolled in antenatal care (studies II, III, IV).

The questionnaires consisted of study-specific questions (studies II, III, IV) and questions from a validated instrument (studies III, IV). When using the self-reporting questionnaire the reliability of the answers was considered. The questionnaires were tested for face validity before being distributed to the study population (140). The distribution between the different categories of fetal movements (study II) was similar to the distribution that emerged during the study by Rådestad and Lindgren (2012) (60). The PAI-R (studies III, IV) has previously been used in a population-based longitudinal survey in Sweden (88) with results suggesting that the sample is fairly representative of women in late pregnancy.

Amongst the 28 women with complications due to pregnancy who participated in studies II and III, it is possible that women with complicated pregnancies can be included. An examination of their diagnoses on a group level demonstrates that the participants answered the survey before their complications arose, for example women with placenta ablatio. Since information about each participant on an individual level is not accessible, it cannot be ensured that women with other complications were affected in their perceptions of the fetal movements.

One person (the first author) was responsible for inputting all data using the IBM statistical software package for the Social Sciences (SPSS) for Windows, version 20.0. Armonk, NY: IBM Corp. A statistician checked the data sheets and samples were drawn to confirm that data had been correctly filled in. Furthermore, data was adjusted (study III) in order to ensure its reliability by constructing a variable that measured the magnitude of fetal movements from the original question, e.g. “presence of frequent fetal movements during the current week”. If the question had been formulated differently, i.e. if the women instead graded the fetal movements on a continuous scale from non-powerful to powerful, the results might have been different, as well as if a different method had been used. Another limitation is the sparse background data of the participants. In order to achieve an acceptable response rate the questionnaire was kept as short as possible to maintain the respondent’s interest and motivation to start and complete it (113). The high response rate in study II (78%), in study III (100%), and in study IV (81%), indicates that the questionnaire was easily completed.

## Observations

During observations, data were collected with a crossover design and by triangulation. The experiences of fetal movements were reported by the women in their own words and confirmed by questionnaires and the researcher's observations, which could strengthen the reliability of the study. It has a relatively small sample size of primiparas women collected in only two communities, factors that can limit generalizability.

The role as a non-participating observer (study IV) was only to observe, and not to get involved in the interaction between the women and her attention towards her unborn baby. At the same time a potential interaction between the observer and the women could have led to more data being extracted (study IV).

Being observed may have influenced the women's feeling of comfort in the observation sessions, but a purely observational role was thought to be more suited in order not to interrupt the woman's contact with her unborn baby. Furthermore, the observer kept an adequate distance in order not to disturb the participant's personal emotional sphere.

Right before the observation sessions started, the women were asked to discontinue the self-assessment session if the baby was asleep or resting, which happened on eight occasions. In these cases, the observation had to be canceled and restarted at a later point in time. After the observations were performed, some women stated that their babies were not as active as expected during the observation, but the women still chose to continue the observation. It is possible some participants wanted to be "good" and show an active result, which can be interpreted as a desirability bias (137). Most women reported that their baby is most active before they go to sleep in the evening, but bedside observations were not considered to be appropriate.

The same observer was present during all 80 observations (study IV) thus ensuring observation techniques and compliance with what the text says. When needed, the observer could get help to process the experiences within the research team. The research team discussed the analyzed data in order to ensure the descriptive categories are in accordance with the data material. The texts were read and re-read repeatedly to achieve stability and be discussed by the authors and in research seminars (111, 141).



# CLINICAL IMPLICATIONS

The findings of this thesis highlight the importance of midwives and other healthcare professionals who provide antenatal care to support women's awareness of fetal movements. Encouraging women to focus on fetal movements may prevent pre-hospital delays when the unborn baby's health in the long term is at stake. Furthermore, there are other parameters than the frequency of the fetal movements to observe and communicate; intensity, duration, and the type of movements give additional valuable information about the fetal movement pattern. For women who prefer systematic self-assessment methods of their unborn baby's movements, both *count-to-ten* and *mind-fetalness* have high compliance and can be presented as options. However, we lack scientific evidence concerning the effects. The methods need to be better defined and evaluated concerning their potential to prevent pre-hospital delay when the unborn baby's health is at stake before they can be implemented in antenatal care as a routine.

## FUTURE RESEARCH

Further studies are needed to investigate if proactivity from the midwives and other health care professionals in encouraging pregnant women to systematically self-assess fetal movements can be used to prevent pre-hospital delay when fetal health in the long term is at stake.

# CONCLUSIONS

In full-term and uncomplicated pregnancies, women usually perceive fetal movements as powerful and describe them as firm, slow, stretching, large, and side-to-side. Furthermore, women in late pregnancy who reported frequent fetal movements on several occasions during a 24-hour period had higher mean scores on a scale measuring prenatal attachment.

Women in full term pregnancy who used two different self-assessment methods *count-to-ten* and *mindfetalness* stated that they felt calm, relaxed and mentally present, and focused during their observations. They had a reasonably high compliance for both methods.

Most women who had experienced a stillbirth describe that they had a premonition that their baby might be unwell before they were told that their baby had died in utero. The women had felt decreased fetal movements and the premonition can be described as a process illustrated by using “The staircase to insight”, a model with six descending steps from a vague to a strong feeling that something is wrong with the baby.

# SUMMARY IN SWEDISH- SVENSK SAMMANFATTNING

*Bakgrund:* Det finns begränsad kunskap om fostrets rörelsemönster och hur gravida kvinnor uppfattar och beskriver fosterrörelserna i slutet av graviditeten. Vidare, är kunskap om hur gravida uppfattar systematiska metoder för att uppmärksamma fosterrörelser sparsam, liksom hur dessa metoder påverkar kvinnor när de använder dem. Kunskap om fosters rörelsemönster är viktigt för barnmorskor och andra professioner som möter gravida med frågor om fosterrörelser i allmänhet och i synnerhet när kvinnorna är bekymrade över sitt ofödda barns rörelser. Mer kunskap om hur kvinnor i slutet av graviditeten uppfattar fosterrörelserna kan bidra till en ökad förmåga att upptäcka foster som löper risk att födas sjuka eller dö före födelsen.

*Metod:* I föreliggande avhandlingsarbete har tre metoder för att samla in data använts. I studie I har data från intervjuer med 26 kvinnor som fött ett dött barn använts. Kvinnornas berättelser analyserades med hjälp av innehållsanalys. I studie II och III har en enkät som besvarats av kvinnor i slutet av graviditeten använts; i studie II analyserades 393 kvinnors svar och i studie III, 456 kvinnors svar. Fokus i studie II och III var på olika frågor, men data kom från samma enkät. Svaren analyserades med hjälp av innehållsanalys samt beskrivande och analytisk statistik. I studie IV har data från 40 kvinnor som i sen graviditet fick pröva två olika metoder för systematisk observation av fosterrörelser använts. Efter två observationstillfällen besvarade kvinnorna en enkät. Sammanlagt 80 protokoll med anteckningar av observatören samt 80 besvarade enkäter har använts.

*Resultat:* Resultaten i avhandlingen tyder på att en indelning av fosterrörelser är möjlig utifrån gravida kvinnors beskrivning av sitt ofödda barns rörelser. En mall med två huvudgrupper benämnda ”kraftfulla” och ”icke kraftfulla” fosterrörelser med sju undergrupper; ”starka”, ”långsamma”, ”stretchande”, ”stora”, ”från sida till sida” samt ”lätta” och ”ryckiga” rörelser visade sig vara lämplig för att kategorisera hur kvinnor uppfattar fosterrörelserna i slutet av en graviditet som klassificerats som okomplicerad. De flesta kvinnorna i studien upplevde sitt ofödda barns rörelser som kraftfulla (studie II). Studie I, visar att kvinnorna vars barn dött före födelsen hade upplevt att fosterrörelserna blivit färre och svagare innan de fick besked att barnet inte

längre levde. Kvinnorna beskrev att de förlorade kontakten med sitt ofödda barn men att de försökte intala sig att det fanns naturliga förklaringar till att barnet rörde sig mindre eller inte alls. Svårigheten att förstå att barnets liv var i fara gjorde att det tog lång tid innan de sökte vård trots att de var oroliga (studie I). Resultat från delstudie IV visar att de kvinnor som uppfattade mycket fosterrörelser vid ett flertal tillfällen under ett dygn, skattade en högre anknytning till sitt ofödda barn jämfört med de kvinnor som beskrev färre tillfällen av mycket fosterrörelser under ett dygn. Nästan alla kvinnor upplevde flest fosterrörelser på kvällen. Vidare var kvinnans ålder och antal tidigare födda barn förknippat med hur ofta kvinnan kände att hennes ofödda barn rörde sig mycket samt med anknytningen till det ofödda barnet. Både kvinnorna i studie I, som mist sitt barn före förlossningen och kvinnorna i studie II med en graviditet utan komplikationer, beskrev att de var väl förtrogna med sitt ofödda barns vanor och rörelsemönster. I allmänhet rapporterade kvinnorna att de kunde tänka sig att använda systematisk självskattning av fosterrörelser och att de kände sig bekväma med att utföra självskattningen (studie III). De 40 kvinnor som prövade självskattningsmetoden *mindfetalness* och *räkna-till-tio* hade positiva känslor under sin bedömning med båda metoderna. Av de kvinnor som föredrog en av självskattningsmetoderna, valde de flesta *mindfetalness*, då fosterrörelserna styrka, frekvens och karaktär observerades men rörelserna räknades inte, före *räkna-till-tio* metoden, där kvinnan skulle mäta den tid det tog för henne att uppfatta tio fosterrörelser.

*Konklusion;* I fullgången och okomplicerad graviditet uppfattar kvinnorna vanligtvis fosterrörelserna som kraftfulla och beskriver rörelserna som ”starka”, ”långsamma”, ”stretchande”, ”stora” och ”sida till sida”. Vidare hade de kvinnor som i slutet av graviditeten rapporterade fler tillfällen med frekventa fosterrörelser under dygnet, högre andel poäng på en skala som mäter prenatal anknytning. Kvinnor i fullgången graviditet som använde två olika självskattningsmetoder, *mindfetalness* och *räkna-till-tio*, förklarade att de kände sig lugna, avslappande, mentalt närvarande och fokuserade under observationerna. Det förelåg en hög följsamhet för båda metoderna. De flesta kvinnorna som hade fött ett dött barn beskrev att de haft en föräning om att deras barn kanske inte mått bra innan de fick information om att barnet hade dött i livmodern. Kvinnorna hade känt färre fosterrörelser och föräningen kan beskrivas som en process, illustrerad av ”Insiktstrappan”, en modell med sex trappavsatser från en vag till en växande känsla att något är fel med barnet.

*Kliniska implikationer:* Avhandlingens resultat belyser vikten av att barnmorskor och andra yrkeskategorier som erbjuder mödrahälsovård, ska stödja kvinnornas uppmärksamhet av fosterrörelser. Att uppmuntra kvinnor fokusera på fosterrörelser kan förhindra fördröjning av vård när det ofödda barnets hälsa är under risk. Vidare är det fler faktorer än fosterrörelsernas frekvens

som kan observeras och kommuniceras; intensitet, varaktighet och fosterrörelsernas karaktär ger ytterligare värdefull information om fosterrörelsernas mönster. För kvinnor som föredrar systematisk självskattning av sitt ofödda barns rörelser har både *mindfetalness* och *räkna-till-tio* metoderna hög följsamhet och kan presenteras som möjliga val. Metodernas effekt att minska prehospitalet fördröjning, när fostret är under risk, måste dock utvärderas innan de rutinmässigt kan introduceras inom mödrahälsovården.

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# REFERENCES

1. Sadler T. Langman's medical embryology. 13 ed: Lippincott Williams & Wilkins; 2014. 424 p.
2. Maršál KH, H Westgren, M. Fostrets utveckling och fysiologi. In: Hagberg H, Maršál K, Westgren M, editors. Obstetrik. 2nd ed. Lund: Studentlitteratur; 2014. p. 37-50.
3. Wolf K, Hovatta O, Hreinsson J. Konception. In: Hagberg H, Maršál K, Westgren M, editors. Obstetrik. 2nd ed. Lund: Studentlitteratur; 2014. p. 21-9.
4. Balkawade NU, Shinde MA. Study of length of umbilical cord and fetal outcome: a study of 1,000 deliveries. *Journal of obstetrics and gynaecology of India.* 2012;62(5):520-5.
5. Vindla S, James D. Fetal behaviour as a test of fetal wellbeing. *British journal of obstetrics and gynaecology.* 1995;102(8):597-600.
6. de Vries J, Fong B. Normal fetal motility: an overview. *Ultrasound in Obstetrics and Gynecology.* 2006;27(6):701- 11.
7. Birnholz J. The development of human fetal eye movement patterns. *Science.* 1981;7(213):679-81.
8. Woitek R, Gregor K, Lindner C, Stuhr F, Weber M, Schöpf V, et al. Fetal Eye Movements on Magnetic Resonance Imaging. *PLoS ONE* 2013;8(10):e77439.
9. Govindan RB, Wilson JD, Murphy P, Russel WA, Lowery CL. Scaling analysis of paces of fetal breathing, gross-body and extremity movements. *Physica A.* 2007; 1;386(1):231-9.
10. Nijhus J, Prechtl H, Martin JC, Bots R. Are there behavioral states in the human fetus? *Early human development.* 1982;6(2):177-95.
11. Brändle J, Preissl H, Draganova R, Ortiz E, Kagan K, Abele H, et al. Heart rate variability parameters and fetal movement complement fetal behavioral states detection via magnetography to monitor neurovegetative development. *Front Hum Neurosci.* 2015;7(9).
12. Rayburn WF. Fetal movement monitoring. *Clin Obstet Gynecol.* 1995;38(1):59-67.
13. Patrick J, Campbell K, Carmichael L, Natale R, Richardson B. Patterns of gross fetal body movements over 24-hour observation intervals during the last 10 weeks of pregnancy. *American journal of obstetrics and gynecology.* 1982;142(4):363-71.
14. D'Elia A, Pighetti M, Moccia G, Santangel N. Spontaneous motor activity in normal fetuses. *Early human development.* 2001;65(2):139-47.
15. Hayat T, Nihat A, Martinez-Biarge M, McGuinness A, Allsop J, Hajnal J, et al. Optimization and initial experience of a multisection balanced steady-state free precession cine sequence for the assessment of fetal behavior in utero. *AJNR Am J Neuroradiol.* 2011 32(2):331-8.
16. Zoia S, Blason L, D'Ottavio G, Biancotto M, Bulgheroni M, Castiello U. The development of upper limb movements: from fetal to post-natal life *PLoS one.* 2013;4;8(12):e80876.

17. Malm M, Lindgren H, Rubertsson C, Hildingsson I, Rådestad I. Development of a tool to evaluate fetal movements in full-term pregnancy. *Sex Reprod Healthc.* 2014;5(1):31-5.
18. Dierker LJ, Rosen M, Pillay S, Sorokin Y. Correlation between gestational age and fetal activity periods. *Biology of the neonate.* 1982 42(1-2):66-72.
19. Hijazi ZR, East CE. Factors affecting maternal perception of fetal movement. *Obstet Gynecol Surv.* 2009;64(7):489-97; quiz 99.
20. de Vries JI, Visser GH, Precht HF. The emergence of fetal behaviour. III. Individual differences and consistencies. *Early human development.* 1988;16(1):85-103.
21. Patrick J, Cambell K, Carmichael C, Natale R, Richardson B. Patterns of gross fetal body movements over 24-hour observation intervals during the last 10 weeks of pregnancy. *American Journal of Obstetrics & Gynecology.* 1982;142(4):363-71.
22. Harrington K, Thompson O, Jordan L, Page J, Carpenter R, Campbell S. Obstetric outcome in women who present with a reduction in fetal movements in the third trimester of pregnancy. *Journal of Perinatal Medicine.* 1998;26(2):77-82.
23. Velazquez M, Rayburn W. Antenatal evaluation of the fetus using fetal movement monitoring. *Clin Obstet Gynecol.* 2002;45(4):993-1004.
24. Valentine L, Löfgren O, Marsal K, Gullberg B. Subjective recording of fetal movements I. Limits and acceptability in normal pregnancies. *Acta obstetricia et gynecologica Scandinavica.* 1984;63:223-8.
25. Ehrström C. Circadian rhythm of fetal movements. *Acta obstetricia et gynecologica Scandinavica.* 1984;63(6):539-41.
26. de Vries JIP, Visser GHA, Mulder EJH, Precht HFR. Diurnal and other variations in fetal movement and heart rate patterns at 20–22 weeks. *Early human development.* 1987;15(6):333–48.
27. Birger M, Homburg R, Insler V. Clinical evaluation of fetal movements. *International journal of gynaecology and obstetrics: the official organ of the International Federation of Gynaecology and Obstetrics.* 1980;18(5):377-82.
28. Hepper P, Dornan J, Lynch C. Sex differences in fetal habituation. *Developmental science.* 2012 15(3):373-83.
29. Nowlan NC. Biomechanics of foetal movement *European Cells and Materials.* 2015;29:1-21.
30. Lüchinger A, Hadders Algra M, van Kan C, de Vries JIP. Fetal onset of general movements. *Pediatric research.* 2008;63(2):191-5.
31. Eller D, Stramm S, Newman R. The effect of maternal intravenous glucose administration on fetal activity *American Journal Obst Gynecol.* 1992;167:1071-4
32. Cito G, Luisi S, Mezzesimi A, Cavicchioli C, Calonaci G, Petraglia F. Maternal position during non-stress test and fetal heart rate patterns. *Acta obstetricia et gynecologica Scandinavica.* 2005;84(4):335-8.
33. Sherer DM, Spong CY, Minior VK, Salafia CM. Decreased amniotic fluid volume at < 32 weeks of gestation is associated with decreased fetal movements. *American journal of perinatology.* 1996;13(8):479-82.
34. Pearson J, Weaver J. Fetal activity and fetal wellbeing: an evaluation. *British Medical Journal.* 1976;1(6021):1305-7.
35. Saastad E, Ahlborg T, Froen F. Low maternal awareness of fetal movements is associated with small for gestational age infants. *J Midwifery & Womens Health.* 2008;53:345-52.
36. Gynaecologist RCoOa. Reduces fetal movements. London: RCOG, 2011.

37. Radestad I. Fetal movements in the third trimester--Important information about wellbeing of the fetus. *Sexual & reproductive healthcare : official journal of the Swedish Association of Midwives*. 2010;1(4):119-21.
38. Jeffreys R, Stepanchak W, Lopez B, Hardis J, Clapp J. Uterine blood flow during supine rest and exercise after 28 weeks of gestation. *BJOG : an international journal of obstetrics and gynaecology*. 2006;113(11):1239-347.
39. Stacey T, Thompson J, Mitchell E, Ekeroma A, Zuccollo J, McCowan L. Maternal perception of fetal activity and late stillbirth risk: findings from the Auckland stillbirth study. *Birth*. 2011;38(4):311-6.
40. Batcha T, Goonewardene I. The fetal acoustic stimulation test: a reliable and cost effective method of antepartum fetal monitoring. *Ceylon Med J* 2005;50(4):156-9.
41. Kisilevsky BH, SMJ. Comparison of fetal behavior in low- and high-risk pregnancies. *Fetal Pediatr Pathol*. 2005;24(1):1-20.
42. Kisilvesky B, Muir D. Human fetal and subsequent newborn responses to sound and vibration. *Infant Behavior and Development*. 1991;14(1):1-26.
43. Fulford J, Vadeyar S, Dodampahala SM, RJ , Young P, Baker P, James D, et al. Fetal brain activity in response to a visual stimulus. *Human Brain Mapping*. 2003;20(4):239-45.
44. Esin S, Basera E, Cakira C, Tuncala G, Kucukozkana T. Chocolate or orange juice for non-reactive non-stress test (NST) patterns: a randomized prospective controlled study. *The Journal of Maternal-Fetal & Neonatal Medicine*. 2013;26(9):915-9.
45. Nijhuis JG. Fetal behavior. *Neurobiol Aging*. 2003;24 Suppl 1:S41-6; discussion S7-9, S51-2.
46. Timor-Tritsch I, Zador I, Hertz R, Rosen M. Classification of human fetal movement. *Am J Obstet Gynecol* 1976;1;126(1):70-7.
47. Sadovsky E, Mahler Y, Polishuk WZ, Malkin A. Correlation between electromagnetic recording and maternal assessment of fetal movement. *Lancet*. 1973;1(7813):1141-3.
48. Valentin L, Marsal K. Fetal movement in the third trimester of normal pregnancy. *Early human development*. 1986;14:295-306.
49. Malamateniou C, Malik SJ, Counsell SJ, Allsop JM, McGuinness AK, Hayat T, et al. Motion-compensation techniques in neonatal and fetal MR imaging. *AJNR Am J Neuroradiol*. 2013;34(6):1124-36.
50. Rayburn WF. Fetal body movement monitoring. *Obstet Gynecol Clin North Am*. 1990;17(1):95-110.
51. Olesen AG, Svare JA. Decreased fetal movements: background, assessment, and clinical management. *Acta obstetrica et gynecologica Scandinavica*. 2004;83(9):818-26.
52. Valentin L, Marsal K, Gullberg B. Subjective recording of fetal movements III Screening of a pregnant population; the clinical significance of decreased fetal movement counts. *Acta obstetrica et gynecologica Scandinavica*. 1986;65:753-8.
53. Tuffnell DJ, Cartmill RS, Lilford RJ. Fetal movements; factors affecting their perception. *European journal of obstetrics, gynecology, and reproductive biology*. 1991;39(3):165-7.
54. Hertogs K, Roberts A, Cooper D, Griffin D, Campbell S. Maternal perception of fetal motor activity. *Br Med J*. 1979;10(2):1183-5.
55. Mohr S, Tsur A, Kalter A, Weissmann Brenner A, Gindes L, Weisz B. Reduced fetal movement: factors affecting maternal perception. *J Matern Fetal Neonatal Med* 2015 15:1-4.

56. Frøen J. A kick from within--fetal movement counting and the cancelled progress in antenatal care. *J Perinat Med.* 2004;32(1):13-24.
57. Heazell A, Frøen J. Methods of fetal movement counting and the detection of fetal compromise. *J Obstet Gynaecol* 2008;28(2):147-54.
58. de Vries J, Fong B. Normal fetal motility. *Ultrasound in Obstetrics and Gynecology.* 2006;27(6):701-11.
59. de Vries J, Visser G, Prechtl H. The emergence of fetal behaviour. I. Qualitative aspects. *Early Hum Dev.* 1982;7(4):301-22.
60. Rådestad I, Lindgren H. Wome's experiences of fetal movements in fullterm pregnancy: a pilot study including individual interviews with 40 pregnant women. *Sexual & Reproductive Healthcare.* 2012;3:113-6.
61. Frøen J, Heazell A, Tveit J, Saastad E, Fretts R, Flenady V. Fetal movement Assessment. *Sem Perinat.* 2008;32:243-6.
62. O'Sullivan S, Martindale E, Heazell A. Predicting poor perinatal outcome in women who present with decreased fetal movements. *J Obstet Gynaecol* 2009;29(8):705-10.
63. Prechtl H. Developmental neurology of the fetus. *Baillieres Clin Obstet Gynaecol.* 1988 2(1):21-36.
64. Rayburn WF, McKean HE. Maternal perception of fetal movement and perinatal outcome. *Obstetrics and gynecology.* 1980;56(2):161-4.
65. Heazell A, Sumathi G, Bhatti N. What investigation is appropriate following maternal perception of reduced fetal movements? *J Obstet Gynaecol* 2005;25(7):648-50.
66. Tan K, Sabapathy A, Wei X. Fetal manipulation for facilitating tests of fetal wellbeing. *Cochrane Database Syst Rev.* 2001 7(12):CD003396.
67. Malm M, Lindgren H, Radestad I. Losing contact with one's unborn baby--mothers' experiences prior to receiving news that their baby has died in utero. *Omega.* 2010;62(4):353-67.
68. Holm Tveit J, Saastad E, Stray-Pedersen B, Børdahl P, Frøen J. Maternal characteristics and pregnancy outcomes in women presenting with decreased fetal movements in late pregnancy. *Acta obstetricia et gynecologica Scandinavica.* 2009;88(12):1345-51.
69. Lalor L, Fawole B, Alfirevic Z, Devane D. Biophysical profile for fetal assessment in high risk pregnancies. *Cochrane Database Syst Rev.* 2008;23(1):CD000038.
70. Eaton O, Saudino K. Prenatal activity level as a temperament dimension? Individual differences and developmental functions in fetal movement. *Infant Behavior and Development.* 1992;15(1):57-70.
71. Jokhan S, Whitworth M, Jones F, Saunders A, Heazell A. Evaluation of the quality of guidelines for the management of reduced fetal movements in UK maternity units. *BMC pregnancy and childbirth.* 2015 5(15):54.
72. Coppens MV, S, James D, Sahota D. Computerized analysis of acute and chronic changes in fetal heart rate variation and fetal activity in association with maternal smoking. *Am J Obstet Gynecol.* 2001;185(2):421-6.
73. Baschat A. Fetal responses to placental insufficiency: an update. *BJOG : an international journal of obstetrics and gynaecology.* 2004;111(10):1031-41.
74. Erlandsson K, Lindgren H, Davidsson-Bremborg A, Radestad I. Women's premonitions prior to the death of their baby in utero and how they deal with the feeling that their baby may be unwell. *Acta obstetricia et gynecologica Scandinavica.* 2012;91(1):28-33.

75. Efkarpidis S, Alexopoulos T, Kean L, Liu D, Fay T. Case-Control study of factors associated with intrauterine fetal deaths. *Medscape General Medicin.* 2004;6(2):53.
76. Linde A, Pettersson K, Radestad I. Women's Experiences of Fetal Movements before the Confirmation of Fetal Death--Contractions Misinterpreted as Fetal Movement. *Birth.* 2015;42(2):189-94.
77. Raynes-Greenow C, Gordon A, Qiushuang L, Hyett J. Examining maternal perception of fetal movements using a qualitative framework: it's the type of movement rather than the number that may be important. In: Health JoPaC, editor. *The 17th Congress of the Federation of Asian and Oceania Perinatal Societies and the 16th Congress of the Perinatal Society of Australia and New Zealand*; Sydney, Australia: Wiley-Blackwell; 2012. p. 99-100.
78. Frøen J, Tveit J, Saastad E, Børdahl P, Stray-Pedersen B, Heazell A, et al. Management of decreased fetal movements. *Semin Perinatol* 2008 32(4):307-11.
79. Flenady V, Koopmans L, Middleton P, Frøen J, Smith G, Gibbons K, et al. Major risk factors for stillbirth in high-income countries: a systematic review and meta-analysis. *The Lancet.* 2011;16(377 (9774)):1331-40.
80. Lawn J, Blencowe H, Pattinson R, Cousens S, Kumar R, Ibiebele I, et al. Stillbirths: Where? When? Why? How to make the data count? *The Lancet.* 2011;23(3):1448-63.
81. SCB, Statistiska Centralbyrån, Statistics Sweden [http://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START\\_BE\\_BE0101\\_BE0101I/DodFod-daAlderMorK1/table/tableViewLayout1/?rxid=48639f59-40ce-402d-91ed-4abcca8a39be2015](http://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START_BE_BE0101_BE0101I/DodFod-daAlderMorK1/table/tableViewLayout1/?rxid=48639f59-40ce-402d-91ed-4abcca8a39be2015).
82. Brandon AP, S, Denton WS, AM Evans, HM. A history of the theory of prenatal attachment *J Prenat Perinat Psychol Health.* 2009;23(4):201-22.
83. Condon JC, C. The correlates of antenatal attachment in pregnant women. *British Journal of Medical Psychology.* 1997;70(4):359-72.
84. Rådestad I. Fetal movements in the third trimester--Important information about wellbeing of the fetus. *Sexual & reproductive healthcare : official journal of the Swedish Association of Midwives.* 2010;1(4):119-21.
85. Dutton P, Warrander L, Roberts S, Bernatavicius G, Byrd LG, D, Kroll J, et al. Predictors of Poor Perinatal Outcome following Maternal Perception of Reduced Fetal Movements – A Prospective Cohort Study. *PloS one.* 2012;7(7):e39784.
86. Cranley M. Development of a Tool for the Measurement of Maternal Attachment During Pregnancy. *Nursing research.* 1981;30(8):281-4.
87. Siddiqui A, Hagglof B. An exploration of prenatal attachment in Swedish expectant women. *Journal of Reproductive & Infant Psychology.* 1999;17(4):369-1p.
88. Rubertsson C, Pallant, J.F, Sydsjö, G., Haines, H., Hildingsson, I. Maternal depressive symptoms have a negative impact on prenatal attachment—Findings from a Swedish community sample. *Journal of Reproductive and Infant Psychology.* 2015;33(2):153-64.
89. Raphael-Leff J. *The Psychological Processes of Childbearing: Fourth Edition.* Fourth ed. Great Britain: Anna Freud Centre; 2005. 663 p.
90. Muller M. Development of the prenatal attachment inventory. *Western Journal of Nursing Research.* 1993;15(2):199-215.
91. Pallant JH, HM Hildingsson, I, Crossa M, Rubertsson C. Psychometric evaluation and refinement of the Prenatal Attachment Inventory. *Journal of Reproductive and Infant Psychology.* 2014;32(2):112-25.

92. Berndl A, O'Connell C, McLeod N. Fetal movement monitoring: how are we doing as educators? *J Obstet Gynaecol Can.* 2013 35(1):22-8.
93. Heazell A, Green M, Wright C, Flenady V, Frøen J. Midwives' and obstetricians' knowledge and management of women presenting with decreased fetal movements. *Acta Obstet Gynecol Scand.* 2008;87(3):331-9.
94. Health NCCfWsaCs. Antenatal care: routine care for the healthy pregnant women. London: RCOG Press; 2003. p. 105-6.
95. Defens DoVADo. VA/DoD Clinical practice guideline for management of pregnancy Visits during weeks: 28-37. Washington, DC: Department of Veteran Affairs. Department of Defens 2009. p. 162.
96. Sadovsky E, Yaffe H. Daily fetal movement recording and fetal prognosis. *Obstetrics and gynecology.* 1973;41:845-50.
97. Govindan RB, Wilson JD, Murphy P, Russel WA, Lowery CL. Scaling analysis of paces of fetal breathing, gross-body and extremity movements. *Physica A.* 2007;386(1):231-9.
98. Radestad I. Strengthening mindfetalness. *Sexual & reproductive healthcare : official journal of the Swedish Association of Midwives.* 2012;3(2):59-60.
99. Dowswell T, Carroli G, Duley L, Gates S, Gülmezoglu A, Khan-Neelofur D, et al. Alternative versus standard packages of antenatal care for low-risk pregnancy *Cochrane Database Syst Rev.* 2010;16(7):CD000934.
100. SFOG Ifmi, SBF Si. Mödrahälsovård. sexuell och reproduktiv hälsa. Stockholm: SFOG, 2008.
101. Socialstyrelsen. Graviditet, förlossningar och nyfödda barn. Stockholm: Epidemiologiskt centrum, 2007.
102. Guidance NifHaCEfNifHaCE. Antenatal Care: Routine Care for the Healthy Pregnant Woman. 126 Fetal Wellbeing London: RCOG Press; 2008.
103. Frøen J. A kick from within-fetal movement counting and the cancelled progress in antenatal care. *J Perinat Med.* 2004;32(1):13-24.
104. Neldam. 1978.
105. Trulsson O, Rådestad I. The silent child-mothers' experiences before, during, and after stillbirth. *Birth.* 2004;31(3):189-95.
106. www.spadbarnsfonden.se. Spadbarnsfonden Göteborg, Sweden. [Nonprofit organization].
107. Kvale S. *Inter Views - An Introduction to Qualitative Research Interviewing*: Sage Publications Inc; 1996. 344 p.
108. Radestad I, Malm MC, Lindgren H, Pettersson K, Larsson LL. Being alone in silence - mothers' experiences upon confirmation of their baby's death in utero. *Midwifery.* 2014;30(3):e91-5.
109. Malm M, Radestad I, Erlandsson K, Lindgren H. Waiting in no-man's-land - mothers' experiences before the induction of labour after their baby has died in utero. *Sexual & reproductive healthcare : official journal of the Swedish Association of Midwives.* 2011;2(2):51-5.
110. Lindgren H, Malm MC, Radestad I. You don't leave your baby--mother's experiences after a stillbirth. *Omega.* 2013;68(4):337-46.
111. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse education today.* 2004;24(2):105-12.
112. Radestad I, Lindgren H. Women's perceptions of fetal movements in full-term pregnancy. *Sexual & reproductive healthcare : official journal of the Swedish Association of Midwives.* 2012;3(3):113-6.
113. Cluett ER, Bluff R. *Principles and practice of reserach in midwifery.* Second ed. Edinburgh UK: Elsevier Limited; 2006. 293 p.

114. Bergman M. Content analysis within a mixed methods framework. In: Tashakkor A, Teddlie C, editors. *Handbook of mixed methods in social and behavior research*. London: Sage; 2010. p. 387-8.
115. Raynes-Greenow CH, Gordon A, Li Q, Hyett JA. A cross-sectional study of maternal perception of fetal movements and antenatal advice in a general pregnant population, using a qualitative framework. *BMC pregnancy and childbirth*. 2013;13:32.
116. Ryo E, Nishihara K, Matsumoto S, Kamata H. A new method for long-term home monitoring of fetal movement by pregnant women themselves. *Medical engineering & physics*. 2012;34(5):566-72.
117. Carmichael L, Campbell K, Patrick J. Fetal breathing, gross fetal body movements, and maternal and fetal heart rates before spontaneous labor at term. *American journal of obstetrics and gynecology*. 1984;148(5):675-9.
118. Wood C, Gilbert M, Oconnor A, Walters WAW. Subjective Recording of Fetal Movement. *British journal of obstetrics and gynaecology*. 1979;86(11):836-42.
119. Siddiqui A, Hagglof B. Does maternal prenatal attachment predict postnatal mother-infant interaction? *Early human development*. 2000;59(1):13-25.
120. Lindgren K. Relationships among maternal-fetal attachment, prenatal depression, and health practices in pregnancy. *Research in nursing & health*. 2001;24(3):203-17.
121. Salisbury A, Law K, LaGasse L, Lester B. MSJAMA. Maternal-fetal attachment. *JAMA : the journal of the American Medical Association*. 2003;289(13):1701.
122. Saastad E, Israel P, Ahlborg T, Gunnes N, Froen JF. Fetal movement counting-effects on maternal-fetal attachment: a multicenter randomized controlled trial. *Birth*. 2011;38(4):282-93.
123. Stainton MC. Parents' awareness of their unborn infant in the third trimester. *Birth*. 1990;17(2):92-6.
124. Yarcheski A, Mahon NE, Yarcheski TJ, Hanks MM, Cannella BL. A meta-analytic study of predictors of maternal-fetal attachment. *International journal of nursing studies*. 2009;46(5):708-15.
125. Condon JT, Corkindale C. The correlates of antenatal attachment in pregnant women. *The British journal of medical psychology*. 1997;70 ( Pt 4):359-72.
126. Kaplan B, Hoggart C, Hildingsson I, Lundgren I, editors. *Lärobok för barnmorskor. 3: upplagan* ed. Lund: Studentlitteratur; 2009.
127. Westlund M, Rode U, editors. *Graviditet, förlossning och den nya familjemedlemmen. 6:e utgåvan* ed. Göteborg: SCA Hygiene Products AB; 2010.
128. Grant V, Elbourne, & Alexander, 1989. Routine formal fetal movement counting and risk of antepartum late death in normally formed singletons. *The Lancet*. 1989;2:345-9.
129. Saastad E, Winje BA, Israel P, Froen JF. Fetal movement counting--maternal concern and experiences: a multicenter, randomized, controlled trial. *Birth*. 2012;39(1):10-20.
130. Sjostrom K, Thelin T, Marsal K, Valentin L. Effects of maternal anxiety on perception of fetal movements in late pregnancy. *Early human development*. 2003;72(2):111-22.
131. Liston R, Bloom K, Zimmer P. The psychological effects of counting fetal movements. *Birth*. 1994;21:135-40.
132. Draper J, Field S, Thomas H, Hare MJ. Womens' views on keeping fetal movement charts. *British journal of obstetrics and gynaecology*. 1986;93(4):334-8.



133. Freda M, Mikhail M, Mazloom E, Polizzotto R, Damus K, Merkatz I. Fetal movement counting: which method? *MCN Am J Matern Child Nurs.* 1993;18(6):314-21.
134. Mikhail M, Freda M, Merkatz R, Polizzotto R, Mazloom E, Merkatz I. The effect of fetal movement counting on maternal attachment to fetus. *American journal of obstetrics and gynecology.* 1991;165:988- 91.
135. Simkin P. Just another day in a woman's life? Women's long-term perceptions of their first birth experience. Part I. *Birth.* 1991;18(4):203-10.
136. Simkin P. Just Another Day in a Woman's Life .2. Nature and Consistency of Women's Long-Term Memories of Their 1st Birth Experiences. *Birth-Iss Perinat C.* 1992;19(2):64-81.
137. LaBar KS, Cabeza R. Cognitive neuroscience of emotional memory. *Nature reviews Neuroscience.* 2006;7(1):54-64.
138. Kvale S, Brinkmann, S. . *Interviews; Learning the craft of qualitative research interviewing.* London: Sage Publications Inc.; 2008.
139. Quinn Patton M. *Qualitative research and evaluation methods.* Fourth ed. London: SAGE; 2015. 806 p.
140. Polit DF, Beck, C.T. . *Essentials of nursing research. Appraising evidence for nursing practice.* Philadelphia: Lippincott Williams & Wilkins 2014. 796 p.
141. Krippendorff K. *Content analysis. An introduction to its methodology.* Second ed. Thousand Oaks, London, New Dehli: Sage Publications Inc.; 2004. 411 p.

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