Pregnancy Ultrasound Detecting Soft Markers - the Challenge of Communicating Risk Figures

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Abstract

This thesis focuses on expectant parents’ experiences and needs when soft makers are detected at mid-trimester ultrasound, resulting in an unexpected assessment of risk for fetal anomalies. The thesis also describes the prevalence of ultrasonographic fetal soft markers and the incidence of Down syndrome in a low-risk population of 10,535 pregnant women with a total of 10,710 fetuses, as well as the risk of invasive prenatal diagnostics in conjunction with the detection of soft markers. Finally, the thesis aims to explore the value of a web-based patient decision aid (DA) in facilitating informed decision making regarding routine fetal screening for anomalies and the fathers’ role in decision making regarding prenatal screening.

A prospective observational study was conducted between 2008–2011 to investigate the prevalence of ultrasonographic fetal soft markers at second trimester screening. During this time period, 12 women and 17 men were interviewed about their experience when soft markers were detected. Based on the results of these interviews, a web-based decision aid (DA) to enhance expectant parents’ decision-making concerning fetal screening was developed and a trial initiated to test its utility. Interviews were conducted with 17 women who received access to the DA, 11 who had chosen to use the DA and six who had not used it. All interview studies were analysed using systematic text condensation (STC) developed by Malterud.

Soft markers were detected in 5.9% of the fetuses at mid-trimester ultrasound, whereof 5.1% were isolated. All soft markers showed a positive likelihood ratio (LR+) for DS; however, the association was only statistically significant for the collapsed category ‘any marker’ (isolated, multiple or combined with anomaly), not for isolated markers. An almost 24-fold increase of invasive diagnostic testing was shown in all women, including those with a low estimated risk for aneuploidy, i.e. < 1/200 (paper III).

The results from interviews showed that the finding of soft markers created much anxiety and indicated that both women and men lacked awareness of the potential of the ultrasound examination (papers I and II). The results also showed that the men were actively engaged in decision making not only by supporting their partners, but also considered their own values and needs regarding these issues (paper II). It was also evident that women wanted their partners to be engaged in decisions regarding fetal diagnostics (papers I and IV).

The web-based patient DA was able to initiate a process of conscious decision making in pregnant women, as a result of their interaction with the tool. The DA allowed for clarification of women’s thoughts and priorities and helped them to understand the significance of the screening result and providing a basis for making informed decisions regarding fetal screening (paper IV).

Keywords: Pregnancy, Ultrasound, Soft markers, Prenatal, Screening, Fathers, Informed decision making, Decision aid.

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To my daughters Hanna and Stina
List of Papers

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


IV  Åhman A, Sarkadi A, Lindgren P, Rubertsson C. ‘It made you think about your opinion’ Women's perception of a web-based decision aid concerning screening for fetal anomalies. (Submitted manuscript)

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Contents

Introduction...................................................................................................11

Background...................................................................................................13
  Early prenatal diagnosis.......................................................................13
  Ultrasonographic soft markers.............................................................14
  Information and counselling...............................................................15
  Study context.......................................................................................21

Rationale for this study ................................................................................24

Overall and specific aims.............................................................................25

Material and methods....................................................................................26
  Papers I and II......................................................................................27
  Paper III ...............................................................................................30
  Paper IV...............................................................................................32
  Data analysis........................................................................................35

Summary of findings.....................................................................................40
  Papers I and II......................................................................................40
  Paper III ...............................................................................................43

Methodological considerations .....................................................................50

Discussion.....................................................................................................54

Conclusions...................................................................................................62

Clinical implications.....................................................................................63

Further research..........................................................................................65

Sammanfattning på svenska..........................................................................66

Acknowledgements.......................................................................................68

References.....................................................................................................71
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMC</td>
<td>Amniocentesis</td>
</tr>
<tr>
<td>CPC</td>
<td>Choroid plexus cysts</td>
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<td>CUB</td>
<td>Combined Ultrasound and Biochemical test</td>
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<td>CVS</td>
<td>Chorionic Villus Sampling</td>
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<td>DA</td>
<td>Decision aid</td>
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<td>DS</td>
<td>Down syndrome</td>
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<td>EIF</td>
<td>Echogenic intracardiac focus</td>
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<td>FISH</td>
<td>Fluorescence in situ hybridization</td>
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<td>NIPT</td>
<td>Non-invasive prenatal tests</td>
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<tr>
<td>PL</td>
<td>Pyelectasi</td>
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<tr>
<td>ThNF</td>
<td>Thickened nuchal fold</td>
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<tr>
<td>EB</td>
<td>Hyperechogenic bowel</td>
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<tr>
<td>LR+</td>
<td>Positive likelihood ratio</td>
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<td>RR</td>
<td>Risk ratio</td>
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<tr>
<td>STC</td>
<td>Systematic text condensation</td>
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<tr>
<td>TOP</td>
<td>Termination of pregnancy</td>
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<td>IUFD</td>
<td>Intrauterine fetal death</td>
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The antenatal care of women with high-risk pregnancies or complications related to childbirth has been my field of specialty during most of my 27 years as a professional midwife. During this time, I have met many expectant parents in situations that caused concern about the health of the baby. I realised early on that lack of information in many of these cases caused unnecessary worry to expectant parents. Since then I have engaged myself in the development of written information for women and the parents in need of specialised antenatal care.

Over the last decade I have observed great frustration among midwives at the fetal medicine unit, not being able to give expectant parents sufficient information and support, especially when soft markers were detected at an ultrasound screening. This made me curious about expectant parents’ experiences and understanding of screening results, in addition to the midwives’ role in informing couples. While studying different modes of providing information and possibilities to enhance informed decisions, the idea of developing and testing a patient decision aid came into my mind.
Introduction

Pregnancy is associated with great hope and high expectations but may also include fear that something might go wrong, either with the mother or the fetus being harmed. In modern society, information is all around us and readily available for expectant parents having any questions or concerns. In this flow of information through media and the health care system, pregnant women are inundated with warnings about a range of potential risks that can harm the fetus such as certain food, drugs or environmental factors. This heightened awareness of the risks concerns both women’s own health but even more the health of the fetus. The more visible the pregnancy becomes, the more advice a pregnant woman will be given from people in her surrounding, directed at avoiding and preventing risks. As a consequence, the concept of pregnancy as the natural state (1) is competing with the diametrically opposed discourses, pregnancy as being a state of risk (2) where medical technology is suggested to be one way of gaining control (3).

From a global perspective, Sweden is a very safe place to give birth, having both a low incidence of intrauterine fetal death (0.4%) and neonatal death, (0.14%) (4), together with only a few cases of pregnancy related mortality. Only 1–5 cases of death related to pregnancy have been reported each year to the Swedish medical register during the last decade although the number is suggested to be at least twice that number (5).

Unlike many other developed countries, midwives in Sweden are the primary caregivers during pregnancy, and in the absence of known pregnancy related risk factors, there is no planned visit to see a physician. The guidelines for antenatal care states that it is only if something deviates from the ‘normal’ that the midwife shall consult a physician. Although there is also a shift in Sweden toward increasing technical monitoring and information concerning health risks, Swedish midwives are still the main caregivers during pregnancy and childbirth having their focus on the normal reproductive health and prenatal care (6). Also, the midwives who provide care for women facing high obstetrical risk, strive to maintain the natural aspects in the process of childbearing (7).

Antenatal care has been developed for the purpose of preventing adverse outcomes by early detection of conditions that might affect the health of the
mother or the fetus and to prepare women for birth and parenthood (8). Information gained from the antenatal checks is documented in the patient record, which becomes a compilation that determines whether the woman is designated as being at high or low risk. Furthermore, recommendations are given by the midwife on what women should avoid and potential risks. Viewing pregnancy as a risky situation means that the mother needs to avoid a number of factors to protect herself and the baby (2), and Lupton suggests that this process reinforces the labelling of pregnancy as a risk status (2).

According to the risk theorist Ortwin Renn, the conception of risk refers to the possibility that human actions or events lead to consequences that affect aspects of what humans value (9). There are two modes of thinking, described by Paul Slovic, which affect the perception of risk (10, 11): the experiential system and the analytic system. The experiential system includes “affect”, which refers to ‘specific feelings of goodness or badness experienced with or without conscious awareness’. This implies that people judge a risk not only by what they think about it but also by how they feel about it, meaning that real risks are filtered through one’s own imaginations, values and interests. Consequently, the perception of risk will be affected by values in society, and Slovic suggests that the low risk tolerance for things that concern the unborn child is an example of this (10).

This thesis describes a space where lay perspectives of risk meet the professional perspectives of medical screening, early diagnostic testing and genetic counselling. It is in this shared space that the vital information exchange between the users and providers of fetal medicine services takes place and where informed decisions or agonizing misunderstandings can occur. This is also the space where I feel there is most room for improvement, to which I hope to contribute in this thesis.
Background

Early prenatal diagnosis

In this thesis, the term early prenatal diagnosis refers to screening and diagnostic tests for identifying fetal chromosomal and structural abnormalities, administrated before 22 gestational weeks (12). This includes a second trimester screening ultrasound called the ‘routine ultrasound’, which is part of the general maternity healthcare offered to all women free of charge. It also includes the first trimester combined ultrasound and biochemical screening (CUB) for Down syndrome (DS), and invasive diagnostic tests such as chorionic villus sampling (CVS) or amniocentesis (AMC) to detect the most common aneuploidies, DS, trisomy 18 and 13. The CUB test and the invasive diagnostic tests, CVS and AMC, are primarily available for women with elevated risk for aneuploidies; however, routines for offering these tests vary between the different counties in Sweden.

Invasive diagnostic tests for aneuploidy CVS and AMC are associated with an increased risk for miscarriage (13) and other side effects, such as musculoskeletal deformities and respiratory disturbances (14). Therefore, many women choose to abstain from such tests.

Much effort has therefore been devoted to developing non-invasive screening tests for DS with the aim of reducing the number of invasive tests and thus the number of procedure-related miscarriages. The CUB-test, now available for the screening of DS, is a combined test for the ultrasound nuchal translucency measurement and maternal serum biochemistry, which also takes into account the maternal age. It is performed in gestational week 11-13 to assess the probability of the most common fetal chromosomal abnormality, DS. This test, which is widely used, is robust and has a high detection rate not only for DS but also for other less common fetal trisomies such as trisomy 18 and 13 (15). The result of the test is obtained as a given risk number for the likelihood that the fetus has such abnormalities; the result can be used as the basis for a decision on whether an invasive diagnostic test should be performed to determine if aneuploidies are actually present.

Pregnancy ultrasound is extensively used in many countries, but the use of this procedure varies between countries. It can be performed at each antena-
tal check-up or only once, for medical reasons or for the parents’ desire to get a view of their unborn child. Possible side effects of the ultrasound on the fetus have been discussed (16) and according to Swedish health policies, repeated ultrasound scans during pregnancy should only be performed for medical reasons (6, 12).

The pregnancy ultrasound examination was first introduced in Sweden in the 1970s at Lund University Hospital and became more prevalent in Swedish antenatal care during the 1980s. Today, all pregnant women are offered one screening ultrasound at 18–22 weeks of gestation, which is part of the maternal healthcare, free of charge, and a great majority of women choose to participate (17). The purpose of the screening is to estimate the gestational age and determine multiple pregnancies, but it also examines the form and structure (morphology) of the fetal anatomy to detect fetal anomalies. This specific time period in the pregnancy is recommended because of the high detection rate of severe fetal abnormalities (18) and termination of pregnancy is still legal in many countries at this gestational age (19).

The ultrasound has become very important not only for the woman, but also for her partner (20); furthermore, studies have shown that the examination is experienced as a social event rather than a medical screening by expectant parents (20-22). Most women have positive feelings about the ultrasound scan and expect it to confirm the well-being of the fetus, and to have a visual encounter with their baby (17, 20, 23-27).

These expectations are shared by men (17, 20, 27) and according to Eurenius et al. (24), they feel just as positive as the women about the scan. It is also suggested that the ultrasound images make the baby more real to the expectant father (28), thereby reinforcing the reality of the transition to fatherhood (29). Most often, these positive expectations are fulfilled (17, 25), but if abnormalities of unclear significance are detected, parents also have fears and difficult choices to deal with (12, 19, 25).

**Ultrasonographic soft markers**

The development of ultrasound devices and more extensive education for staff involved in obstetrical ultrasound means that the detection rate of fetal abnormalities increases significantly, including the abnormalities most difficult to detect, such as congenital heart defect (30). It is now also possible to detect minor structural abnormalities with little or no pathological significance. Some of these minor sonographic findings, commonly known as ‘soft markers’, are more often found in fetuses with congenital anomalies and are suggested to be associated with chromosomal abnormalities (12, 31). The issue of whether there are associations between ultrasonographic soft mark-
ers and fetal chromosomal abnormalities has been studied primarily in research projects, and it has been suggested that this association has not been subject to sufficient scientific assessment in clinical practice (12).

The risk calculation for DS based on sonographic soft markers found in the second trimester varies significantly among studies and populations. The overall sensitivity is low, 1-16% (32-36), and the use of isolated soft markers for risk assessment in an otherwise low-risk pregnancy has been questioned (37, 38). In addition, few studies have reported on the prevalence of isolated soft markers in low-risk populations and the recorded prevalence varies (12).

When soft markers are detected during a second trimester ultrasound, the finding may raise new questions about invasive diagnostic testing. This may be of concern both for women who did not have a first trimester CUB test as well as for those who had a low-risk for DS according to the CUB test.

**Information and counselling**

It is stipulated in the Swedish law on genetic integrity that prenatal screening or diagnostic examinations are voluntary and that the antenatal healthcare shall offer all pregnant women general information about the fetal diagnostic examinations provided routinely in antenatal care (39). After being given the information, women decide if they will undergo any of these examinations. The law also specifies that all information of medical significance revealed by the examination shall be given to the women.

In Sweden, information and counselling on early prenatal diagnostic tests are primarily provided by the antenatal care midwife both orally and in writing. Upon the women’s request or if the midwife determines that it is necessary, expectant couples are referred to an obstetrician for additional counselling.

The national guidelines for antenatal care (6) specify the content of this information, stating that it shall include information both about the potential, as well as the limitations of the prenatal diagnostics, to enable women to make an informed decision on whether or not to attend the examination (40).

Several studies suggest that expectant fathers wish to be more involved in antenatal care (28, 29, 41-43). In Sweden, the fathers generally attend one or more visits to the antenatal care midwife and a vast majority of expectant fathers participate in the fetal ultrasound screening (44). Still, the responsibility for providing information to the partner is not specified in the national guidelines for antenatal care (6). Although an increasing number of studies comprising the father’s perspectives on fetal diagnostics have been published...
during the last decade (20, 45-54), there are still only a few where men have been interviewed separate from their partner (48-50, 54).

In Sweden, most second trimester routine ultrasound and first trimester CUB tests are performed by specially trained midwives, who also inform the expectant parents about the results of the scan. In the event of deviant findings, couples are referred to a physician for confirmation and information about the significance of the findings. When findings of deviations in the fetal anatomy are confirmed, expectant parents can be faced with the need to choose between different possible paths of action and uncertainty about which course of action to take. Therefore, when counselling women regarding the results of the prenatal diagnostics, the practitioners must ensure relevant support to enable expectant parents’ possibility to make an informed decision.

Informed decision

Enabling women to make informed decisions is a key objective in the guidelines that govern prenatal diagnostics (12). Marteau defines ‘informed decision’ as a decision based on relevant knowledge, which is consistent with the decision maker’s values and behaviourally implemented i.e. the person acts accordingly (55). This means that the individual shall decide based on knowledge of the purpose, benefits and potential risks of the examination as well as the limitations of the method. Sometimes however the scientific evidence about options is limited; therefore, the best choice depends on the personal importance the person places on the benefits, harms and scientific uncertainties (55).

According to Marteau (55), this implies that declining a test can be an informed choice when a person has the relevant knowledge but holds a negative attitude towards undergoing the test. On the other hand, an uninformed choice occurs when an individual chooses a test despite the lack of knowledge or has a negative attitude towards the test. Marteau also points out that healthcare professionals’ own attitude, negative or positive, as well as their level of knowledge, can in these situations affect an individual’s possibility to make informed decisions.

Despite efforts to provide information, research shows that women’s participation in prenatal diagnosis is often not an informed choice (56). Any responsibility for providing the information to the partner is not expressed in maternal healthcare guidelines, and knowledge about expectant fathers’ needs in relation to decisions about prenatal diagnosis is limited (57). It is, therefore, necessary to develop methods of information sharing and counseling that also meet the partner’s needs in connection with prenatal diagnosis.
Non-directive counselling
The American psychologist Carl Rogers originated the non-directive client-centred approach in psychoanalysis (58), later adopted in the area of genetic counselling by Seymour Kessler (59). He introduced the term non-directiveness and offered the following definition: non-directive describes procedures in genetic counselling aimed at promoting autonomy and self-directedness of the client.

It is recognised that disclosure of one’s genetic status may adversely affect the autonomy and privacy of individuals (60). To prevent this, the practice of medical genetics has generated principles of ethics to guide this profession (61). These principles acknowledge the patient as the primary decision-maker, capable of understanding options and making his or her own choices.

There are three main implications of these principles in the prenatal context. As expressed by Baumiller et al. (29), counselling on fetal diagnostics shall according to these principles:
1. Respect individual opinions and values
2. Be non-directive, supportive, responsive to the individual’s requests and respect the choices of patients
3. Convey information to patients with sensitivity, and in language they understand, so that they may make independent decisions and give informed consent to any prenatal tests

Understanding risk
There is a discrepancy between the epidemiological term ‘population-based risk’ and the individual’s conception of being at risk (62). Risk related to health and illness is often expressed in statistical terms as means of probabilities, distribution, as uncertainty, or as an event.

Likelihood ratios or risk ratios are also commonly used to describe statistically calculated risks. Calculation of risk ratio is performed by comparing the absolute risk of an attribute or event in two different groups with the occurrence of a specific decease (63). The confidence interval obtained in this calculation describes the uncertainty of the correlation. Likelihood ratios, positive or negative, are used for assessing the value of a screening test, calculated by the sensitivity and the specificity of the test (64). Although these terms are valuable when one estimates the level of certainty, they can lead to incorrect conclusions when used as part of patient counselling (65, 66).

In everyday language, the word risk has a negative connotation and relates to possible unwanted or threatening outcomes. Personal experiences, perceived seriousness of the condition in question and pre-existing notions of risk are
factors that influence an individuals’ perception of risk (67). The understanding of risk can also be dependent upon how risk is expressed (62, 68, 69). Frequencies and rates are shown to be more easily understood than percentages and probabilities (67). Additionally, it is found that certain words commonly used in genetic counselling, such as “rare” or “abnormal” can be particularly worrisome (65, 69).

Theories from cognitive psychology on human being’s comprehension of risk describe this diverse perception of risk (11) as, on the one hand, a perception derived from probabilities calculated by logics and on the other hand, a perception based on personal experiences and feelings. According to Slovic (10, 11), this means that personal feelings, values and own interest affect how individuals experience information they obtain.

In studies on perception and understanding of risk, the Swedish sociologist Wall introduced the term sense-making of risk as something created in a social context and suggests that this can explain people’s behaviour in relation to risk in different situations (70). In line with Lupton (71), Wall suggests that sense-making of risk is a process influenced also by cultures and values, in which a person gains understanding of risk. Consequently, because the concept of risk is socially constructed, it has different meanings depending on the context and will therefore be subjectively valued. Consultation concerning options involving risk assessments in healthcare can be especially difficult since the perception of risk is affected by how people construct and interpret their risk (72), a process influenced by emotions (73) and earlier experiences (74).

Defining risk is, therefore, only part of the counselling process that also needs to take into account the value and experienced based dimensions of the issue it concerns (67). With regard to the definition of informed choice used by Marteau (55), the task of enhancing informed decisions regarding fetal diagnostics is not only about supplying relevant information, but it must also include strategies so that men and women embrace the knowledge needed and include their own values.

**Decision making**

The development of prenatal diagnostic techniques have made decision making regarding pregnancy more complicated than it has been previously (75). By offering women the possibility of prenatal testing to rule out specific fetal anomalies, women must not only consider their own preferences, but also the risk of miscarriage and any competing interests between ones moral beliefs and practical concerns for the family that might accompany decision-making regarding termination of pregnancy (76, 77). Several models have been developed in an attempt to understand the process of decision making,
whereof some have been used in research describing decisions regarding healthcare options and tested in the context of decision making concerning prenatal diagnostics (78-80).

Decision making is described by Orem as the first phase of deliberate self-care, a step that is of special importance in helping individuals to maintain their autonomy in healthcare situations (81). According to Lawson, decision making research in healthcare has largely been guided by rational-choice models, which view the decision-maker as an autonomous, rational and individualistic actor (75). In this framework, the decision making is based on deliberate processing of the available information. Theory of Reasoned Action (82) is one such model that has been used to predict the probability that an individual will engage in their own personal healthcare decisions. According to this theory, the individual’s decisions and actions are directly affected by factors such as perceived susceptibility, seriousness, benefits, and barriers (83).

A model referred to in several studies in the realm of fetal diagnostic decision making is the expected utility model (84). According to von Winterfeldt (85), this prescriptive model aims (a) ‘to make individual’s values about the decision outcomes explicit and (b) to help individuals balance these values and risks during the decision process’ (85). This implies that a rational decision-maker will favour the option that offers the highest expected utility. Other studies have shown that knowledge is not always a dominant factor in these decisions and that health beliefs (86) as well as ethical beliefs (87) can be more decisive for their choices.

However, others suggest that decisions to use or not to use prenatal tests are not entirely rational, being constructed in a social context were norms and expectations from society can determine women’s choice (75, 77, 88).

**Patient Decision Aid as a tool in counselling**

Use of a patient decision aid (DA) before a screening or specific treatment in healthcare has shown to increase the likelihood that people will make decisions based on informed choices (89-91). The purpose of a DA is to help individuals make specific and carefully considered choices that are aligned with one’s own values, and to explain the risks, benefits and consequences of available choices regarding tests or treatments in healthcare (92). They are designed to clarify personal values, to communicate risk probabilities and guide deliberations (92). DAs are recommended for use when there are alternative options with features that people value differently, and fetal screening for anomalies involve such decisions that require detailed information and careful considerations (93). Patient DAs have received attention also as
a valuable tool for women taking a stand on whether to choose prenatal testing or not (92, 94-97).

The design and development of DAs have been criticised for lack of theoretical foundation (98). However, two theoretical frameworks have been described as foundations for the development of decision aids concerning prenatal screening: the decision analytic method (95, 99) and the Ottawa decision support framework (100). The decision analysis model is based on the expected utility theory involving trade-offs of benefits and risks of these tests. This differs from the Ottawa decision support framework that claims to be based on expectancy value (101), decision conflict (102) and social support theory (103, 104).

Recommendations for the use of patient DAs have been developed by the International Patient Decision Aid Standard (IPDAS) Collaboration (www.ipdas.ohri.ca). The standards emphasise that the aim of patient DAs is to improve the quality of decisions (105), defined as ‘the extent to which patients choose and/or receive healthcare interventions that are congruent with their informed and considered values’. More specifically, the standards imply that a decision aid shall:

- Provide information about options in sufficient detail for decision making
- Present probabilities of outcome in an unbiased and understandable way
- Include methods for clarifying and expressing patients’ values
- Include structured guidance in deliberation and communication

It is also emphasised that a decision aid shall explicitly point out the fact that there is no single best action.

Patient DAs have been tested in various forms as pamphlets, audio taped booklets, interactive video discs and computer based tools (89). Some of these technologies also help patients to personalise this information. Knowledge in this area is mainly based on studies from Canada and US, but also other countries such as England and Australia (89). Results from a Swedish study show that a film about prenatal screening and diagnoses tended to increase informed decisions (94, 106). Web-based decision support tools have been tested in the context of screening for fetal anomalies with positive results (92, 96).
**Pregnancy related information and Internet**

A vast majority of pregnant women in Sweden have access to the Internet and use the Internet to collect information on pregnancy issues. A Swedish study based on data from 2004 shows that 84% of women in the third trimester retrieved pregnancy related information from the Internet at a time when 91% had access (107). Since then, access to the Internet has increased; in 2012, more than 98% had access to the Internet in their homes (108) and among women between 25–34 years, it was close to 100% (108). Moreover, the digital divide in Sweden is less significant than in other countries; among women aged 16–74-years-old, 81% are daily users of the Internet, 68% of women with less than high school education use the Internet daily, 79% of women with high school education do so, whereas the corresponding figure for women with university education is 91% (108). We also know that Swedish men seek pregnancy related information on the Internet although not to the same extent as the women (109). The healthcare organisations in Sweden now also use the Internet to provide information to the general public.

**Study context**

**Antenatal healthcare in Sweden**

Almost 99 per cent of all pregnant women in Sweden participate in the antenatal care program (110), and their overall satisfaction with care is high (111). Antenatal care is provided by midwives within the public healthcare sector and free of charge. It is organised in local outpatient clinics, and only a few antenatal clinics are private. The program includes at least eight to nine visits to the midwife for routine check-ups, including medical tests and pregnancy related counselling and support. A follow-up visit is also included in this program (6). Women are offered additional appointments to visit the midwife, an obstetrician or a general practitioner depending on their needs. Partners of pregnant women are encouraged to attend antenatal visits and available childbirth education classes.

The second trimester ultrasound screening is included in the antenatal program free of charge (112). Routines concerning first trimester screening for DS, the CUB-test, differ between counties in Sweden; it can be age dependent, thus, available only for women 35 years or older, or for all pregnant women without any costs while some units charged younger women (<35 years) the full amount. However, invasive diagnostic testing for fetal aneuploidy, CVS and AMC, are mainly offered to women with elevated risk for these conditions.
Antenatal healthcare in Uppsala County, Sweden

There are 20 antenatal centres of different sizes across the county, out of which nine are in the city of Uppsala. The County Council runs thirteen of the centres while private companies own the other seven; however, all of them have financial agreements with the county council, which corresponds to the financing of public maternal healthcare.

All pregnancy ultrasound screening and diagnostic examinations are conducted at the Fetal Medicine Unit at Uppsala University Hospital. This hospital has the only delivery ward in the county with approximately 4,000 deliveries each year, including women referred for specialist care from other counties. A few of the women living in Uppsala County give birth at hospitals in the neighbouring counties. During the period of data collection 2008 – 2012, the mean age of women delivering at Uppsala University hospital was 31 years (range, 15–50) and 42.8% was nulliparous. In Uppsala County, 47% of the women in this age range have more than 12 years of education.

As in other counties in Sweden, all pregnant women in Uppsala County are offered one ultrasound examination, free of charge during the second trimester. Additionally, the first trimester screening for DS, the CUB-test, is offered to women 35 years or older at a cost of 300 Swedish crowns, subsidised by the public health insurance. Women less than 35 years old, who want to have the CUB-test are obliged to pay the full amount which is 1,500 Swedish crowns; they are only offered this possibility when the fetal medicine clinics are fully staffed, meaning that that it is not available to them during the summer. A few privately owned clinics in the city of Stockholm, a distance of 65 kilometres from Uppsala, also offer the CUB-test at full price regardless of the woman’s age.

Invasive diagnostic testing, CVS and AMC, are available to all women at a cost of 300 Swedish crowns regardless of age. In the event of deviant findings at the ultrasound screening or CUB-tests indicating elevated risk for fetal chromosomal anomalies, which in this setting is >1/200, there is no additional charge to the women opting for invasive testing.

Preparing information

At the women’s first visit to the antenatal care midwife, in pregnancy week 5–8, the midwife shall ask them if they want basic information on available fetal diagnostics; if so, this information shall be offered. The issue shall be raised also at the second visit at 12 weeks of gestation when ethical issues and problems that can occur in relation to fetal diagnostics shall also be addressed. Information on available examinations is provided orally, often in combination with receiving a locally developed pamphlet, and if needed, via
a consulting obstetrician. Recommendations are also made to the women to use the non-commercial website 1177.se, run by the public healthcare authorities in Sweden, if they want to search for information on the Internet.

Information about findings
Most often, the person conducting the examination presents the results of prenatal diagnostics to the expectant parents. Sometimes this will be a physician; however, at the second trimester routine ultrasound and first trimester CUB-test, it will most often be a midwife. In the event of deviant findings, the midwives refer the expectant parents to the physician for a second opinion and consultation.

During the study period, the midwives conducting ultrasound examination identifying any deviations with unclear significance, specifically a soft marker, were not supposed to discuss these markers in further detail with the couple; consequently, many of them had a lot of questions but few answers when they left the examination.

In accordance with the standard procedure at the clinic, couples were referred to an obstetrician when a soft marker was detected. These cases were normally seen in addition to the regular outpatient clinic of the obstetricians, which meant that the couple had to wait hours or even days before getting any additional information.
Rationale for this study

The development of pregnancy ultrasound has led to an increased detection rate of fetal anomalies. In many such cases, the examination provides expectant parents the possibility to prepare for special caring needs for their child after birth. However, for some of these findings the effect on the child’s health is ambiguous. Detection of ultrasonographic soft markers is such an example, where the result does not lead to any clear diagnoses but can be used in assessments of risk for chromosomal aberrations in the fetus. This development placed additional demands on the prepared information (40), which shall enhance expectant parents’ informed choice concerning fetal diagnostics, thus, affecting both the work of antenatal care midwives as well as midwives and physicians in the fetal medicine field.

Knowledge is still limited about expectant parents’ needs when ultrasound findings provide an unexpected assessment of risk for fetal chromosomal anomalies, and their decision regarding invasive diagnostic testing in this situation. Moreover, the increased demands in antenatal care for information and support regarding fetal diagnostics require more research that can support new methods to enhance informed decisions.

This study can contribute to previous knowledge about expectant parents’ needs when ultrasonographic soft markers are detected and add new knowledge about its effect on decisions regarding invasive diagnostic testing. Additionally, this study takes a step towards understanding conditions that can enhance women’s decision making regarding fetal diagnostics.
Overall and specific aims

The overall aim of this thesis was to gain a deeper understanding of expectant parents’ experiences when sonographic soft markers for fetal chromosomal abnormalities were detected and their need to acquire knowledge and support to enhance informed decision making regarding routine fetal screening for anomalies. Another aim was to describe the prevalence of soft markers in a Swedish low-risk population and their relation to invasive prenatal diagnostic procedures.

Paper I
To explore women’s experiences when isolated ultrasonographic soft markers were discovered during the routine ultrasound screening. The specific questions were: what did the disclosure mean to the women, how it affected them, how they experienced the information given and why they chose or chose not to undergo amniocentesis?

Paper II
To explore expectant fathers’ experiences when isolated ultrasonographic soft markers were discovered during a routine ultrasound screening. The specific questions were: what did the disclosure mean to the fathers, how it affected them, how they experienced the information given and why they were either in favour of or against an amniocentesis?

Paper III
To investigate the prevalence of soft markers identified during a second trimester ultrasound in a low-risk Swedish population. Secondary aims were to estimate the association between the soft markers and trisomies 13, 18 and 21 as well as the effect on the number of invasive tests performed.

Paper IV
To investigate the potential of a web-based patient decision aid to initiate a process of reflection and conscious decision making in pregnant women concerning screening for fetal anomalies.
Material and methods

<table>
<thead>
<tr>
<th>Aim</th>
<th>Design</th>
<th>Participants</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Exploring pregnant women’s experiences when isolated ultrasonographic soft markers were detected</td>
<td>Qualitative study based on semi-structured interviews</td>
<td>Twelve women who experienced a second trimester ultrasound where an isolated soft marker was detected</td>
<td>Thematic analysis with systematic text condensation</td>
</tr>
<tr>
<td>II Exploring expectant fathers’ experiences when isolated ultrasonographic soft markers were detected</td>
<td>Qualitative study based on semi-structured interviews</td>
<td>Seventeen men who experienced a second trimester ultrasound where an isolated soft marker was detected</td>
<td>Thematic analysis with systematic text condensation</td>
</tr>
<tr>
<td>III Investigating the prevalence of ultrasonographic soft markers and their association with trisomies and invasive testing</td>
<td>Prospective observational study</td>
<td>10,535 women with a total of 10,710 fetuses examined by ultrasound at 15+0–22+0 weeks gestation July 2008 to March 2011</td>
<td>Positive likelihood ratio (LR+) estimated for detection of DS and risk ratio (RR) for undergoing an invasive test after detection of soft markers</td>
</tr>
<tr>
<td>IV Investigate the potential of a web-based decision aid to initiate reflection and conscious decision making in pregnant women regarding screening for fetal anomalies</td>
<td>Qualitative study based on semi-structured interviews</td>
<td>Seventeen pregnant women participating in a RCT and were randomised to the intervention group and had access to a web-based DA</td>
<td>Thematic analysis with systematic text condensation</td>
</tr>
</tbody>
</table>
Papers I and II

Study sample
To explore expectant women and men’s experiences when isolated ultrasonographic soft markers were detected, participants were recruited using a purposive sampling strategy. This is based on the belief that a researcher’s knowledge about the population can be used to hand pick the cases to be included in the sample (113). It implies that participants are enrolled according to preselected criteria relevant to the particular research question.

For the purposes of these studies, we recruited women and men who had attended a second trimester routine ultrasound examination at Uppsala University Hospital where the midwife identified an isolated soft marker, such as CPC or EIF, in the fetus. All participants had been referred to a physician for consultation after the ultrasound examination regarding the findings of soft markers. These ultrasonographic findings were chosen because of their lack of direct pathological significance but indicative of possibly elevated risk for cytotypic abnormalities and thereby lead to diagnostic dilemmas (32). Women and men who had experienced findings of multiple markers or abnormalities with clear pathological significance were not included in this study. For practical reasons, we were only able to include non-Swedish speaking men and women.

Participants for these two studies were recruited during September to December 2007. An additional five men were recruited in September 2009 after an initial analysis for completion and to reach saturation. There were no changes in the routine at the clinic between these two periods of recruitment. A total of 14 women and 24 men were contacted by telephone approximately 2–6 weeks after they had attended the scan and asked if they wanted to participate in an interview regarding their experiences from the ultrasound examination. Both first time expectant parents and parents with previous pregnancies were included. Initially, all women accepted participation but three declined later because of lack of time. Seven of the men who were asked also declined, whereof three stated that they lacked time, and the remaining four did not state any specific reason.

A total of 12 women and 17 men participated in the studies. The women and men were recruited separately for these two studies and were not related to each other. They lived both in the rural and the urban catchment areas of the hospital. They were all born in Sweden except for one man, who was of Middle-Eastern origin. Out of a total of 29 participants, 11 of them decided together with their partner, after detection of the soft marker that they wanted to have an amniocentesis. Background variables of participants in studies I and II are described in Table 2.
Table 2: Characteristics of participants (paper I and II)

<table>
<thead>
<tr>
<th>Interview person</th>
<th>Women N = 12 (I)</th>
<th>Men N = 17 (II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>25 – 36 (median 29)</td>
<td>23 – 45 (median 35)</td>
</tr>
<tr>
<td>Educational status*</td>
<td>(1) 4/11 (36%)</td>
<td>(1) 6/17 (35%)</td>
</tr>
<tr>
<td></td>
<td>(2) 7/11 (64%)</td>
<td>(2) 11/17 (65%)</td>
</tr>
<tr>
<td>First child</td>
<td>7/11 (64%)</td>
<td>6/17 (35%)</td>
</tr>
<tr>
<td>Gestational age when interviewed</td>
<td>25+5 – 30+0</td>
<td>25+5 – 30+5</td>
</tr>
<tr>
<td>Soft marker</td>
<td>7 EFC/5 CPC</td>
<td>12 EFC/5 CPC</td>
</tr>
<tr>
<td>Background risk</td>
<td>1/280 – 1/1507</td>
<td>1/73 – 1/1206</td>
</tr>
<tr>
<td>Risk score after disclosure of marker</td>
<td>1/93 – 1/901</td>
<td>1/93 – 1/901</td>
</tr>
<tr>
<td>Had an AMC</td>
<td>6 yes / 5 no</td>
<td>7 yes / 10 no</td>
</tr>
<tr>
<td>Wanted AMC</td>
<td>4 yes / 7 no</td>
<td>7 yes / 10 no</td>
</tr>
<tr>
<td>Keep child despite DS</td>
<td>6 yes / 3 no / 2</td>
<td>8 yes / 5 no / don’t know</td>
</tr>
</tbody>
</table>

* Educational status: (1) primary school 9 years or/and high school 3 years; (2) college or university education

AMC= Amniocentesis, CPC= Choroid Plexus Cysts, DS= Down Syndrome and ECF= Echogenic Cardiac Foci

Method for data collection

Data were obtained via individual semi-structured interviews using an interview guide (Table 3) to ensure that the same sets of topics were discussed with all participants. Demographic data were obtained from informants during the interview.
Table 3: Interview guide (paper I and II)

<table>
<thead>
<tr>
<th>Main questions</th>
<th>Probing questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>What expectations did you have on the routine ultrasound?</td>
<td>What information did you get about the routine ultrasound?</td>
</tr>
<tr>
<td></td>
<td>Why did you choose to undergo this examination?</td>
</tr>
<tr>
<td>How did you perceive the information given to you by staff?</td>
<td>Can you tell me what the increased risk was that the baby would have chromosomal abnormality?</td>
</tr>
<tr>
<td>How did the information affect you?</td>
<td>How did you experience the information you received about your risk?</td>
</tr>
<tr>
<td></td>
<td>How were you treated by the midwife and the physician?</td>
</tr>
<tr>
<td></td>
<td>Had you wanted them to just ignore the presence of this soft marker?</td>
</tr>
<tr>
<td>Why did you choose/not choose to undergo amniocentesis?</td>
<td>Did the risk for miscarriage influence your decision about amniocentesis?</td>
</tr>
<tr>
<td></td>
<td>What would you have done if the invasive test confirmed a chromosomal abnormality?</td>
</tr>
<tr>
<td></td>
<td>What did you feel when you got a normal test result?</td>
</tr>
<tr>
<td>How do you experience your pregnancy in relation to this event?</td>
<td>How do you feel when you think about it?</td>
</tr>
<tr>
<td></td>
<td>What are your thoughts about the baby?</td>
</tr>
<tr>
<td></td>
<td>Do you think we do more harm than good?</td>
</tr>
</tbody>
</table>

All interviews were scheduled 6–12 weeks after the scan in order to allow for some time after the experience of the ultrasound screening procedure. Twelve interviews were carried out at the hospital, in a quiet room located on a floor other than the ultrasound department. One interview took place at the local antenatal clinic and one in the home of the participant. The remaining three were telephone interviews because of travel distance. Two midwives, experienced in interviewing, conducted the 15–35 minutes long interviews.
Paper III

Study sample
This study included all women living in Uppsala County with fetuses examined by ultrasound at 15+0–22+0 weeks gestation between July 2008 and March 2011. During the study period, a second trimester ultrasound screening was performed on 10,710 fetuses, including 169 sets of twins and three sets of triplets. Women in the study population (n=10,535) had a mean age of 31 (range, 15–50) years, 42.8% (4,507) were nulliparous and 57.2% (6,028) parous. The mean maternal age at examination, for the 625 women who had fetuses with soft markers, was 30 (range 15–44) years, 42.2% (264) were nulliparous and 57.8% (361) parous. The mean gestational age at detection of markers was 17+5 (range 15–22) weeks.

During the study period, 1,709 women underwent a first trimester CUB test for trisomies, which corresponds to 16% of the study population. Within this group, 13 cases of DS, three trisomy 13, one trisomy 18, one Klinefelter syndrome, one Turner syndrome and one case of triple X syndrome were identified. Moreover, two other cases of DS and one case of trisomy 18 were diagnosed in the first trimester. All pregnancies with trisomies underwent a termination of pregnancy (TOP). Second trimester biochemistry tests for fetal chromosomal abnormalities were not performed during the study period.

Study variables
The soft markers included in this study were echogenic intracardiac focus, choroid plexus cysts, pyelectasis, thickened nuchal fold and hyperechogenic bowel (Table 4). Ultrasonographic markers were considered isolated when not associated with other markers or structural anomalies.

Other possible soft markers such as absent nasal bone and single umbilical artery were not included since they were not part of the routine second trimester scan at the unit. Ventricomegaly was defined as a structural abnormality. Short femur and humerus were routinely measured but not included in the study because of the variation in definitions (114, 115).

According to the policy at the Fetal Medicine Unit, the women’s age related risk for DS was multiplied by 3 when an isolated EFC was detected and with 1.5 for CPC.
Table 4: Overview of fetal ultrasonographic soft markers discussed in this thesis (12)

<table>
<thead>
<tr>
<th>Soft marker</th>
<th>Definition</th>
<th>Associations with fetal trisomies</th>
<th>Risk increase LR+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echogenic intracardiac focus (EIF)</td>
<td>One or more focus of echogenicity in heart chamber, equal to bone</td>
<td>Trisomy 21 (possibly also trisomy 18)</td>
<td>3</td>
</tr>
<tr>
<td>Choroid plexus cysts (CPC)</td>
<td>Uni- or bilateral cysts, ≥2 mm</td>
<td>Trisomy 18 (possibly also trisomy 21)</td>
<td>10</td>
</tr>
<tr>
<td>Pyelectasis (PL)</td>
<td>Renal pelvis ≥ 4mm</td>
<td>Possible but no significant association with aneuploidy</td>
<td></td>
</tr>
<tr>
<td>Thickened nuchal fold (ThNF)</td>
<td>≥ 5 mm in gestational weeks 16–17 and ≥ 6mm in weeks 18–22</td>
<td>Trisomy 21</td>
<td>17</td>
</tr>
<tr>
<td>Hyperechogenic bowel (EB)</td>
<td>Homogenous areas of echogenicity equal or greater than surrounding bone</td>
<td>Trisomy 21</td>
<td>6</td>
</tr>
</tbody>
</table>

Data collection

Ultrasound findings were registered in the women’s medical records, and cases with soft markers were documented and compiled in a local database at the fetal medicine unit. Results from the invasive testing and data on pregnancy outcome cases with soft markers were retrieved from the hospital records.

Fetuses and infants with DS were diagnosed via the department of clinical genetics at Uppsala University Hospital, where all chromosomal analyses in the county are performed. Women giving birth outside the county were followed up through the National Birth Defect Register. Out of all identified cases with soft markers, only one was lost to follow-up because the woman moved abroad before giving birth. Data on the study population concerning age and frequency of invasive testing, CVS and AMC, were retrieved from the hospital’s local statistical records.
Paper IV

This web-based DA concerning screening for fetal anomalies is currently tested in a randomised controlled trial. The DA, which was designed for this project, was inspired by a DA pamphlet previously tested in an Australian study (92) based on the Ottawa decision framework (100); furthermore, consideration was given to recommended quality criteria for DAs in healthcare published by the International Patient Decision Aid Standards (IPDAS) Collaboration (105).

The DA is divided into four main modules; two modules focusing on facts, the first ‘About fetal diagnostics’ with information about the various risks with different methods, benefits and consequences, and the second ‘Likelihood of anomalies’ describing likelihood of certain results based on the individual’s \textit{a priori} risk. A third module related to ‘Expectant parents’ stories’, i.e. narratives that provide illustrative examples of others’ experiences relevant to the decision (116), and finally a fourth module with interactive ‘Worksheets’ with specific exercises aiming to clarify one’s own values as well as acts as a guide in decision making.

The research team produced the portal with the DA in collaboration with a qualified web designer and professionals at the fetal medicine unit. Information was also adapted to prevailing routines at the unit. This web-based DA is divided into four main modules: Knowledge about fetal diagnostic, Likelihood of anomalies, Expectant parents’ own stories and Working material with worksheets, as described in Table 5.

Users are guided through the DA and prompted to read more about the specific methods for fetal screening that they were interested in. A link to the fetal medicine unit’s homepage was inserted in connection with the information about available tests.

The researchers who prepared the DA have several years of experience in providing information to expectant parents about prenatal diagnosis. Experts within the field of fetal medicine and genetic counselling also reviewed the tool. The DA was pilot tested on paper with a total of six women, and the online version with an additional three women and one man, after which minor changes were made.
Table 5: The components of the web-based DA with headings, sub headings and short descriptions of the content.

<table>
<thead>
<tr>
<th>Heading</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facts: Knowledge about fetal diagnostic</td>
<td>Table with short information on - What tests are offered - What time in pregnancy the different tests are performed - What information the tests can provide - Any risks associated with the tests and what the costs are</td>
</tr>
<tr>
<td>What do the results mean? Likelihood of anomalies</td>
<td>- Different ways of describing risk figure, as numbers and as images - Information and examples on what high and low risk for DS are in real figures</td>
</tr>
<tr>
<td>Expectant parents’ own stories</td>
<td>- Four different fictional stories in 150–200 words on how the couples think, their choices, and possible consequences of their choice</td>
</tr>
<tr>
<td>Worksheets What is valuable for you?</td>
<td>- Sets of prompts regarding personal opinions on what high or low risk is, and the value of such information - Worksheets intended to promote awareness of one’s own values, risk perception and understanding of risk figures - Information on how to assess one’s own age related risk for carrying a fetus with Down syndrome (DS) with the help of a diagram on risk for DS at different ages - Series of claims on personal values that users are requested to take a stand on</td>
</tr>
</tbody>
</table>

Study sample
Participants for this study were initially recruited by their antenatal care midwife in Uppsala County, Sweden, between January and March 2013 to participate in a randomised controlled trial (RCT), to test a web-based decision aid developed for this project. Inclusion criteria were: having a personal e-mail address, fluent in Swedish, wanting information about screening for fetal anomalies and being randomised to the intervention with the decision aid.

A purposive sample of a total of 24 women was contacted 4–8 weeks after the mid-trimester ultrasound screening and asked if they had visited the website, used the decision aid and if they wanted to participate in an interview about their experiences. This time point was chosen in order to allow for any diagnostic procedures to be completed.
The first six women were approached by mail; the other 18 were contacted by telephone. All six, contacted via mail, declined participation; of those contacted by telephone, only one declined because of medical reasons. Twelve of these women said they had used the decision aid and were invited to an in person interview, which eleven accepted, whereas one preferred to be interviewed by telephone. Short telephone interviews were conducted with the six women who had not used the decision aid. Gestational age at the time of the interview was between 24 and 30 weeks. Characteristics of the participants are presented in Table 6.

The first six women were approached by mail; the other 18 were contacted by telephone. All six, contacted by mail, declined participation; of those contacted by telephone, only one declined because of medical reasons. Eleven of these women had used the DA and were invited to a face-to-face interview, which ten accepted, whereas one preferred to be interviewed by telephone. In addition, short telephone interviews were also conducted with the six women who had not used the DA.

Table 6: Background variables for women participating in the interviews: users of the decision aid and non-users (paper IV)

<table>
<thead>
<tr>
<th>Characteristics of participants (N=17)</th>
<th>Users (11)</th>
<th>Non-users (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong> (years)</td>
<td>23–36</td>
<td>21–39</td>
</tr>
<tr>
<td></td>
<td>(median 28)</td>
<td>(median 30)</td>
</tr>
<tr>
<td><strong>Social status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cohabiting</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>63.6%</td>
<td>66%</td>
</tr>
<tr>
<td>Married</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>36.4%</td>
<td>33%</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school or/and high school 10–12 years</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>27.3%</td>
<td>33.3%</td>
</tr>
<tr>
<td>College or university education 1–3 years</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>9.1%</td>
<td>16.7%</td>
</tr>
<tr>
<td>College or university education &gt;3 years</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>63.6%</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Number of previous pregnancies</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nulliparous</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>45.5%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Multiparous</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>54.5%</td>
<td>66.6%</td>
</tr>
<tr>
<td><strong>Examinations in present pregnancy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CUB-test</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>0.36%</td>
<td>0</td>
</tr>
<tr>
<td>CVS or AMC</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>16.7%</td>
</tr>
<tr>
<td>Mid trimester ultrasound</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Method for data collection

The interviews with women who used the decision aid were conducted while sitting in front of the computer, guided by the website and the interview guide (Table 7). The interviews with the users of the decision aid lasted 20 to 48 minutes (median 33.7 minutes) each, and the telephone interviews with non-users lasted 3 to 5 minutes. All interviews were recorded and transcribed verbatim.

Table 7: Interview questions for users of the decisional aid and for non-users (paper IV)

<table>
<thead>
<tr>
<th>Main question to users</th>
<th>Probing questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>While watching the website, can you tell me how you felt and what you thought when using this tool?</td>
<td>- How did you perceive this part?</td>
</tr>
<tr>
<td></td>
<td>- Is there any information here that you did not receive elsewhere?</td>
</tr>
<tr>
<td></td>
<td>- Do you have any suggestions on how to improve the features of this website?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Main question to non-users</th>
<th>Probing questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Why didn’t you use the decision aid?</td>
<td>- From where did you receive information about the tests?</td>
</tr>
</tbody>
</table>

Data analysis

Paper I, II and IV

Qualitative analysis of data means that the researcher develops knowledge from participants’ experiences by interpreting and summarising the organised empirical data (117, 118). There are several methods described for conducting qualitative analysis of data in healthcare research as well as underlying theories (113). For the purpose of exploring the experience of the participants in these three studies, interview data were analysed following Malterud’s principles of Systematic text condensation (STC) (117), which is inspired by Giorgi’s phenomenological method for analysis (119).
Malterud describes STC as ‘a descriptive approach presenting the experience of the participants as expressed by themselves rather than exploring the underlying meaning of what is said’. Similar to phenomenology, STC explores the life world of a limited group of people, while it differs from Giorgi’s phenomenology in the sense that STC is governed by the research question; therefore, text units not relevant to the research question are excluded in the analysis.

The analytic process in STC is described by Malterud in four main steps (Table 8). First, all interviews are read as a whole to obtain an overall impression while bracketing previous preconceptions. After identification of preliminary themes relevant to the research question, researchers discuss their separate understanding of content and meaning of the themes.

Second, meaning units are identified by reading the transcripts in search of statements containing some information relevant to the research question. These statements are thereafter coded to connect related meaning units in groups. Third, meaning units are condensed and abstracted by rewriting the content of each of the coded groups as well as emerging subgroups as a story told by one person. Fourth, the contents of each code group are synthesised to generalise descriptions and concepts that can elucidate the study question by presenting the most salient content in a narrative. Subsequently, these descriptions are compared with the unbroken original interview text to ensure that the designated themes and categories fit the data.

By documenting each step taken during the analysis, decisions can be easily followed throughout the entire process. This enables the researcher to go back and forth through the analytic steps from selected meaning units to the condensed meaning of themes, which will be the basis for the final descriptions of the results.

It is emphasised by Malterud that analysis shall be conducted by more than one researcher in order to create a larger analytic space and thereby enhance the analytic process (117). Therefore, to achieve a strong dependability in our results, the steps in the analysis were conducted by the researchers separately and thereafter discussed together until agreement was reached on the meaning and descriptions of the result from our interviews.
Table 8. The four steps of the analysis process in systematic text condensation according to Malterud (117)

<table>
<thead>
<tr>
<th>Steps in data analysis</th>
<th>An example from the data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Read transcripts to get a total impression of the data</td>
<td><strong>The impression</strong>: Women related to their previous experiences and knowledge when they talked about new knowledge and ideas gained from using the DA. The effect of preunderstanding</td>
</tr>
<tr>
<td>→ Preliminary themes</td>
<td></td>
</tr>
<tr>
<td>2 Identify and sort relevant text units i.e. meaning units</td>
<td><strong>Text unit</strong>: 'When we continued reading, we thought there’s not really that much you can find out about, except well, it was Down’s syndrome (...) And I don’t think that Down’s syndrome is so bad if my child should have that'.</td>
</tr>
<tr>
<td>→ Meaning units are sorted to create code groups</td>
<td><strong>Code group</strong>: Significance of earlier experiences and knowledge</td>
</tr>
<tr>
<td>3 Condense the meaning in each code group as if it is a story told by one person</td>
<td><strong>Abstraction</strong>: I understood that the test would not give us any information apart from possible DS and I don’t think that’s such a serious condition.</td>
</tr>
<tr>
<td>→ The meaning of code is clarified through abstraction</td>
<td><strong>Meaning</strong>: New knowledge about the test and the woman’s preconception affected her view.</td>
</tr>
<tr>
<td>4 Summarizes the essence of each code group to a synthesis</td>
<td><strong>Essence</strong>: New knowledge gained from the DA was comprehended in the light of earlier understanding regarding DS.</td>
</tr>
<tr>
<td>→ Validate the result by re-reading transcripts</td>
<td><strong>Validation of results</strong> confirmed that the code group matched statements in the interviews and that the theme recurred in most of the other interviews.</td>
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</table>
Data were analysed using descriptive statistical methods. Prevalence of soft markers was calculated and cases with soft markers were compared with non-cases, to describe the incidence of fetal trisomies and invasive tests. Since there were no cases of trisomy 13 or 18 detected in fetuses without structural abnormalities during the study period, this comparison was only possible for DS. Data were also analysed to estimate the positive likelihood ratio (LR+) for the detection of DS and the probability of women choosing an invasive test after detection of fetal soft markers.

Incidence describes the number of disease occurrences or events in the population while prevalence, according to Rothman, is commonly used when describing the proportion of individuals with certain characteristics or conditions other than diseases (63). Given that soft markers have little or no pathological significance, their occurrence is in this thesis described as prevalence while the occurrence of fetal trisomies and number of invasive testing after detection of fetal soft markers is calculated as incidence proportion.

Likelihood ratios are used for assessing the sensitivity and specificity of a test and to determine whether a test result usefully changes the probability that a condition exists. Sensitivity is a measure of false negative test results while specificity measures the proportion of false positive test results, giving information on the value of performing a test. Results are considered as being significant if the calculated confidence interval (95%) does not include the figure one.

The probability of women choosing an invasive test after detection of fetal soft markers is expressed here as relative risks (RR), which is calculated as ratios between incidences of invasive testing in women carrying fetuses with markers, and women who did not. A 95% confidence interval for the relative risk was estimated using the method described by Mantel and Haenszel (63).

Ethical considerations
Researchers are obliged to respect the rights of all individuals participating in research projects i.e. participation must be voluntary, informed consent must be obtained, participants must be treated with dignity and respect and they must not be harmed (120). Researchers must also assure participants’ confidentiality. These rights are explained by Beaucamp and Chikdress (121) within four guiding principles: autonomy, beneficence, non-maleficence and justice. The principles imply that researchers are obligated to respect participants’ free, independent choices, to avoid causing harm and
weigh the good derived from research against the potential harm. The principle of justice involves an obligation that the research procedures are fair and just.

Integrity, one of the key components, needs special attention when conducting interview studies with a small number of participants. In the presentation of our results, we assured that no data could be connected to any of the participants. Participants’ confidentiality has been prioritised in all reporting of the study findings. Moreover, when conducting these interviews, it was foreseen that participants might reveal strong emotions and personal concerns. Given that the interviews were conducted by two certified midwives having experiences in such situations, we were prepared for this.

In compliance with the ethical principles presented by the Helsinki Declaration regarding informed consent (122), participants in the interview studies, papers I, II and IV, were provided written information about the study aim and procedure and informed that participation was voluntary. They were also informed that they were allowed to stop the interview at any time if they did not want to continue. Informed consent was provided verbally prior to the interview.

However, a departure from the requirement of participant’s informed consent is generally made in epidemiological research, arguing that refraining from the requirement is necessary in order to make important epidemiological research possible (120). According to Swedish law (123), it is possible to do this when patients have explicitly consented to register data being gathered about them based on patient record extracts or when anonymised data files are created with no possibility to identify individual persons, i.e. no code list exists. Ethical audit for approval of the research is a general rule to ensure that the research fulfils the standard requirement.

Ethical approval was obtained from the Regional Ethics Committee at Uppsala University, papers I and II: dnr 2006/296, paper III: dnr 2008/163, paper IV: dnr 2012/062.
Summary of findings

Here I have chosen to present a summary of the most important findings in the four papers included in this thesis.

Papers I and II
The analysis of the interviews regarding expectant parents experience when a soft marker was detected at routine ultrasound screening showed that 1) the detection of soft markers created strong emotional reactions, especially in the women, 2) they had little remembrance of any information given and neither women nor men were aware of the potential of the screening ultrasound, 3) they had difficulties apprehending the screening results and 4) that the father was strongly engaged in the decision making regarding fetal screening and the women appreciated their engagement.

Detection of soft markers created strong emotional reactions
Several women experienced serious discomfort when they were told about the soft marker and the increased risk for a chromosomal defect. They describe it in words like ‘traumatic’, ‘shocking’ and ‘very unpleasant’. The hours or days of waiting for more information had in their opinion created a lot of unnecessary worry and frustration. The men in the same situation also expressed confusion from not receiving any facts to help them make sense of the risk figures as well as a strong concern about their partner’s reaction. Most remarkable, though, was that several of the women and one man said they would rather not have known about the soft marker at all. Either they had already decided they did not want a risk assessment for chromosomal aberrations or they thought the information caused anxiety although the risk figure given was low.

Expectant mother:
‘The doctor finished by saying, “I don’t think you should worry”, but hey, it’s too late. Once you have gotten such a process started, it doesn’t matter what people say (...) for me it was a real catastrophe’.
Women and men did not take part of any preparing information

Most of the parents in these studies said they had little previous knowledge about the second trimester ultrasound, and only one had heard about soft markers before. None of the men recalled getting any information from the antenatal care midwife about the ultrasound. Although most women said that they had received written information not all had actually read it and few remembered any verbal information given at their antenatal clinic. The reason the women provided was that the information was given so far in advance of the ultrasound and that it did not seem to concern them at the time. Several women stated that most of their knowledge about the pregnancy ultrasound was based on stories from friends or from the Internet.

Expectant father:
‘That I don’t remember (any preparing information) but I have friends who have children. I've heard about it so some idea of it I believe I had created, I guess’.

Both women and men were all very upset by the insufficient information given during the examination. The women were also dissatisfied with the following consultation with the physician. Most of them felt that it was insufficient, and several of these women turned to friends or relatives for support. While the majority of the men said they relied on the facts that were given by the physician, they had felt very frustrated during the time when they were waiting for the consultation, and it was not until they got a hold of the facts that they were really able to deal with the situation.

The screening result was difficult to apprehend

Both women and men expressed difficulties in making sense of the information given regarding the screening results. Women related to previous experiences and events when they talked about their apprehension of the findings; earlier ultrasound examinations, or close friends who had experienced traumatic events during pregnancy caused fear of negative outcomes in general. Although they did not perceive the risk figure they had received as high, they felt that there was something abnormal that necessitated further examination. Several women had also sought more knowledge by asking other parents what their recommendations were, how common such markers were, and what was expected of them in such a situation. Some also contacted friends working in the medical field for advice and support or search the Internet for information. Moreover, some women suggested that information about soft markers before the scan might have made it easier to understand what the findings meant. At the same time, they thought that too much information in early pregnancy also could cause unnecessary worry.
Apprehending the risk figures had been complicated also for the men, and they did not know what to do with this information at first. Although they initially felt that there was a very high risk of something being wrong with the child, this changed when they received additional information and had time to reflect on what these figures really meant. A few of the men who had been informed about the name of the marker said it had enabled them to research on the Internet for facts and thereby they had gained some reassurance that this marker was not such a serious condition.

Expectant father:
‘If you have 60 lottery tickets, one with 10 million and the rest are blank. How big do you think the chances are that you get that one? Now, it’s the other way around (...) suddenly you think this is the only thing that can happen’.

Also, most of the men expressed great satisfaction with the doctor’s appointment, during which the information they needed was provided and their questions were answered. Even though the men strived for control, they were aware that it was impossible to have full control over the outcome of a pregnancy and most of them had put the thoughts about the soft marker aside and did not worry anymore. Still, several men had some doubts about the significance of the findings, even some of those who had a diagnostic test that showed the chromosomes were normal.

Men were involved in decision making and women wanted them to be
The men were immensely engaged in decisions regarding possible amniocentesis and most women also emphasised the importance of their partner’s involvement. The interviews showed that this decision was not only affected by the women’s view, but also by the partner’s own experiences and thoughts. All men talked about this as a joint decision where their opinion was also considered. Still, a few pointed out that the woman’s opinion was especially important because as they said, ‘it’s her body’. Although some wanted a diagnostic test to remove any doubts and thereby reduce their own or their partner’s anxiety, not all were convinced that they would have gone through an abortion in case of a positive test result. Others who had a clear personal conviction against abortion saw no reason for undergoing an AMC.

Expectant mother:
‘My husband was really calm and like “there is always a risk”. He handled it well and absolutely did not think we should do the amniocentesis’.

While one man was very upset about what he perceived as a suggestion from the doctor concerning amniocentesis, others wanted the doctor’s advice.
Even though this advice was expressed in very vague terms, it was considered to be supportive regardless of whether the couple had accepted or declined the offer. The men were aware that amniocentesis increased the risk of miscarriage, but despite this some had no hesitation to do the test because they felt that they relied on the doctor’s competence that ‘this was a safe thing’.

Paper III

The focus of this paper was to investigate the prevalence of ultrasonographic soft markers and their association with trisomies and invasive testing. The main finding shows that detection of soft markers was common during the second trimester ultrasound. Although associations estimated as LR between the markers and DS were positive, it was only statistically significant for ‘any marker’ (isolated, multiple or combined with anomaly). A high increase in the number of invasive tests was found when soft markers were also detected in pregnancies with an isolated marker.

**Figure 1:** Flowchart with prevalence of soft markers detected at the ultrasound screening in the second trimester, number of invasive tests (including tests done in first, second and third trimester), cases of DS and pregnancy outcome. EIF means echogenic intracardiac focus, CPC plexus chorioideus cysts, PL pyelectasis, EB hyperechogenic bowel and ThNF thickened nuchal fold.

**Prevalence of soft markers**

Findings showed that soft markers were detected in 5.9% (626 / 10,710) of the fetuses at the second trimester ultrasound screening; in 5.1% (545), the markers were isolated; in 0.7% (70), multiple and in 0.1% (11), combined with anomalies. In one twin pregnancy, isolated markers were detected in both fetuses. The most common marker identified was EIF, which accounted for 46.2% of all markers, followed by CPC (32.6%), pyelectasis (16.0%), EB (3.3%) and ThNF (1.9%).
**Likelihood ratio (LR+) for trisomies**

This study showed that the total incidence of trisomy 21, including the number of cases detected in the first trimester, was 0.28%. Among those who underwent a second trimester ultrasound screening, the percentage of DS fetuses/infants was 0.16% (17 / 10,710), seven of these had soft markers. Trisomy 18 was diagnosed in four cases; all had multiple anomalies whereof one also had CPC. No cases of trisomy 13 were diagnosed.

All soft markers showed a positive likelihood ratio (LR+) for DS; however, the association was only statistically significant for ‘any marker’ (isolated, multiple or combined with anomaly).

**The increase of invasive tests after detection of soft markers**

The incidence of invasive tests for aneuploidy after the second trimester ultrasound was 26.2% (135 / 544) in pregnancies with isolated soft markers compared with 1.1% (103 / 9,910) in pregnancies without markers (p < .001), with a risk ratio (RR) of 24.0 for invasive testing. The corresponding figure for pregnancies with multiple markers was 61.0. No incidents of premature rupture of membranes or miscarriages related to the invasive tests were recorded.

**Table 9: The number of fetuses with soft markers and positive likelihood ratio for Down syndrome (DS)**

The percentage (%) concerns the number of fetuses with soft markers in relation to the total number of fetuses examined (10,710). No DS cases were recorded in combination with isolated choroid plexus cysts, echogenic bowel and thickened nuchal fold.

<table>
<thead>
<tr>
<th>Marker</th>
<th>n</th>
<th>%</th>
<th>DS (n)</th>
<th>LR+</th>
<th>95 % CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolated pyelectasis</td>
<td>85</td>
<td>0.8%</td>
<td>2</td>
<td>20.4</td>
<td>-5.8 – 46.6</td>
</tr>
<tr>
<td>Isolated echogenic intracardiac focus</td>
<td>270</td>
<td>2.5%</td>
<td>2</td>
<td>6.4</td>
<td>-1.7 – 14.6</td>
</tr>
<tr>
<td>Isolated marker (total)</td>
<td>545</td>
<td>5.1%</td>
<td>4</td>
<td>5.6</td>
<td>0.94 – 10.3</td>
</tr>
<tr>
<td>Multiple marker</td>
<td>70</td>
<td>0.7%</td>
<td>2</td>
<td>24.9</td>
<td>-7.1 – 56.9</td>
</tr>
<tr>
<td>Marker combined with anomaly</td>
<td>11</td>
<td>0.1%</td>
<td>1</td>
<td>91.7</td>
<td>-88.8 – 272.2</td>
</tr>
<tr>
<td>Any marker (isolated, multiple or combined with anomaly)</td>
<td>626</td>
<td>5.9%</td>
<td>7</td>
<td>7.1</td>
<td>3.0 – 11.2*</td>
</tr>
</tbody>
</table>

* Statistically significant
**Table 10:** Risk ratios (RR) for invasive tests in women with fetuses with and without markers at the second trimester ultrasound.

<table>
<thead>
<tr>
<th>Invasive tests before and after second trimester screening</th>
<th>Tested before</th>
<th>Not tested before</th>
<th>Tested after</th>
<th>RR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>10,535</td>
<td>514</td>
<td>10,021</td>
<td>291</td>
<td></td>
</tr>
<tr>
<td>No markers</td>
<td>9,910</td>
<td>483</td>
<td>9,427</td>
<td>103</td>
<td>1.1%</td>
</tr>
<tr>
<td>&lt; 35 years</td>
<td>7,914</td>
<td>129</td>
<td>7,785</td>
<td>85</td>
<td>1.1%</td>
</tr>
<tr>
<td>≥ 35 years</td>
<td>1,996</td>
<td>354</td>
<td>1,642</td>
<td>18</td>
<td>1.1%</td>
</tr>
<tr>
<td>Isolated marker</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population</td>
<td>544</td>
<td>29</td>
<td>515</td>
<td>135</td>
<td>26.2%</td>
</tr>
<tr>
<td>&lt; 35 years</td>
<td>428</td>
<td>8</td>
<td>420</td>
<td>107</td>
<td>25.5%</td>
</tr>
<tr>
<td>≥ 35 years</td>
<td>116</td>
<td>21</td>
<td>95</td>
<td>28</td>
<td>29.5%</td>
</tr>
<tr>
<td>Multiple markers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population</td>
<td>70</td>
<td>1</td>
<td>69</td>
<td>46</td>
<td>66.7%</td>
</tr>
<tr>
<td>&lt; 35 years</td>
<td>57</td>
<td>0</td>
<td>57</td>
<td>36</td>
<td>63.2%</td>
</tr>
<tr>
<td>≥ 35 years</td>
<td>13</td>
<td>1</td>
<td>12</td>
<td>10</td>
<td>83.3%</td>
</tr>
<tr>
<td>Marker combined with anomaly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population</td>
<td>11</td>
<td>1</td>
<td>10</td>
<td>7</td>
<td>70.0%</td>
</tr>
<tr>
<td>&lt; 35 years</td>
<td>10</td>
<td>0</td>
<td>10</td>
<td>7</td>
<td>70.0%</td>
</tr>
<tr>
<td>≥ 35 years</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>Any marker (isolated, multiple, or combined with anomaly)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Population</td>
<td>625</td>
<td>31</td>
<td>594</td>
<td>188</td>
<td>31.7%</td>
</tr>
<tr>
<td>&lt; 35 years</td>
<td>495</td>
<td>8</td>
<td>487</td>
<td>150</td>
<td>30.8%</td>
</tr>
<tr>
<td>≥ 35 years</td>
<td>130</td>
<td>23</td>
<td>107</td>
<td>38</td>
<td>35.5%</td>
</tr>
</tbody>
</table>

*Number of invasive tests before second trimester ultrasound in women with no markers was only available for the whole group but not for the separate age groups, < 35 years and ≥ 35 years. This was assumed to be the same as in women with fetuses with any markers (isolated, multiple or combined with anomaly) i.e. 1.6% and 17.7%, respectively.*
The analysis of interviews with women who had used the web-based decision aid showed that the women appreciated the information being briefly but clearly described, that the DA was easily accessible on the Internet and that it came from a reliable source. Women also felt they were able to take in the new knowledge obtained and incorporate it with their prior experiences. Reading the expectant parents’ stories seemed especially instrumental in making women more aware of their own standpoint. The DA allowed for clarification of their own thoughts and priorities and helped them to understand the significance of the screening result, which also made them aware that abnormal findings could involve difficult decisions. Using the tool initiated discussions with the woman’s partner, thus making them more aware of their partner’s view.

**Appreciated for being reliable and for giving easily accessible information**

It was obvious that the women in this study were experienced Internet users and that they had no problem finding their way to the parts of the decision aid they were interested in. For these women it was important that information was readily accessible online, and some of them pointed out that they wanted the information immediately without having to search for it; therefore, the way the website was structured was essential to them. They seemed surprisingly aware of and sensitive to the graphic features of the website. Especially important to them was that: there was not too much text on a page, thus requiring them to scroll; the text was subdivided into sections easy to browse; and it was straightforward to navigate the site. The generic brochure the women were given from the antenatal health care midwife was described as being less attractive because of the layout, which lacked both pictures and colours. It was also much appreciated that the decision aid felt reliable, which was supported by the link to the fetal medicine unit. The women mentioned that they had searched on Google for facts relating to pregnancy, but mainly ended up on chat sites, with information that could not be relied upon.

**Expectant mother:**

'Because it feels good when you have a webpage that you can rely on ..., of course, one can read in chat forums and places like that. But it's not the same, and with these kinds of things, you really want it to be something from an institution or something like that'.
**Incorporated new knowledge with earlier understanding**

Although all the women had acquired some information on prenatal testing prior to the offer of the decision aid, they found the website to be informative. The decision aid had helped them to understand more clearly what the tests were about, both the differences between the tests, but also the implications for performing the tests. The women recognised that test results comprising risk figures were difficult to understand but noted that when described both in words and in images, it became more obvious to them what these figures meant, not only the degree of the risk but also that it was not a ‘yes or no’ answer.

Expectant mother:

‘It was very good information …that it is nothing you know for sure’.

The explanations of risk figures in images were much valued by the women and they pointed out that understanding the risk figures was especially important because of the seriousness of the matter. Also, one woman, who claimed she was knowledgeable in statistics appreciated that the risks were presented both as numbers and images.

In discussing the different options, the women repeatedly returned to their own previous experiences while simultaneously referring to knowledge gained from using the decision aid. In their reasoning, new knowledge was incorporated into previously obtained information as well as personal values and experiences that all jointly influenced their decision. One woman referred to her previous pregnancy, where the fetus had a serious and rare condition, and said she felt that her fetus could be affected regardless of any level of estimated risk. The only test of value to her was a diagnostic test and no additional information could have changed that.

Expectant mother:

‘Whether I’m one out of twenty thousand or two hundred, it does not matter. My child will have Down’s syndrome regardless’.

**The DA initiated reflections about women’s own standpoint and discussions with their partner**

The decision aid affected the women’s decision making process about fetal screening by the fictional stories of different couple’s mode of reasoning, giving them examples of different paths of action, using the worksheets to clarify their own standpoint.
The stories in the DA on different couples' experiences where especially appreciated. Women said that when encountering difficult situations they wanted to know what other people in a similar situation thought, and reading the expectant parents’ stories on the website made them more aware of their own standpoint. These stories also made them realise that there are no right or wrong approaches in these decisions. One woman said that it was especially important for her to see that couples in these stories based their decisions on personal values; therefore, she felt that this really was a matter of her own choice.

Expectant mother:
‘To learn from other people's stories, it is more meaningful. It's sort of more real, (...) you can relate. One may start thinking, okay, what would we do and how would we react and what is it that we may need to talk about’.

Women also expressed that using worksheets had enabled them to put their thoughts and beliefs into words. Furthermore, women, who had decided upon which test to take before they had access to the website, appreciated that the use of this website made them more convinced that they had made the right decision.

Using the DA had for some also initiated discussions with their partner, which was much appreciated. In four cases they had reviewed the website together; in two cases the woman and her partner did it separately while other women did it by themselves and discussed with their partner afterwards. One woman said that the discussion revealed differences in opinions between her and her partner, which she felt was important for them to know. Some women also pointed out that the DA clarified the fact that prenatal tests could provide information leading to a situation where they would have to make a decision regarding termination of pregnancy which would have been difficult.

Expectant mother:
‘My partner and I went through this together too, you could see if you both thought the same way, or if you had different views for it can also be a good basis to discuss.. where one stands’.

Although women believed they knew what their standpoints were in case of abnormal findings, they realised that they could not be absolutely certain before they actually received such a result. One woman stressed the importance of raising these questions in the information to emphasise that choosing to participate entails being prepared to make a decision.
Those who did not use it do not believe they needed more information

Women who chose not to use the web based decision aid when offered believed they already had sufficient knowledge to make a decision about the different tests. They either had knowledge from earlier pregnancies or they felt that the information from the midwife was adequate. One woman said that talking to friends with recent experiences had given her the information she needed.

Expectant mother:
‘You have so many acquaintances who are pregnant and have been. And we talk to each other and in that way, you will get information in like other ways’.
Methodological considerations

Papers I, II and IV

Data collection and analyses
In these three interview studies, data were collected by conducting semi-structured interviews. This means that the researchers had drafted an interview guide, which helps the interviewer to focus on the theme that the research wants to elucidate. Although the research question is limited to a certain situation, probing questions are most important to reach a deep understanding of how a particular person experienced the situation in question.

For the qualitative analysis of the interview data obtained for papers I, II and IV in this thesis, the method of STC (124) was chosen. There are several other methods for analysis of qualitative interview data used by healthcare researchers (113) such as qualitative content analysis (125), the Grounded Theory method (126) and Giorgie’s phenomenological approach (119). Although these have much in common with STC, they differ with regard to the purpose; therefore, the research question must determine the choice of method for data analysis.

Giorgie’s phenomenological analysis strives for the essence of a phenomenon and aims to describe a deeper meaning of what participants experience (113, 119), while Grounded Theory aims to generate a theory that explains the problem of the situation in question. In turn, STC, like content analysis, uses a descriptive approach that intends to describe the experience of the participants as expressed by themselves (118). Nevertheless, Malterud claims that STC, similar to other qualitative methods of analysis, shares the foundation of life-world experience as valid knowledge but comprises no search for deeper meanings (118).

Quality criteria in qualitative research are commonly expressed in terms of: 1) credibility, which refers to confidence in the truth of the data; 2) dependability, referring to the stability of data and 3) transferability, the extent to which findings can be transferred to other settings or groups (113). These concepts are used here when discussing methodological issues concerning the three interview studies included in this thesis.
Credibility
In papers I and II, we chose to interview the men and women separately, avoiding the risk of influencing their statements by the presence of their spouse, which could have affected the credibility of this study. Credibility was further strengthened by the use of an interview guide, ensuring that the same areas would be covered in all interviews for each of the studies.

In paper IV, the aim was to focus on women’s experience and the feasibility of the decision aid, not their impression of the information they received concerning fetal screening, in general. To help women focus on the decision aid during the interview, conducting the interview with the decision aid on the computer screen in front of us was supportive. The fact that almost three months had passed since women received access to the decision aid also helped women recollect their thoughts and actions at the time when they first used the website.

Most of the interviews were conducted in a quiet room at the hospital premises, but participants were also offered the possibility of being interviewed at their home or by telephone which made it possible for them to choose a location where they felt most comfortable.

The researchers conducting the interviews and participated in data analysis were experienced midwives, and familiar with the fetal medicine context. The in-dept understanding and prolonged engagement in the area of research can according to Lincon and Guba enhance the credibility (127).

Dependability
One of the main advantages of STC is that the method is thoroughly described so that the analytic steps can be easily followed in a group of researchers and a clear decision trail can be presented (Table 8) which strengthen the dependability of the studies (124).

The step of condensation, where abstracts of all meaning units in a code-group are treated together and described as a story told by one person, is most significant in STC. When systematically abstracting meaning units and creating narratives from participants’ experiences both similarities and divergences will become most obvious and different aspects of the cod-group will thereby become clear. In this step of condensation, the researchers will also detect if the code-group consist statements that are recurrent and strong enough to be considered as a theme in the data, contributing to dependability.
Finally, all the authors of the separate papers analysed the data individually and then contested each other’s analysis with their different perspectives until a consensus was reached. This has been of great benefit when communicating findings between authors involved in the project. Moreover, this practical approach has given the researcher a strong reliance on the results, which also strengthens the dependability of the study.

Transferability

Transferability of results from these interviews was promoted by paying careful attention to describing both typical and atypical views expressed by the participants (negative case analysis). It is however, possible that results from interview studies could vary depending on the prevailing routines of the particular antenatal unit. Still, by providing a thorough description of the sampling procedure and the setting in which this study was conducted readers will be able to determine the situations in which these results are applicable. The findings may be limited by the lack of non-Swedish speaking participants and overrepresentation of well-educated men and women.

Paper III

The strengths of this study include: the prospective design, a relatively large low-risk population, and having the ultrasound examinations performed in a standardised way by specially trained midwives using modern equipment.

In this study, data were collected from women’s medical records and a local database at the fetal medicine unit. However, it cannot be disregarded that cases with markers could have been missed when the examination was performed or failed to be entered into the local database of the fetal medicine unit; if so, this could affect the credibility of the study.

However, due to the prevailing routines at the unit, some markers considered to be associated with DS, e.g. short femur, short humerus and absent nasal bone were not included. Only one case with soft marker was lost to follow-up, and the Swedish National Birth Defect Register enabled us to confirm all DS cases in Sweden. The fact that the prevalence of soft markers and incidence of fetal trisomies was consistent with results from low-risk populations implies that these findings are reasonably reliable. It was not possible though to retrieve the exact number of invasive tests before the second trimester ultrasound in women with fetuses without markers. Thus, this figure is estimated to be the same in the different age groups of women with fetuses with no markers, as in women with fetuses with any marker. Since we know the age distribution of the two groups, we believe that this estimation is close to the true figure.
Researcher’s Pre-conceptions
The questions asked in this thesis originated from the author’s own experiences in the clinical setting of antenatal care. This can strengthen the validity of the research question, but necessitated an open approach, in order to deliberately bracket pre-understanding when conducting interviews and analysis of data.
Discussion

There are four findings that are especially prominent in these studies. First, findings showed that detection of minor structural deviations in the fetal anatomy such as soft markers created strong emotional reactions although they have little pathological significance. This was especially salient in women’s accounts, but men also felt great frustration, mainly regarding the lack of immediate explanations about the significance of these findings.

Secondly, these findings stressed a lack of knowledge in both women and men regarding the potential of the second trimester ultrasound, where most of the expectant parents did not remember receiving any preparing information and several of them felt they did not want to know about the findings of soft markers at all. This was further emphasised by the high increase of invasive testing that was evident among women in whom these markers were detected, as well as in those below 35 years of age where the estimated risk for fetal trisomy was still low.

Thirdly, the findings showed that the a web-based decision aid concerning fetal diagnostics was appreciated by the women for being brief with clear descriptions, being easily accessible on the Internet and coming from a reliable source. The decision aid allowed for clarification of their own thoughts and priorities and helped them to understand the significance of the screening result. Further, using the tool initiated discussions with the woman’s partner, thus, making them more aware of their partner’s view.

Finally, the interviews revealed that the men were immensely engaged in decision making about invasive testing and that the women wanted them to be.

**Unexpected findings cause much anxiety**
In the midst of this research project, I was at the post natal ward one day doing midwifery work when I had a conversation with a father who was lying on the bed with his newborn son on his chest. I had only just given my compliments to the father when he asked ‘can you tell me, what that was they saw on the ultrasound, the marker in his head, what does it mean, really?’ Almost five months had passed since the routine ultrasound, but the ultrasonographic soft marker was still lingering on his mind.
In modern societies today, pregnancy is often planned and much awaited, and pregnancy ultrasound has become the optimum confirmation of its success and first time encounter for the parents to be (21, 128). Thereby, a sharp contrast has evolved between the medical purpose of pregnancy ultrasound and the social significance that it is associated with today.

The pregnancy is closely monitored and there is an intense focus on the health of the unborn child from the very beginning of pregnancy. Recommendations on how to safeguard the child are given already before conception, for example, with information about the importance of taking folic acid to reduce the risk of the child having spina bifida (129). A long series of checks and recommendations then follow the woman throughout pregnancy whereof many are intended to reduce the probability of negative pregnancy outcome. Screening for fetal anomalies has become a means for expectant parents to gain reassurance about the well-being of the fetus (19).

When pregnancy ultrasound detects deviations in the fetal anatomy, this raises much anxiety in the expectant parents, and as papers I and II showed there is an obvious need for immediate counselling and support, which has also been reported by others (130). Still, in spite of information and counselling some parents retain a generalised feeling that something unexpected might go wrong with the pregnancy (131, 132). Even after receiving a favourable test result, some express lingering feelings of uncertainty (132, 133), and in one case also difficulties in becoming attached to a possibly “damaged” child. Anxiety, which is one of the most common experiences among pregnant women (133-137), increases significantly after abnormal screening results (134), especially for those who have not perceived themselves as being at risk (138). This occurred to the extent that the majority of women who chose invasive testing put their pregnancy “on hold” while waiting for the test results (131, 132, 139).

Being concerned about your child’s health is a normal parental attribute and from a global perspective, a question of the child’s survival. However, a single-minded focus on health risk can create much anxiety and guilt (140). Although soft markers are by no means diagnostic for chromosomal defects, the screening result can be both frightening and confusing (135, 141) which was confirmed both in paper I and II. When the ultrasound screening resulted in an assessment of risk for fetal aneuploidy that the expectant parents had not been prepared for, the problem of comprehending the test result became most obvious. Although expectant parents had received information and counselling concerning the findings the significance of a soft marker was still not clear to all. This confusion and anxiety that both women and men express in the interviews is also reflected in the high number of invasive
tests performed after detection of soft markers also in pregnancies where the calculated risk for chromosomal aberration was low.

**Prenatal screening – participation and information needs**

*Prenatal screening - a conscious choice or just something everyone does*

The general offer of second trimester ultrasound which very few decline has led to a situation where the screening test is no longer considered as something optional (papers I and II). Given that this examination is much talked about, the expectant parents might also assume that they have enough knowledge about the scan and therefore do not search for additional information. Moreover, the strong social implications for having a pregnancy ultrasound (21, 23, 27) may contribute to a situation where information about the medical potential of the examination might seem less important to expectant parents. Having the opportunity to participate in prenatal screening can therefore be reason enough to do so (142). However, when aberrations are detected the expectant parents’ lack of awareness concerning the potential of the ultrasound scan becomes most obvious. This unpreparedness was especially evident in the parents who, in early pregnancy, consciously had refrained from screening for DS and ended up having one at the second trimester ultrasound without asking for it (papers I and II).

The question has also been raised as to whether participating in first trimester screening for DS will become as self-evident as the mid trimester ultrasound, thus, ignoring the requirements of knowledge and deliberation that enable conscious decision making. There are considerable differences in uptake of the CUB-test between settings despite the fact that women’s individual characteristics are the same, among those who chose the test and those who declined the test (143). In Denmark, where the CUB test is offered to all women free of charge the uptake is now over 90%, which is high compared to nearby countries such as England where the uptake is 61% and the Netherlands, where 27% of the women chose the test (143-145). Also, in Sweden, the uptake is comparably quite low being 30% in 2012, although there are differences between counties (146).

These differences in utilisation of the test are suggested to be due mainly to the way it is offered, as an extra offer or as part of routine care (143). Crombag concludes that the availability and utilisation of the test will affect how it is perceived by the social environment and in turn influence women’s choice to participate or not (143). If this analysis is correct, it implies that decisions regarding prenatal testing will be a question of the technical development and its implementation in the healthcare system instead of being based on personal needs and values.
A Swedish study from 2009 indicates that counselling regarding prenatal testing in maternal healthcare does not fulfil the requirements of decisional support to enable expectant parents’ informed choice (147). It is also suggested that midwives’ prioritisation of client-midwife relation is at the expense of sufficient decision making support (148). Also, according to an English study, midwives are concerned about the new demands imposed by the development of new technologies and find it difficult to give information and counselling regarding fetal screening (149). While women appreciate a separate visit to the midwife for structured information and consultation (150), there is still the question about the extent to which antenatal healthcare can provide this service to all expecting couples. If this shall be implemented, new resources have to be allocated to finance this activity. It is possible that midwives also need additional education to improve their counselling skills.

The technical development in prenatal screening

Technological innovations and scientific advances have driven the trend of increased use of technique to predict pregnancy outcome, and it is expected that there will be an increase in number of conditions that can be detected in early pregnancy (151). According to Nicolaides, in the near future this will include defining of an additional number of biophysical and biochemical markers of diseases not only in the fetus but also in the pregnant women, findings that will generate likelihood ratios that can be used to modify the individual patient- and disease-specific estimated risk from the initial assessment at 11–13 weeks (151).

It is suggested that this high-tech biomedicine tends to individualise risks and to impose a form of ethical individuality characterised by the demand for reflexivity through personal risk assessment producing anxiety generated by existential responsibility (152). Helén argues that because of this maternity care is now characterised by an ethical split where the use of prenatal diagnosis is based on the rationales of control while simultaneously impose responsibility on the individual to decide what is the right choice. She also states that “this situation emerges when reproductive healthcare limit their responsibility to the technicalities and leaves the choice and the ethical responsibility concerning the decisions about selective abortion, to the pregnant woman” (152).

The public's acceptance and expectation of prenatal testing is suggested to be reinforced by the strong value society places on knowledge, information and technology (153). When presented as a public health issue, women who choose not to participate in prenatal screening can be looked upon as being irresponsible. Moreover, general offers of prenatal tests to all women can put
blame on those who choose not to participate in case the baby is found to have a serious condition after birth (75).

This trend has raised needs of developing counselling practices (152). It is therefore of outmost importance that antenatal health care professional giving consultation or any written information concerning fetal screening clearly emphasize the significance of making informed decision regarding prenatal screening.

**Communicating prenatal screening results**

There was a lack of knowledge in both women and men regarding the potential of the second trimester ultrasound, where most of the expectant parents did not remember receiving any preparing information. There are a number of factors that need to be taken into account when informing people on the significance of a screening result. Risk is something genuinely subjective, and perception of risk is based on mental models affected by subjective, social and cultural assumptions and judgments (72, 154). When communicating results from assessments of health risks, it will be interpreted by people in light of their past experiences and present knowledge (67). Consequently, individuals will perceive risk differently, and screening results will therefore have different meanings dependent on the individual’s apprehension of the term and unknown risks can be perceived as more threatening than the known ones (155). Moreover, the negative connotation of the expression “risk” can lead to incorrect conclusions.

In fetal diagnostics, as in other medical contexts, the term risk is used synonymous with probability. It is often described in words such as high and low risk of fetal anomalies where the cut-off point is set by the system to guide the clinicians in recommendations concerning invasive diagnostic testing for aneuploidy. From the perspective of the expectant parents, this cut-off point between high and low risk can be on quite a different level. Results from the screening tests are also commonly given in a numerical format as probability and relative risk, data that has been shown to be particularly difficult to understand (156, 157). On the other hand, graphical displays of information have shown to increase the effectiveness of risk communication (158).

Communicating knowledge in various manners, such as use of language, numbers or diagrams is suggested to enhance deliberate considerations (159). According to prospective theory, this is a consequence of what Kahneman calls the anchoring, effect which implies that the affective system of judgement will generate intuitive conclusion without conscious deliberations that enable rapid decisions to be built upon the person’s opinions, earlier experiences and knowledge. In turn, the “framing effect” means that alterna-
tive formulations of the same situation cause different aspects of it to be accessible. Additionally, this entails that normally intuitive judgment and intentions can be modified by more deliberate consideration (159). It is suggested that this knowledge shall be taken into account in the design of tools for decisional support (78).

**Decision aid can enhance deliberation in decision making**

The web-based DA developed for this study (paper IV) was shown to be appreciated by the women for clarification of their own thoughts and priorities, and for making the screening result more comprehensible, which made them aware of the fact that prenatal screening could involve difficult decisions. Reading the expectant parents’ stories seemed especially instrumental in making women aware of their own standpoint. Moreover, using the tool initiated discussions between the woman and her partner, thus, making women also conscious of their partner’s view. Preparedness for the results of the examinations evolved as a result of interacting with the web tool.

Patient decision aids have been suggested to improve decision making in pregnancy care including prenatal screening decisions (160). A recent study in the US confirms that web-based DAs can enhance knowledge more effectively than standard care counselling regardless of women’s educational level and health literacy, and also increases satisfaction with the decision support (161).

Although patient DAs have shown to improve informed decision making regarding healthcare treatment and screening also in pregnancy care (160), there is a lack of Swedish studies on patient DAs. In searching the Pub Med database, no Swedish studies were found; moreover, the Cochrane review on the effect of patient DAs from 2011 also does not include any Swedish studies. This suggests that there is a lack of research on patient DAs in Swedish healthcare research; however, it is unclear if any patient DAs are used in clinical practice in Sweden, as this has not been in the scope of this research project.

**Web-based decision aid – a tool for all?**

The web-based DA was feasible in informing expectant women about routine fetal examinations as well as engaging their partners in decisions regarding these tests. Women described their interactions with the DA as enhancing their perceptions and empowering them to be able to make informed decisions regarding fetal screening.

The women that used the web-based patient DA (paper IV) were experienced Internet-users and had no difficulties guiding themselves through the
website. They pointed out that most of the information available on the Internet is found on chat forums where people present stories about personal experiences and hence nothing they could rely upon. Therefore, it is an important finding that women perceived the website as reliable and that having a connection to the fetal medicine unit was viewed as a sign of this reliability. The importance of expert control of websites that intend to provide effective web-based support on pregnancy issues has also been emphasised by Sparud-Lundin (162).

In judging the potential of the web-based tool to be implemented as part of routine care, the core elements from the diffusion of innovations theory (163) should be considered. The relative advantage of a web-based tool is the accessibility for the users. It is designed to be simple to use and anyone who is given the opportunity can try it out. However, what really impacts whether an innovation makes it or does not is its compatibility to people’s lifestyle. Given the pervasiveness of the Internet in the lives of Swedish women, who are of childbearing age, Internet-based tools seem to have a clear advantage. There are also significant advantages from the perspective of the healthcare organisations that today distribute much information through the Internet. In Uppsala County, the residents have the possibility to access their medical records through the Internet already today.

We know that a considerable number of those who received a login to the website did not actually use it. Preliminary data from an on-going RCT shows that only 56% out of 300 visited the site. The reason for this, as expressed by the women, was that they believed that they had sufficient knowledge to make their decision (paper IV). The question is whether expectant parents make correct assessments of their need for knowledge in this situation. Results from the studies included in this thesis indicate that it is not necessarily so. This was especially salient in the situation when soft markers were detected at second trimester ultrasound screening which both women and men were totally unprepared for (papers I and II). Still, knowledge alone is not sufficient to make informed decisions (55); therefore, midwives need to motivate expectant couples to not only be open to available facts but also to consider their own needs and values and also encourage them to talk about the issue with their partner.

The web-based patient DA for prenatal screening can be a valuable tool in maternal healthcare. However, such a tool needs to be tested in a larger study to assess its feasibility for different groups of parents.
The father – invisible appendix or salient actor?

The men attended the ultrasound screening, unprepared for the potential of this examination, but still engaged immensely in decisions regarding possible amniocentesis (paper II). This was also confirmed by women (paper I). Men’s needs are not met in a systematic manner in the system of prenatal care (42, 164-171), and it is possible that the partner’s need for knowledge is neglected in regard to fetal diagnostics. A majority of expectant fathers in Sweden attend the fetal diagnostic examinations; most of them also attend several visits to the antenatal care midwife (44). Still the guidelines for maternity care only express responsibility to care for the pregnant woman’s need for information and counselling supporting decisions regarding fetal diagnostics, not her partner’s (112).

Moreover, the study results showed that the men’s ability to deal with the situation was conditioned upon access to facts about the ultrasound findings (paper II). Their intense focus on collecting facts in such situations is also described by Locock et al. (53) who argue that this is a way for men to channel their anxiety, findings that were confirmed in a meta-analysis by Dheensa et al. (57). This shows that men’s needs might differ from the women’s, which should be taken into account in counselling concerning these issues.

Regarding the men’s participation in decisions concerning amniocentesis, findings in this study (paper II) were consistent with those of Kenan et al. (172), where men described this decision as a joint enterprise with their female partner. Nevertheless, very little is known about decisional needs of partners regarding prenatal testing (173). However, recent research identifies men’s desire to be more involved in consultations before prenatal screening, both for their own needs prior to becoming fathers, but also to enable them to support their spouse when dealing with difficult issues (50).

Swedish men have become increasingly involved during pregnancy and in the care of the newborn child. There is also strong evidence that paternal involvement will lead to various positive outcomes for children (174). An increasing number of Swedish men exercise their rights to paid parental leave the first year after the birth of their child (175). Although women need to uphold their right to decide whether to continue a pregnancy or not, the child has the right to have access to both his/her parents. Insufficient information about pregnancy and childbirth is shown to increase the risk of distress in expectant fathers (41). In addition, women wish to involve their partner in care during pregnancy; thus, practitioners shall continue to enhance father’s involvement by supporting their need for pregnancy related information.
Conclusions

This thesis identified a serious lack of awareness in both women and men, about the potential of the pregnancy ultrasound as a screening tool for fetal anomalies. Being completely unprepared for the assessment of risk for DS following the detection of soft markers, the expectant parents had difficulties making sense of the risk figures presented to them. Strong feelings of anxiety evolved in this situation, and several of the women and men chose invasive diagnostic testing to ease their concerns, even though the factual risk for DS was estimated as low i.e. < 1 / 200.

Although likelihood ratios for DS fetuses were above one, when isolated soft markers were present, the only significant likelihood ratio concerned any marker (isolated, multiple or combined with anomaly). The observed increase of invasive diagnostic tests when isolated soft markers were detected was 24-fold, almost irrespective of women’s age and the level of calculated risk for DS. Moreover, lingering feelings of something being wrong with the child was found also among those that had an invasive diagnostic test ruling out any fetal trisomy. This indicates that the antenatal health services did not succeed in making the screening result intelligible to the expectant parents.

There is strong evidence that patient DAs can enhance informed decision making in healthcare situations, but there is a lack of research from the Swedish setting in this area. The web-based patient DA developed for this project was able to initiate a process of conscious decision making in pregnant women as a result of their interaction with the tool. The DA was also appreciated for clarifying the potential of prenatal screening examinations and the meaning of results from the risk assessment. Thus, the web-based patient DA could be both a feasible and valuable method in the effort to enhance informed decision making about routine fetal examinations.

This thesis also describes the expectant father’s role in decision making about screening for fetal anomalies. The results showed that the men were not only focused on supporting their spouse but were also actively engaged in decision making and considering their own personal standpoint (paper II). Noteworthy, this thesis showed that women wanted their partner to be engaged and that they appreciated being able to have discussions on these issues with them (papers 1 and IV).
Clinical implications

Lack of awareness of the potential of screening examinations may not be noticed by the professional unless some deviations in the fetal anatomy are detected, and in most cases there are none. When the practitioner performing the examination says that everything looks fine, expectant parents will be happy and content; however, when information about adverse findings is given their reactions are usually strong. This is unavoidable upon the detection of conditions that seriously affect the health of the child, but in case of common findings such as soft markers, these findings should be prepared for and mentioned in the information provided by the antenatal care midwife. Also, all units performing fetal ultrasound examinations must have established routines concerning information management when soft markers are detected. There is also a need to use methods that enhance understanding of the results from risk assessments.

We know that expectant parents might rely on second hand information from relatives and friends based on the person’s own experiences and they may not be open to further information. Therefore, antenatal care midwives need to explore women’s and men’s preconceptions of the prenatal screening examinations and to motivate them to study the information available from the antenatal care organisation. Nonetheless, gathering facts is not enough to enable informed decision making; therefore, midwives should encourage the expectant parents to carefully deliberate with regard to their own values.

The web-based DA shows promise as a tool to support expectant parents in decision making regarding prenatal screening. A web-based DA has low costs, is conveniently available to a population with Internet access and can be used on one’s own terms without influence from the practitioner. The source of the website needs to be clearly stated so that users can trust that it is from an official reliable source. To be trustworthy, the website also needs to be continually updated to reflect current practice. A decisional aid should be available to expectant parents during the early stages of pregnancy when they need it. However, having the DA available only in Swedish limits its accessibility to non-Swedish speaking women; therefore, it would be beneficial to have it translated into several different languages.
Given the fathers’ involvement in decision making regarding prenatal screening, practitioners in antenatal healthcare need to invite the fathers to discuss their perspectives on prenatal screening and information about this issue should be directed to both parents. The pregnant woman has the right to decide on her own on these issues, which needs to be stressed; nonetheless, many women want their partner to be involved. Therefore, midwives should support the partners’ engagement in these decisions also with regard to the importance of father involvement after birth.
Further research

Additional research has been initiated via a population-based randomised controlled trial to assess the effectiveness of the web-based DA to enhance informed decision making regarding routine prenatal screening for anomalies. This research also addresses the qualitative aspects of men’s perception of the web-based DA and their engagement in decision making regarding routine prenatal screening.

However, more research is needed regarding expectant parents’ motivations to obtain prepared information and how this affects their information seeking behaviour. Also, their information seeking behaviour when confronted with adverse screening results needs to be further explored.

Further research needs to be conducted to gain knowledge on how a web-based decision aid can be effectively implemented in antenatal health care settings as well as the role of the midwives in such implementations.
Sammanfattning på svenska

Utvecklingen av ultraljudstekniken och den ökade kunskapen hos barnmorskor som utför undersökningen har inneburit att andelen avvikelser i fostrets anatomi som upptäcks vid den rutinmässiga ultraljuds undersökningar har ökat. Det har medfört att mindre avvikelser med lite eller ingen betydelse för barnets hälsa också upptäcks. En del av dessa avvikelser, de så kallade mjuka markörerna, förekommer oftare hos foster med kromosomavvikelser som trisomi 13, 18 och 21, vilket innebär att de kan få betydelse vid riskvärderingar gällande dessa kromosomavvikelser.

Denna avhandling fokuserar på blivande föräldrars upplevelse och behov när mjuka markörer upptäckts vid ultraljudsundersökningen i andra trimester och därmed lett till en oväntad riskbedömning för kromosomavvikelse hos fostret. Avhandlingen beskriver också hur ofta fetala ultraljudsmarkörer upptäcks och risken för Downs Syndrom i en lågrisk population av 10 535 gravida kvinnor med totalt 10 710 foster (inkluderat tvillingar och trillingar), samt risken för invasiv diagnostisk provtagning i samband med dessa fynd. Avhandlingen är också inriktad på att undersöka värdet av ett webbaserat beslutsstöd som skapats för att användas av blivande föräldrar vid ställningstagande till den fosterdiagnostik som erbjuds rutinmässigt, samt den blivande pappans roll i ställningstaganden gällande fosterdiagnostik.


Vid rutinultraljudet upptäcktes mjuka markörer i 5,9% av fostren och i 5,1% var markörerna isolerade. Alla mjuka markörer visade ett positive likelihood
ratio (LR+) för Downs syndrom men associationen var statistiskt signifikant endast när samtliga fall med markörer (isolerade, multipla och de i kombina-
tion med annan avvikelse) togs i beräkning. Resultatet visade en nära 24
gångers ökning av invasiv provtagning när en isolerad markör upptäckts också bland kvinnor med låg risk för DS dvs < 1/200 (artikel III).

Resultatet från intervjuerna visade att fyndet av en isolerad mjuk markör
skapade en stark oro som hos vissa fanns kvar också efter att fostervatten-
prov bekräftat att fostrets hade en normal uppsättning kromosomer. Resulta-
tet indikerande också att både kvinnor män var omedvetna om ultraljudsun-
dersökningens potential och ingen av dem kunde minnas att det tagit del av
någon förberedande information från mödravården angående rutinultraljudet
(artikel I och II).

Intervjuarna visade att männen var starkt engagerade i beslut angående fos-
terdagnostiken inte bara som stöd till sin partner utan också att de gjorde
ställningstagande utifrån egna synpunkter och behov (artikel II). Kvinnor
uttryckte också uppskattning över att deras partner intagit en aktiv roll i det
här sammanhanget (artikel I och IV).

Det webbaserade beslutsstödet visade en potential att kunna initiera ett med-
vetet beslutstagande hos de gravida kvinnorna som ett resultat av deras inter-
aktion med verktyget. Beslutsstödet kunde också tydliggöra kvinnornas tan-
kar och prioriteringar, vilket hjälpt dem att förstå betydelsen av de resultat
man erhåller vid screeningundersökningar, och därmed också utgöra en
grund för informerat beslutstagande gällande screening för fostermissbild-
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