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# Measuring Pregnancy Planning and the Effect of Childhood Abuse on Reproductive Health

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### **Abstract**

Drevin, J. 2019. Measuring Pregnancy Planning and the Effect of Childhood Abuse on Reproductive Health. *Digital Comprehensive Summaries of Uppsala Dissertations from the Faculty of Medicine* 1555. 71 pp. Uppsala: Acta Universitatis Upsaliensis. ISBN 978-91-513-0603-2.

The London Measure of Unplanned Pregnancy (LMUP) and the Swedish Pregnancy Planning Scale (SPPS) are two measurements of pregnancy planning. Adverse childhood experiences (ACEs) and childhood abuse are stressful events that have been suggested to have both short- and long-term effects.

Study I investigated the psychometric properties of the LMUP and the SPPS and compared their assessments. Questionnaire data from 2,314 pregnant women showed medium-high construct validity and high test-retest reliability for both measurements. The convergent validity of LMUP was low. The assessments of the LMUP and the SPPS corresponded substantially.

Study II explored how the SPPS was interpreted and what women considered when responding to it. Twenty-five pregnant women were interviewed. Women responding to the SPPS took into account their life situation, intentions, desires, timing, actions to prepare for, or avoid, pregnancy, having discussed becoming pregnant with their partner, and reactions after learning of the pregnancy.

Study III analysed the association between ACEs and pregnancy-related pain. Pregnant women ( $n = 142$ ) responded to questionnaires in early and late pregnancy, respectively, and reported their pain intensities and pain distributions. Greater exposure to ACEs was associated with higher pain distribution and women exposed to ACEs reported higher worst pain intensities compared to non-exposed.

Study IV investigated effects of childhood emotional, physical and sexual abuse on pregnancy planning. The effect of a potential collider-stratification bias were also studied. Questionnaire data from 76,197 pregnant Norwegian women showed separate but no joint effects of the categories on having an unplanned pregnancy and a collider-stratification bias could not explain the effects.

The LMUP and the SPPS measure somewhat different aspects of pregnancy planning and there is a substantial agreement between their assessments. Both the LMUP and the SPPS showed good validity and test-retest reliability. However, the LMUP would likely benefit from item reduction and the SPPS poorly captures any health-related changes made in and the preconception period.

The results suggest that childhood abuse and ACEs have an effect on pregnancy planning and pregnancy-related pain. The findings suggest that preventing child abuse could have a positive effect on later reproductive health.

*Keywords:* pregnancy planning, unplanned pregnancy, childhood abuse, adverse childhood experiences, reproductive health

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*To William, Noah and Lucas*



# List of papers

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

- I Drevin, J., Kristiansson, P., Stern, J., Rosenblad, A. (2017). Measuring pregnancy planning: A psychometric evaluation and comparison of two scales. *Journal of Advanced Nursing*, 73(11), 2765. doi:10.1111/jan.13364
- II Drevin, J., Wadensten, B., Ekstrand Ragnar, M. 'How planned was your current pregnancy' – What women take into account when responding to the Swedish Pregnancy Planning Scale. *Submitted*.
- III Drevin, J., Stern, J., Annerbäck, E.M., Peterson, M., Butler, S., Tydén, T., Berglund, A., Larsson, M., Kristiansson, P. (2015). Adverse Childhood Experiences influence development of pain during pregnancy. *Acta Obstetrica et Gynecologica Scandinavica*, 94(8):840-846. doi:10.1111/aogs.12674
- IV Drevin, J., Hallqvist J., Sonnander, K., Rosenblad, A., Pingel, R., Bjelland, E.K. Childhood abuse and unplanned pregnancies: A cross-sectional study of women in the Norwegian Mother and Child Cohort Study. *In manuscript*.

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# Abbreviations

ACE	Adverse childhood experiences
ANC	Antenatal clinic
ART	Assisted reproductive technology
AVE	Average variance extracted
CDC	Centers for Disease Control and Prevention
CFA	Confirmatory factor analysis
CFI	Comparative fit indices
DAG	Directed acyclic graph
LMUP	London Measure of Unplanned Pregnancy
MoBa	The Norwegian Mother and Child Cohort Study
RERI	Relative excess risk due to interaction
RMSEA	Root mean squared error of approximation
SPPS	Swedish Pregnancy Planning Scale
SRMR	Standardised root mean squared residual
STI	Sexually transmitted infection
TDIP	Traits-desire-intention-behaviour framework
TPB	Theory of Planned Behavior
US	United States
VAS	Visual analogue scale
WHO	World Health Organization



# Introduction

“It was planned, so we are excited”, a friend of mine mentioned in passing after revealing her pregnancy to me and some other friends. The dinner conversation continued without any hesitation on the part of the other guests. The word ‘planned’ always attracts my attention these days. What does a person mean when using this word? People seem to understand what is being said, but what does it really imply? What is a ‘planned’ pregnancy?

Reproductive health is defined as ‘a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity, in all matters relating to the reproductive systems and to its functions and processes’ United Nations (1995). It implies having the ability to decide if and when to become pregnant (United Nations, 1995).

The main focus of this thesis is pregnancy planning. The thesis evaluates two scales used for measuring pregnancy planning in antenatal care, but also deals with the effects of childhood abuse on later reproductive health. As we begin our journeys in life, physiological, psychological, and epigenetic mechanisms help us adapt to the environments we encounter. Childhood has been acknowledged as an important time in life, but the effects of experiences during this time on later reproductive health have not been studied thoroughly.

There are both male and female victims of childhood abuse and both men and women are able to plan pregnancies, but this thesis is based solely on the perspective of women.

## Pregnancy planning

### What is a ‘planned’ pregnancy?

A ‘planned’ pregnancy is a concept with no uniform definition among women in general or within science. Barret and Wellings (2002) have found that women use one or more of the following descriptions to define a planned pregnancy: A conscious decision to become pregnant, agreeing with their partner to try to become pregnant, ceasing the use of contraception, good timing of the pregnancy, taking a longer view of how a baby would fit into their lives, trying to get pregnant, targeting fertile periods, and/or making pre-conception preparations. In contrast, an unplanned pregnancy is described as a mistake,

not intentional, a failure of contraception, a failure to use contraception, happening at the wrong time, not thinking it through in advance, or thinking ‘if it happens, it happens’ (Barrett & Wellings, 2002). The findings imply that the intention, timing and the context in which a child is conceived are of importance for women when they consider if a pregnancy was planned or not. With the exception of discontinuing contraceptive usage, preconception preparations are peripheral for women when they categorise a pregnancy (Barrett & Wellings, 2002). This is supported by other studies showing that a high percentage of women who consider their pregnancies to be planned do not make adjustments to prepare for pregnancy, such as taking folic acid supplements (Stephenson et al., 2014; Stern et al., 2016). Women acknowledge that pregnancies may have some characteristics that conform and some that do not conform to the descriptions of planned and unplanned pregnancies, respectively, and sometimes there is a discrepancy between reproductive intention and reproductive behaviour (Barrett & Wellings, 2002; Borrero et al., 2015).

## Measuring pregnancy planning

Reproductive health implies people being ‘... able to have a satisfying and safe sex life and that they have the capability to reproduce and the freedom to decide if, when and how often to do so’ (United Nations, 1995). Hence, measuring pregnancy planning may serve as an indicator of reproductive health. Measuring pregnancy planning may also enable us to develop and evaluate interventions intending to reduce unplanned pregnancies. In a clinical setting, the level of pregnancy planning may be useful as a starting point for further counselling by midwives and other health care professionals. In antenatal care, determining the context of the pregnancy may lead to more individualised counselling and identification of risk behaviours and support needs.

The complexity of the pregnancy planning concept makes measurement problematic. Pregnancy planning is currently measured in a variety of ways. Some measure pregnancy planning dichotomously (planned/unplanned; Lukasse et al., 2015; Rosenfeld & Everett, 1996). About forty years ago, the American Centers for Disease Control and Prevention (CDC) started to classify pregnancies as either ‘wanted’, ‘undetermined’, or ‘unwanted’ in the National Survey of Family Growth (NSFG; Munson, 1977). The NSFG has slightly changed its categories since then. Nowadays, the NSFG categorises pregnancies as ‘intended (wanted)’, ‘mistimed’, or ‘unwanted’ (Finer & Zolna, 2011; Masinter, Feinglass, & Simon, 2013). Mistimed and unwanted pregnancies are jointly labelled ‘unintended’ pregnancies. A previous study has shown that about 20% of women change the intendedness status of their pregnancy postpartum (Guzzo & Hayford, 2014; Joyce, Kaestner, & Korenman, 2002). As pregnancies may have some characteristics that conform to a planned pregnancy and others that do not, one could view pregnancy planning as a continuum with more or less planned pregnancies. Morin et al.

(2003) measure the intensity of the pregnancy planning effort on a scale from 0 to 12 based on timing, effort to become pregnant, and contraceptive use. The Swedish Pregnancy Planning Scale (SPPS) and the London Measure of Unplanned Pregnancy (LMUP) are two other measurements that assess the level of pregnancy planning. The first is a rather newly developed measurement that has never been psychometrically evaluated and the latter is frequently used for scientific purposes and probably the most well-studied scale measuring the level of pregnancy planning.

### **The London Measure of Unplanned Pregnancy**

The London Measure of Unplanned Pregnancy (LMUP) was conceptualised to include the social context in which a pregnancy started (Barrett, Smith, & Wellings, 2004). The measurement is multivariate and takes into account that behaviours, feelings and intentions do not necessarily correspond to each other. The measure was conceptualised using data from in-depth interviews and a psychometric evaluation (Barrett et al., 2004). The LMUP model consists of one latent variable (pregnancy planning) which loads onto six observed variables.

The first item measures contraceptive use. The respondent answers by ticking one of four response alternatives: 'I/we were not using contraception', 'I/we were using contraception, but not on every occasion', 'I/we always used contraception, but knew that the contraception method had failed at least once', or 'I/we always used contraception'.

The second item measures timing of the pregnancy. Respondents are asked to tick the alternative that is most applicable: 'right time', 'ok, but not quite right time', or 'wrong time'.

Item number three measures the pregnancy intention right before conception, if the respondent 'intended to become pregnant', if 'my intentions kept changing', or if the respondent 'did not intend to become pregnant' at that point in time.

The fourth item, desire for pregnancy, is measured by asking if the respondent just before conception 'wanted to have a baby', 'had mixed feelings about having a baby', or 'did not want to have a baby'.

Item number five measures partner agreement using four response alternatives: 'My partner and I had agreed that we would like me to be pregnant', 'My partner and I had discussed having children together, but hadn't agreed for me to get pregnant', and 'We never discussed having children together'. The partner 'might be (or have been) your husband, a partner you live with, a boyfriend, or someone you've had sex with once or twice' (Barrett et al., 2004). The item does not have a response alternative applicable for women who did not have a partner but had become pregnant on their own, using assisted reproductive technology (ART).

The sixth and last item is ‘Did you do anything to improve your health in preparation for pregnancy?’ The respondent is asked to tick all applicable response alternatives (took folic acid; stopped/cut down smoking; stopped/cut down drinking alcohol; ate more healthily; sought medical/health advice). The respondent could write any other actions in free text or choose the pre-specified alternative ‘I did not do any of the above before my pregnancy’.

For items 1–5, each response is given 0–2 points, where each point indicates a higher pregnancy planning level. For item 1, the second and third response alternatives result in 1 point. For item 6, each action taken results in 1 point, with a maximum total of 2 points.

In all, the LMUP results in a score between 0–12 points. A score of 0–3 points is considered to be an unplanned pregnancy, 4–9 points is ambivalent and getting 10–12 points is considered to be a planned pregnancy (Barrett et al., 2004).

### **Psychometric evaluations of the LMUP**

Since its conception, the LMUP has been evaluated in different populations with various income levels (Almaghaslah, Rochat, & Farhat, 2017; Borges et al., 2016; Goossens et al., 2018; Habib et al., 2017; Hall et al., 2013; Morof et al., 2012; Rocca, Krishnan, Barrett, & Wilson, 2010; Roshanaei, Shaghaghi, Jafarabadi, & Kousha, 2015). The LMUP has shown acceptable or good reliability in general, although some items have been questioned. The internal consistency reliability has been acceptable with Cronbach’s  $\alpha$  values of 0.70–0.88 (Almaghaslah et al., 2017; Borges et al., 2016; Goossens et al., 2018; Habib et al., 2017; Hall et al., 2013; Morof et al., 2012; Rocca et al., 2010; Roshanaei et al., 2015). Hypothesis testing has shown good validity, but studies conducted among Indian and Malawian women disclosed a conflicting internal structure not conforming to the LMUP model (Hall et al., 2013; Rocca et al., 2010). The LMUP has also shown a good test-retest reliability (Almaghaslah et al., 2017).

Item 1 (contraception) has in low-income contexts been shown to have its greatest loading on a latent variable different from that of the other LMUP items (Hall et al., 2013; Rocca et al., 2010). The response alternative ‘Not using contraception’ has had high endorsement frequencies in two studies, with up to 92.8% stating not having used contraception (Goossens et al., 2018; Rocca et al., 2010), indicating low contribution to the variance of the total score. Regardless of the LMUP level, it has been shown to be the most common response alternative (Rocca et al., 2010). The item-total correlation for item 1 has also been low in the Indian and Malawian contexts (0.05–0.09; Hall et al., 2013; Rocca et al., 2010). Despite showing a low contribution of item 1, the LMUP model has shown an acceptable internal consistency (Borges et al., 2016; Goossens et al., 2018; Hall et al., 2013; Morof et al., 2012; Rocca et al., 2010).

Item 6 (pre-conception preparations) has one response alternative that has shown high endorsement values in some studies; especially in Brazil, where 84% did not take action to improve health in preparation for pregnancy (Borges et al., 2016). Pre-conception preparations have shown fluctuating loadings (0.16–0.56) and item-total correlations (0.16–0.39) that in some cases call into question if the item is measuring the same construct as the other items (Borges et al., 2016; Goossens et al., 2018; Habib et al., 2017; Hall et al., 2013; Morof et al., 2012; Rocca et al., 2010; Roshanaei et al., 2015).

### **The Swedish Pregnancy Planning Scale**

The Swedish Pregnancy Planning Scale (SPPS) is a briefer measurement created for measuring the level of pregnancy planning. The measurement categorises all pregnancies into one of five levels depending on a respondent's own view of their pregnancy planning status. The SPPS consists of one single question: 'How planned was your current pregnancy?' The response is given by the respondent by ticking any of the pre-specified options given on a Likert scale: 'Highly planned' (5 points), 'Quite planned' (4 points), 'Neither planned nor unplanned' (3 points), 'Quite unplanned' (2 points), and 'Highly unplanned' (1 point). The measurement has been used in some previous studies in the Nordic countries over the last couple of years (Backhausen et al., 2014; Bodin et al., 2017; Stern et al., 2016; Tydén et al., 2011), but its psychometric properties have never been evaluated before.

### **Incidence of unplanned pregnancies**

In Sweden, about 116 000 children were born in 2017 (The Swedish Pregnancy Register, 2018). In the same year, about 37 000 abortions were induced (The National Board of Health and Welfare, 2018), indicating that at least one in four pregnancies (not ending with spontaneous abortion) in Sweden is unplanned. The level of pregnancy planning is not routinely measured by healthcare and is thus unknown. Although it is hard to know if there are any fluctuations in the rates of unplanned pregnancies in Sweden over the last few decades, the induced abortion rates indicate a decline in the last decade. Thus, they seem to follow a global trend of somewhat declining rates of induced abortions in highly developed regions (Bearak, Popinchalk, Alkema, & Sedgh, 2018). Between the years 2000 and 2010, the groups of women  $\leq 19$ , 20–24, and 25–29 years of age had the highest rates of induced abortions in Sweden. Between the years 2006 and 2017, the annual number of induced abortions per 1,000 women decreased from 25 to about 12 for teenagers (The National Board of Health and Welfare, 2018). Excepting only women above 40 years of age, women below the age of 20 now have the lowest rate of induced abortions (The National Board of Health and Welfare, 2018).

It is estimated that 213 million pregnancies occurred globally in 2012, including pregnancies ending in spontaneous or induced abortions (Sedgh,

Singh, & Hussain, 2014). That is a small increase (1.9%) in the number of pregnancies since 1995 (Sedgh et al., 2014), but it should be taken into account that the number of fertile women has increased during the same period. There is a wide range of pregnancy rates in different parts of the world. Fertile women in Southern and Western Europe have the lowest rate (80 pregnancies per 1,000 fertile women and year), while those in Middle Africa have the highest (279 pregnancies per 1000 fertile women; Sedgh et al., 2014).

Global data concerning pregnancy planning, induced abortions and spontaneous abortions are limited, but attempts have been made to estimate the global number of unintended pregnancies and births based on data from scientific studies, and official registries and reports (Bearak et al., 2018; Sedgh et al., 2014; Singh, Sedgh, & Hussain, 2010). Two studies have estimated the global unintended pregnancy rate to be 40% and 44%, respectively, during 2010–2014, resulting in approximately 85 or 99 million unintended pregnancies annually (Bearak et al., 2018; Sedgh et al., 2014). There are big variations between different regions, but about half of the unintended pregnancies end with abortion, 13% end with miscarriage and 38% lead to birth (Sedgh et al., 2014). From 1990–1994 until 2010–2014, the absolute number of unintended pregnancies has increased because of population growth, but the number of unintended pregnancies per 1,000 women has decreased with 17% (Bearak et al., 2018). Less developed regions have shown the largest decline in rates of unintended pregnancies (Bearak et al., 2018).

The incidence of unplanned pregnancies is not evenly distributed at an individual level, but some groups are at higher risk. There is a U-shaped relationship between age and pregnancy planning level, women at young and advanced age have an increased risk for an unplanned pregnancy (Hall et al., 2016). Parity and education levels have also been shown to be related to pregnancy planning level. The unplanned pregnancy rates increase for each child a woman has given birth to and decrease as the level of education increases (Chandra, Martinez, Mosher, Abma, & Jones, 2005; Goossens et al., 2016; Hall et al., 2016; Stern et al., 2016; Wellings et al., 2013). Women are also at an increased risk for unplanned pregnancies if they have recently used drugs, are unmarried, have experienced depression, have been exposed to intimate partner violence, have a young partner, and if only a short time has passed since previously giving birth (Goossens et al., 2016; Hall et al., 2016; Wellings et al., 2013).

## Health-promoting behaviours related to pregnancy planning

The preconception period is often defined as starting with a reproductive intention or the months or years preceding conception (Stephenson et al., 2018). Several factors have been identified as important during this period to increase the chances of conception, and to improve health during the pregnancy and its outcome. Taking folic acid supplements prior to conception and during the

first trimester reduces the risk for neural tube defects by about 70% (De-Regil, Pena-Rosas, Fernandez-Gaxiola, & Rayco-Solon, 2015). Ceasing smoking and alcohol intake, and reaching a normal weight (body mass index 18.5–25.0 kg/m<sup>2</sup>) are some other actions women who plan their pregnancy may take in the preconception period to increase pregnancy-related health. Gestational overweight and obesity reduces fecundity and increases the risk for pregnancy-related complications such as pre-eclampsia, gestational diabetes, intrauterine and neonatal death and premature birth, in part explained by consequences of obesity such as hypertension and diabetes (Cnattingius et al., 2013; Poston et al., 2016; Sohlberg, Stephansson, Cnattingius, & Wikstrom, 2012). In 2017, 42% of all Swedish women were overweight or obese at registration to an antenatal clinic (ANC, The Swedish Pregnancy Register, 2018). Prenatal alcohol consumption is related to the child's neuropsychological development. There is no level of alcohol consumption that is considered safe during pregnancy, but binge drinking is related to more severe consequences than lower consumption (Flak et al., 2014; Subramoney, Eastman, Adnams, Stein, & Donald, 2018). To quit or reduce smoking and snuff use before conception is important, as such use increases the risk for stillbirths (Baba, Wikstrom, Stephansson, & Cnattingius, 2014). Smoking is also associated with restricted intrauterine growth and low birthweight (Flower, Shawe, Stephenson, & Doyle, 2013; Stephenson et al., 2018). Most Swedish women who smoke quit before registration at an ANC, but slightly less than a third are still smoking in the third trimester (The Swedish Pregnancy Register, 2018).

The timing of pregnancy planning also plays a role as maternal and paternal age influence fecundity and pregnancy-related health. Three out of four women who start their attempts to become pregnant at an age of 30 become pregnant within a year (Leridon, 2004). The corresponding numbers for women aged 35 and 40 are 66% and 44%, respectively (Leridon, 2004). Advanced maternal age is also a risk factor for pregnancy-related illness, complications during pregnancy, and perinatal mortality (Jacobsson, Ladfors, & Milsom, 2004). In the last decades, the typical age of childbearing in Sweden has become somewhat older. The average age for women giving birth to their first child is 29 years, compared with 24 years in 1975 (The National Board of Health and Welfare, 2014; The Swedish Pregnancy Register, 2016). One percent of all nulliparas have an age below 20 years, and 17% are 35 years or older (The Swedish Pregnancy Register, 2016). Four decades ago, the situation was about the opposite. In 1975, 15% of all nulliparas had an age of < 20 years, and 2% were ≥ 35 years (The National Board of Health and Welfare, 2014).

## Theoretical frameworks related to pregnancy planning

The Theory of Planned Behaviour (TPB) is a framework designed to explain human behaviours (Ajzen, 1991). It explains a behaviour as the result of having the intention to perform the behaviour at the same time as having confidence in being able to perform the behaviour. According to the TPB, the intention is determined by three factors: the attitude toward the behaviour, the subjective norms (having a social pressure to perform or not perform the behaviour), and the perceived behavioural control (Ajzen, 1991). In the context of pregnancy planning, the attitude may be to find achieving a pregnancy to be something favourable or non-favourable. The subjective norm may include opinions of any partner especially, but also the opinions of family and friends. The perceived behavioural control, in the context of pregnancy planning, may concern how easy or difficult it is to comply with contraceptive treatment or to achieve a normal weight.

Women and men who plan their pregnancies are able to make preconception preparations or as Miller (1986) calls them: proceptive behaviours (as an opposite to behaviours avoiding conception). Miller (1994) has created a four-component theoretical framework for understanding human reproductive behaviour, the Traits – Desires – Intention – Behavior (TDIB) framework. The TDIB framework describes proceptive behaviours as the result of a sequence: Traits, e.g., a motivation to reproduce creates childbearing desires. When childbearing desires are placed in the context of reality (i.e., age, financial security, living space, partner), a commitment to become pregnant may arise, a reproductive intention. Having a reproductive intention is the trigger for adopting proceptive behaviours such as ceasing to use contraceptives, ceasing with smoking and timing intercourse with ovulation (Miller, 1994).

The TDIB framework is similar to the TPB as they both concern development of a motivation that explains behaviours. However, applied to the field of reproductive behaviours, the TPB has been criticised for its inability to explain the group of ‘subintended’ pregnancies conceived after neither trying to achieve nor avoid a pregnancy (Miller, 2011).

## Consequences of unplanned pregnancies

Unplanned pregnancies expose women to unnecessary health risks related to pregnancy and abortions, but also preclude health-promoting actions prior to conception and during the first crucial weeks of pregnancy.

In a global perspective, unplanned pregnancies constitute a great threat to women’s health. In countries with restricted access to contraceptives and safe abortion methods, haemorrhages and infections are common complications among women undergoing induced abortions (World Health Organization [WHO], 2011). Between the years 2010 and 2014, 25 millions of unsafe induced abortions are estimated to have been performed annually (Ganatra et

al., 2017). In 2008, 47,000 women were estimated to have died as a consequence of using unsafe abortion methods to terminate pregnancy (WHO, 2011). Merely being pregnant also exposes a woman to health risks that are unnecessary if the pregnancy is unplanned and preventable.

The preconception period brings an opportunity to take health-promoting actions to optimise the pregnancy-related health. This opportunity is available only to women planning their pregnancies. Women planning a pregnancy have been shown to be about half as likely to be smoking at conception compared to non-planning women (Flower et al., 2013). In addition, associations have been found between pregnancy planning status and gestational and postnatal outcomes. Unwanted pregnancies more often result in premature births, babies small for gestational age, and low birth weight, compared with intended pregnancies, and are explained by prenatal behaviours (Kost, Landry, & Darroch, 1998). Unplanned and unintended pregnancies have also been associated with delayed antenatal care, and maternal depression one month, three months and one year postpartum (Gipson, Koenig, & Hindin, 2008; Hall et al., 2018; Mercier, Garrett, Thorp, & Siega-Riz, 2013)..

### The association between childhood abuse and pregnancy planning later in life

Dietz et al. (1999) have studied the association between childhood abuse and pregnancy intention. They found that women exposed to childhood physical abuse were about 1.5 times as likely as unexposed women to report their first pregnancy as unintended. However, most of the participants were above 40 years of age at participation and had their first pregnancy in their early 20s. As about 20% of women report a different intention status when measured postpartum compared to during pregnancy (Guzzo & Hayford, 2014; Joyce et al., 2002), it is not unlikely that the study is hampered by recall-bias. Lukasse et al. (2015) performed a similar study, but measured pregnancy planning status during ongoing pregnancy. They found that women exposed to childhood emotional, physical, and sexual abuse were more likely to have an unintended pregnancy compared with unexposed women. Women exposed to childhood emotional abuse had a risk about 50% higher for having an unintended pregnancy (adjusted OR = 1.55, 95% CI 1.28–1.86), and women exposed to childhood sexual abuse had the highest risk (OR = 1.66, 95% CI 1.37–20.2) compared to unexposed. However, (Lukasse et al., 2015) did not take into consideration that they only selected pregnancies that had reached antenatal care, thus excluding pregnancies ending with induced abortions. If childhood abuse affects future family planning and the tendency to have an induced abortion, this may have induced a selection bias to the study.

# Childhood abuse and the future health

## Child abuse

Each cultural context has its own common ground regarding which behaviours are acceptable and which are not. Parents meet different expectations on how to behave towards their children depending on the culture; behaviours that are expected for a caregiver to perform in one culture may be strictly prohibited in another. Nevertheless, in almost all countries, violence, incest, and sexual touching conducted by parents or caretakers are considered to constitute abuse (International Society for Prevention of Child Abuse and Neglect, 2008). Less unanimity is shown for the acceptability of physical discipline and parental substance abuse. Physical discipline is less likely to be considered as abuse in African and Asian countries and parental substance abuse is less likely to be considered as child abuse in America and Asia, compared with in other parts of the world (International Society for Prevention of Child Abuse and Neglect, 2008). However, child abuse occurs in all countries.

As there are some variations between cultures in what to include in the concept of child abuse, it is not surprising to find inconsistent definitions and measurements in the scientific literature as well. Child abuse, child neglect and child maltreatment are all terms to describe actions or non-actions that cause or risk causing harm to the child's health. Child maltreatment is seen to include child abuse and child neglect, but the WHO (1999) defines child abuse as '... all forms of physical and/or emotional ill-treatment, sexual abuse, neglect or negligent treatment or commercial or other exploitation, resulting in actual or potential harm to the child's health, survival, development or dignity in the context of a relationship of responsibility, trust or power'. A child is defined as a human being below 18 years of age (WHO, 1999). Thus, the WHO uses a definition that is very broad and that covers ill-treatment of various forms regardless of intensity and frequency. The effect of the behaviour is not decisive, but any behaviour that results in harm or has the potential to do so is included in the child abuse concept, regardless of intention. In scientific studies, cases of child abuse are sometimes measured using descriptions of abusive acts or official registers, e.g., health care classification labels, criminal records and reports to the child protection services (Maclean et al., 2017; Sariola & Uutela, 1992; Wegman & Stetler, 2009). In 1995–1997, the CDC in the United States conducted the Adverse Childhood Experience (ACE) study, examining childhood abuse and health later in life (Felitti et al., 1998). The ACE concept includes experiences of physical, emotional, and sexual abuse within the household at an age below 18 years, but also includes other early-life stressors: having a mother treated violently, household substance abuse, household mental illness, parental separation, and having an incarcerated household member (Felitti et al., 1998). During a second wave of the study,

emotional and physical neglect were added to the ACE definition (CDC, 2016).

The parental approval of abuse for disciplinary purposes has declined in Sweden over the last 50 years. In 1965, 53% of parents agreed that 'A child has to be given corporal punishment from time to time' (Roberts, 2000). In 1979, the endorsement of the same statement had declined to 26% and legislation prohibiting corporal punishment was enacted in the same year (Roberts, 2000). In 2017, 0.3% of Swedish parents were positive to corporal punishment (Children's Welfare Foundation Sweden, 2017).

The occurrence of child abuse is difficult to estimate due to unreported cases. On behalf of the Swedish government, the Children's Welfare Foundation Sweden has conducted a series of national representative studies on the prevalence of child emotional and physical abuse. Twelve and nineteen percent of Swedish parents admit to having used emotional and physical violence (mainly pushing, grabbing or shaking), respectively, towards one of their children in the last year (Children's Welfare Foundation Sweden, 2017). Fourteen percent of children in ninth grade anonymously reported experiences of being beaten by adults in their homes and 3% reported this happening on multiple occasions (Children's Welfare Foundation Sweden, 2011). Globally, every fourth adult reports having been exposed to childhood physical abuse and 20% of women report having been exposed to childhood sexual abuse (WHO, 2014).

## Why are children abused?

According to the Ecological Systems Theory, individual factors, proximal social relationships, the community, and societal factors all contribute to children's development (Bronfenbrenner, 1977). Garbarino (1977) has applied the ecological perspective to child abuse and views child abuse as the result of characteristics of the caregiver and the child, but also of insufficient compensation from the surrounding family, community and society.

Parental stress, cultural norms, family situation, isolation, and societal support are some factors that have been suggested to affect the risk of being exposed to childhood abuse (Cadzow, Armstrong, & Fraser, 1999; Children's Welfare Foundation Sweden, 2011; WHO, 2002; 2014). At a societal level, child maltreatment follows the gradient of child poverty (Drake & Pandey, 1996). At an individual level, children seem to be more vulnerable at certain ages, depending on sex and certain special characteristics. Young children are more often exposed to physical abuse, including fatal abuse, while older children have been shown to be at greater risk for being exposed to sexual abuse (Children's Bureau, 2019; Children's Welfare Foundation Sweden, 2011; Kotch, Chalmers, Fanslow, Marshall, & Langley, 1993). Boys have a higher risk for being exposed to more severe physical abuse, while girls are more exposed to sexual abuse (Children's Bureau, 2019; Children's Welfare

Foundation Sweden, 2011; Stoltenborgh, van Ijzendoorn, Euser, & Bakermans-Kranenburg, 2011). Some groups of children in need of special support, e.g., children with intellectual disabilities, are at an increased risk of becoming victims of child abuse (Maclean et al., 2017). When it comes to the characteristics of the perpetrators, unemployment, separation and disabilities have been shown to be risk factors for carrying out physical abuse (Annerbäck, Wingren, Svedin, & Gustafsson, 2010). Swedish men are more than twice as likely as women to be the suspected of abuse when a child is 0–6 years old (Brå, 2011), but teenage children anonymously reporting parental abuse state similar proportions of maternal and paternal perpetrators (Annerbäck et al., 2010).

### Long-term consequences of childhood abuse

Childhood abuse may cause serious short-term health effects and there is an increasing amount of evidence that it also affects long-term health. In the last two decades, great efforts have been made to study the possible mechanisms for the effects of childhood abuse on long-term health. The effects of childhood abuse have been suggested to be mediated by alterations to the brain structure, a hampered stress response, social and emotional impairments and adoption of harmful coping strategies.

The human brain is plastic and shaped by its environment, especially during childhood. There are indications that certain ages are more sensitive to exposure of abuse than others (Andersen et al., 2008). Being exposed to childhood abuse has been indicated to have effects on the brain structure development that may be considered as either damages and/or adaptations to the environment (Teicher, Samson, Anderson, & Ohashi, 2016). The locus of the alterations of the cortex is related to the sensory cortex involved in experiencing the abuse. For instance, children exposed to verbal abuse get alterations in the auditory cortex (Teicher et al., 2016).

Through an epigenetic mechanism, methylation of DNA, childhood abuse is believed to decrease expression of glucocorticoid receptors in the hippocampal tissue leading to a hampered negative feedback mechanism in the hypothalamic-pituitary-adrenal axis (McGowan et al., 2009). This leads to problems with regulating a normal stress-response level when a stressor is not present anymore, thus preserving the stress reaction.

Childhood abuse is believed to lead to impaired social and emotional abilities (Felitti et al., 1998). Children abused by a caretaker cannot rely on him/her to feel secure, despite being in an environment that is supposed to be nurturing. These children develop behaviours to protect themselves that may lead to disorganised attachments, also in future relationships (Prather & Golden, 2009). The impaired social, emotional and cognitive functions are often dealt with by adopting health risk behaviours such as overeating or use of tobacco, alcohol and illicit drugs (Felitti, 2009; Goncalves et al., 2016). The

risk behaviours have a delayed effect in terms of higher risk for developing a wide range of communicable and non-communicable diseases later in life (Felitti, 2009; Felitti et al., 1998).

Some of the long-term health problems associated with childhood abuse are risk-taking behaviours (including higher number of sexual partners and no contraceptive use), sexually transmitted infections (STIs), depressive disorders, suicide attempts, anxiety disorders, ischaemic heart diseases, chronic lung disease, cancer, and premature death (Felitti et al., 1998; Norman et al., 2012; Senn & Carey, 2010). There is also an association between childhood abuse and experiences of pain in adulthood. Women with experiences of childhood abuse have higher pain intensities and more chronic pain locations than unexposed women (Eriksen et al., 2016). There are indications that this may also apply to experiences of pain during pregnancy. The more categories of abuse a woman experienced during childhood, the higher the risk to experience frequent headaches and migraine during pregnancy (Anda, Tietjen, Schulman, Felitti, & Croft, 2010; Gelaye et al., 2016). Women exposed to childhood abuse are at higher risk for reporting common pregnancy-related complaints including back pain, leg cramps, pelvic-girdle relaxation, and headache (Lukasse, Schei, Vangen, & Oian, 2009). An interview study has shown that women exposed to childhood sexual abuse may experience re-enactments of the abuse during pregnancy (Montgomery, Pope, & Rogers, 2015). The re-enactments of the abuse may be triggered by pregnancy-related pain, vaginal examinations, and feelings of losing control as the body changes.

The associations between childhood abuse and adult health have been argued to be causal because of the consistency between studies, dose-response relationships and taking other possible explanations into account (Felitti, 2009; Norman et al., 2012). Other researchers argue that there is convincing support for causal effects of childhood abuse on brain development, but more research is needed before concluding that changes in the brain are the cause of later health problems (Teicher et al., 2016).

## Pregnancy-related pain

### Prevalence of pregnancy-related pain

Experiences of pregnancy-related pain are very common. The most common locations to experience pain are the back and the pelvic-girdle region. About 50% of pregnant women experience pelvic-girdle pain (20% at a given time-point in third trimester), and a third of all pregnant women experience low back pain (Vleeming, Albert, Ostgaard, Sturesson, & Stuge, 2008; Wu et al., 2004). The onset may be at any gestational length and the intensity often increases with strain and as the pregnancy advances and may lead to disabilities affecting normal day-to-day activities (Kristiansson, 2014). About half of all

women who experience pelvic-girdle pain or back pain have milder complaints, but 25% report pain intensities  $> 75$  mm on visual analogue scales (VAS) ranging from 0–100 mm (Kristiansson, Svardsudd, & von Schoultz, 1996). Women with higher pain intensities report higher disability levels and have more days of sickness benefits (Kristiansson et al., 1996). Exercise does not prevent pregnancy-related pain, but may decrease the symptoms and sick leave and increase function during pregnancy (Liddle & Pennick, 2015; Vleeming et al., 2008).

The pain intensity decreases after pregnancy and the majority of women have no symptoms of pelvic girdle pain or low back pain after some time, but one out of four women experiences pain 12 weeks postpartum (Wu et al., 2004), and 10% of women with pregnancy-related pelvic pain have persisting symptoms 1.5 years after having given birth. For some women, the symptoms remain and lead to disabilities and sick leave more than 10 years postpartum (Bergstrom, Persson, Nergard, & Mogren, 2017; Rost, Jacqueline, Kaiser, Verhagen, & Koes, 2006).

## Development of pregnancy-related pain

What causes pregnant women to develop pregnancy-related pain is not fully understood (Vermani, Mittal, & Weeks, 2010). During pregnancy, the hormone level of relaxin is increased, causing higher laxity in the ligaments. Women with pelvic girdle pain have high serum relaxin levels, which are believed to contribute to pregnancy-related pain (MacLennan, Nicolson, Green, & Bath, 1986; Vleeming et al., 2008). Strenuous work, previous pregnancies, having pain in previous pregnancies, previous low back pain, and previous trauma to the pelvis are also risk factors for pregnancy-related pain (Vleeming et al., 2008; Wu et al., 2004); (Bjelland, Eskild, Johansen, & Eberhard-Gran, 2010), suggesting a more complex path of causation than only hormonal components.

## Rationale of the thesis

Measuring pregnancy planning is important as a reproductive health indicator and for monitoring fluctuations in reproductive health. In a clinical setting, it may also enable health care professionals to understand the context of a pregnancy, which may benefit the individual woman in counselling. The LMUP and the SPPS take into account that pregnancies may be more or less planned, but their psychometric properties have never been studied in a Swedish context before. The SPPS is a single-item scale that would be easier to use in clinics, compared with the more extensive, but frequently used, LMUP. However, there is no knowledge on what is being measured when using the SPPS.

Nor have the psychometric properties and assessments of the LMUP and the SPPS been compared previously.

There is a knowledge gap concerning the influence of childhood abuse on two aspects of reproductive health: pregnancy-related pain and pregnancy planning. It has previously been shown that women exposed to childhood abuse are more likely to suffer from chronic pain, frequent headaches, and pain during pregnancy. However, the association between ACEs and any pain with onset during pregnancy, including pain intensity and distribution, is unknown. Few previous studies have examined the association between childhood abuse and pregnancy planning status. One previous study is probably hampered by recall bias and another study has not taken into account that the association could possibly be explained by a selection bias induced when only recruiting pregnancies still ongoing at the time of the routine foetal ultrasound examination.

# Aims

The overall aim of the thesis is two-fold: (1) To psychometrically evaluate two scales used for measuring pregnancy planning, the LMUP and the SPPS; and (2) to study the association between adverse experiences in childhood, including childhood abuse, and aspects of reproductive health later in life.

## Study I

To study the psychometric properties of the LMUP and the SPPS and compare their assessments of the levels of pregnancy planning.

## Study II

To explore how the SPPS is interpreted by pregnant women and what they consider in responding to the measurement.

## Study III

To study the association between adverse childhood experiences (ACEs) and the development of pregnancy-related pain.

## Study IV

To study the separate and joint effects of childhood emotional, physical and sexual abuse, on having an unplanned pregnancy. An additional aim was to study if the potential effect of a collider-stratification bias, induced by selection, could explain the effects of childhood abuse.

# Methods

Qualitative and quantitative designs were used for this thesis. An overview of the methods used in the studies included in this thesis is shown in Table 1.

Table 1. *The study designs, data collection methods, samples and analyses used in the thesis.*

<b>Study</b>	<b>Design</b>	<b>Data collection</b>	<b>Sample</b>	<b>Analyses</b>
I	Cross-sectional	Questionnaires. 2012–2013.	2,314 + 88 + 32 pregnant women registering at ANCs	Confirmatory factor analysis, Cohen’s weighted $\kappa$ , Kruskal-Wallis test, Spearman’s correlation coefficient
II	Qualitative, descriptive	Think-aloud interviews followed by semi-structured interviews. 2015–2016.	25 pregnant women recruited in early pregnancy at ANCs	Thematic content analysis
III	Cross-sectional	Questionnaires. 2011–2012.	142 pregnant women registering at ANCs	General Linear Model, logistic regression, Spearman’s correlation coefficient
IV	Cross-sectional	Questionnaires from the Norwegian Mother and Child Cohort Study (MoBa). 1998–2008.	76,197 women recruited in connection with routine ultrasound examinations	Poisson regression, relative excess risk due to interaction (RERI), sensitivity analysis

## Participants, procedure and analyses

### Study I

For this study, data from the Swedish Pregnancy Planning Study were used. In total, 215 ANCs from various parts of Sweden were invited to participate in the data collection and 153 (71%) chose to do so. The ANCs recruited women between September 2012 and July 2013. A test-retest pilot study took place in November 2011–February 2012 at five of the ANCs. In Sweden, all pregnant women are offered maternal health care free of charge, mainly provided by midwives. Nearly all pregnancies in Sweden that end with live birth are enrolled to ANCs. Women make their first visit to a midwife around the

tenth week of gestation and a woman on average makes 8 or 9 visits, depending on if she has given birth before or if she is nulliparous (The Swedish Pregnancy Register, 2016).

Women ( $n = 5,493$ ) who came to the ANCs for registration were given verbal and written information about the study and were asked to participate by the midwives. There were no exclusion criteria. In order to include all pregnant women, participants were given the option to answer the self-administered questionnaire in languages other than Sweden or through an interview with a professional interpreter. In all, 303 women were not asked to participate by the midwives. The most common reasons were that the midwives had forgotten to ask ( $n = 114$ ) or time constraints ( $n = 47$ ). Women who accepted participation ( $n = 4,968$ ) gave their written consent. Among women who received ( $n = 4,844$ ) and returned a questionnaire ( $n = 3,327$ , 69%), 925 women met at least one exclusion criterion for this specific paper. Women who had an ability to read Swedish other than 'very well' ( $n = 293$ ), a pregnancy with a gestational age other than  $< 15$  weeks ( $n = 673$ ), or who did not respond to all the LMUP/SPPS items ( $n = 41$ ) were excluded. Four women were excluded since they had no partner at conception and thus could not answer the LMUP item concerning partner agreement.

The remaining 2,402 women were divided into an ART group ( $n = 88$ ) and a main study group ( $n = 2,314$ ) depending on if the pregnancy was a result of becoming pregnant using ARTs or not. The ART group was used to study the construct validity of the LMUP and the SPPS. As ART is only available to people who clearly have an intention to become pregnant and have taken actions to achieve this, it is argued that all pregnancies initiated through ART should be considered as planned. A third group used for this study consisted of data from the test-retest pilot study. Recruitment was conducted in the same manner as for the main study. Women who accepted participation ( $n = 43$ ) received two identical questionnaires; one to answer at the clinic and one to answer 14 days later. The second questionnaire was sent to the researchers using a prepaid envelope. The test-retest group consisted of the 32 women who answered both questionnaires.

### **Adjustments and translations of the scales**

First, adjustments were made to the LMUP. Changes were made to the last item of the measurement, concerning pre-conception preparations, to obtain more detailed information and to adapt it to the Swedish setting. Pre-specified actions starting with 'stopped or cut down' were split into two alternatives, for instance 'stopped or cut down drinking alcohol' was split into 'stopped drinking alcohol' and 'reduced my alcohol consumption'. Some additional response alternatives were added: 'stopped using snus', 'reduced my snus use', 'stopped drinking coffee', 'reduced my coffee consumption', 'exercised more', and 'exercised less'. Ticking one or both response alternatives concerning the same action, e.g., ticking both 'stopped drinking alcohol' and/or

‘reduced my alcohol consumption’ gave 1 point. Other than that, no changes were made to the scorings of the item. Each action taken resulted in 1 point, with a maximum total of 2 points.

The LMUP was translated into Swedish by researchers and clinicians working with reproductive health. The LMUP was then back-translated into English by a professional translator. For this study, the SPPS was translated from Swedish into English by a professional translator.

### **Psychometric evaluation of the LMUP model**

The data fit to the LMUP model was studied using confirmatory factor analysis (CFA). The normed  $\chi^2$  test was used to get an overall picture of the model fit, although the number of participants made it likely to identify small differences that might not be clinically relevant. Therefore, other indices of the model fit were also used (Table 2). Indices that were considered acceptable in studying the model fit, factor loadings and other aspects of the LMUP are presented in Table 2.

### **Test-retest reliability and split-half reliability**

The test-retest reliability of the LMUP and the SPPS was studied using Spearman’s correlation. The total measurement scores were used. The cut-offs for low, medium, and large test-retest reliability were 0.1, 0.3, and 0.5, respectively (Cohen, 1988).

Calculating the split-half reliability of the LMUP, items 1–3 constituted one set and items 4–6 another. A Spearman-Brown coefficient  $\geq 0.70$  was considered reliable (Cohen 2006).

### **Construct validity of the LMUP and the SPPS**

The construct validity of the LMUP and the SPPS was studied using hypothesis testing. Women with higher levels of pregnancy planning should reasonably be less inclined to consider having an induced abortion than women with less planned pregnancies. Thoughts of having an induced abortion were measured using the question ‘During your current pregnancy, have you thought about terminating your pregnancy?’ and the five response alternatives: ‘No, not at all’ (1 point), ‘No, not really’ (2 points), ‘Neither yes nor no’ (3 points), ‘Yes, a little’ (4 points), ‘Yes, a lot’ (5 points). The Kruskal-Wallis test and Spearman’s correlation were used to see if there were any differences or correlations between thoughts of having an induced abortion and the LMUP or the SPPS, respectively. We hypothesised that the level of pregnancy planning was inversely related to the extent of thoughts of having an induced abortion.

Pregnancies initiated using ARTs should be considered as highly planned, since ARTs are only used by women and men who intend to become pregnant. We compared the LMUP and SPPS scores for women who had become pregnant using ARTs. In order to compare the scores, we reduced the levels of

pregnancy planning to three for each measurement. The recommended three-level cut-offs for the LMUP were used (Barrett et al., 2004). The SPPS was categorised into unplanned (1–2 points), ambivalent (3 points), and planned (4–5 points). There were no unplanned pregnancies in the ART group, as measured using either the LMUP or the SPPS. This led us to merge the categories ambivalent and unplanned, and to use McNemar’s test to study any differences in categorisations.

### Comparison of assessments of the LMUP and the SPPS

To study the consistency of ratings between the LMUP and the SPPS, weighted Cohen’s  $\kappa$  was used. Squared weights were used to adjust for the size of the disagreement. The same three-level categorizations that were used to study the construct validity were used for studying the consistency of the ratings. The interpretations of the  $\kappa_w$  value are presented in Table II. Software used for performing analyses were IBM SPSS Statistics 20 (IBM, Armonk, NY, USA) and R 3.0.1 (R Development Core Team, R Foundation for Statistical Computing, Vienna, Austria). The significance level ( $\alpha$ ) was set to 0.05.

Table 2. *Cut-offs for acceptable results of the Confirmatory Factor Analysis (CFA) and Cohen’s weighted  $\kappa$ . Standardised estimates are applied for factor loadings and error variances.*

Property	Indicator	Cut-off	
Model fit <sup>1</sup>	Normed $\chi^2$ -test	< 0.50	
	Comparative fit indices (CFI)	>0.95	
	Root mean squared error of approximation (RMSEA)	<0.055	
	Standardized root mean square residual (SRMR)	<0.055	
	Standardized residuals	-2 to 2	
Factor loadings <sup>2</sup>		-1 to 1	
Error variances <sup>2</sup>		0 to 1	
Item reliability <sup>3</sup>	R <sup>2</sup>	≥0.40	
Convergent validity <sup>3</sup>	Average variance extracted (AVE)	>0.50	
Composite reliability <sup>3</sup>		>0.70	
Agreement of the LMUP and the SPPS <sup>3</sup>	Weighted $\kappa$	Fair	0.21-0.40
		Moderate	0.41-0.60
		Substantial	0.61-0.80
		Almost perfect	0.81-1.00

<sup>1</sup> Wheaton, Munthen & Alwin, 1997; Landis & Koch, 1997; Hu & Bentler, 1999

<sup>2</sup> Everitt & Horton, 2011

<sup>3</sup> O’Rourke & Hatcher, 2013

## Study II

To study how women interpreted the SPPS and what they considered when responding to it, a qualitative study was conducted using a think-aloud method and semi-structured interviews (Charters, 2003). The think-aloud method involves performing a task and verbalizing thoughts as they come to mind, with as little editing and delay as possible. However, thoughts are often very complex and may come and go suddenly. Verbalizing thoughts requires them to be simplified, and they also take time to be expressed, thereby interfering somewhat with the natural flow of thoughts (Charters, 2003).

Sudman, Bradburn, and Schwarz (1996) have described the thought process from reading and interpreting a research question through to a response being given. In short, the interpretation of the question depends on the semantic understanding of the words, but also on the respondent's perception of the researcher's intention. The context in which a question is posed, previous questions in the questionnaire, and the response alternatives influence interpretation of the question. Response alternatives contribute to the understanding of the question and often help to clarify what sort of information the researcher is aiming to get (Sudman et al., 1996). After interpreting the question, the respondent recalls an already formed judgement or forms a new one. Recalling a judgement is often done when the respondent has recently formed a judgement or when the person is emotionally affected. However, in most cases, new judgements are formed after reading a question. When forming a judgement, memories are retrieved about, e.g., having performed the behaviour asked about and the frequency of the behaviour. In general, information is retrieved until a judgement is formed, not until a careful assessment has been made. When motivation is higher, judgements are formed more carefully. Finally, a response is given. Response alternatives restrict the respondent in their possibilities to answer the question. Usually, the response alternative that lies closest to the respondent's judgement is ticked, but social norms and the context may affect what response is reported (Sudman et al., 1996).

The study was performed in one Swedish county at four antenatal clinics, representing both urban and rural areas. Data collection took place in June 2015–May 2016. Swedish-speaking and -reading pregnant women coming for their health visit in early pregnancy or for registration of their pregnancy were eligible for participation. Midwives were informed that we were interested in recruiting eligible women with heterogeneous background characteristics who had become pregnant under differing life circumstances. The ANC contacted the researcher (JD) and notified her when an eligible woman had been booked for a visit. The researcher made sure to be available at the ANC during the appointed time.

Eligible women were briefly informed about the study when they booked their appointments or at the end of their appointment with the midwife. Women who showed interest in participating or wanted more information

were introduced to the researcher. The women were given verbal and written information about the aim of the study, they were informed that participation was voluntary, how data would be used, stored and presented, and that they could end their participation at any time without explaining why. Women who consented to participate were interviewed at the ANC or at another time and place chosen by the participant.

Twenty-five women gave written consent to participate. The median gestational age of the participants' pregnancies was 10 weeks (Interquartile range = 7–11) and the age of the women varied between 20 and 45 years ( $m = 30$ ,  $IQR = 27–35$ ). Five women (20%) were born in a country other than Sweden and 14 (58%) had completed studies at a university or college. Two women (8%) did not have a partner at the time and the participants had experienced between 0 and 4 pregnancies ( $m = 0$ ,  $IQR = 0–1.5$ ). Their levels of pregnancy planning, reported during the interviews, were as follows: Highly planned,  $n = 13$  (54%), Quite planned,  $n = 5$  (21%), Neither planned nor unplanned,  $n = 2$  (8%), Quite unplanned,  $n = 1$  (4%), and Highly unplanned,  $n = 3$  (13%).

One of the women terminated her participation shortly after starting the interview and explained that it was too emotional for her to talk about the topic. During two of the interviews, young children, brought by the participants, were present in the room. Before the start of the study, two pilot interviews were conducted, during which the interview guide was tested. These interviews led to changes in the order of the questions. Some minor changes were also made during the study.

As suggested by Gibson (1997), the participants were given instructions for using the think-aloud method and got to practise the method before the interview started, without any modelling by the researcher. The test question was on a different subject than that of the SPPS.

The interview guide is presented in Table III. The interviews started with a concurrent think-aloud. The concurrent think-aloud interviews lasted between 12 and 232 seconds, with a median of 32 seconds. To increase the possibility of capturing non-verbalised thoughts in the concurrent think-aloud, it was followed by a retrospective think-aloud. If the women did not say anything or only a few words in the concurrent think-aloud interview, the interviewer asked: "What were your thoughts while reading and responding to the last question?" All participants were asked if they had thought about anything that they did not verbalise. To be able to follow up on previously mentioned aspects, and to give a more detailed understanding of how the pregnant women understood and interpreted the SPPS, the think-aloud interviews were followed by semi-structured interviews (Table 3). Afterwards, each participant was asked if they had anything to add to what had been said. The interviewer summarized what the participant had said and the participant was encouraged to correct any misinterpretations or if the interviewer had missed anything of importance. These full interviews lasted 15 minutes in median (range 9–34 minutes). Interviews were conducted until all researchers agreed that no new

data were obtained. The interviews were audio recorded and transcribed verbatim.

Table 3. The phases of the interviews and the interview questions used for data collection.

<b>Interview phase</b>	<b>Questions</b>
Concurrent think-aloud	And from now on I would like you to verbalise all thoughts that come to mind. Please be as detailed as possible
Retrospective think-aloud	[If the concurrent think-aloud interview lasted for a short time:] What were your thoughts while reading and responding to the last question? Was there anything you thought of that you did not verbalise?
Semi-structured interview	How do you interpret the question 'How planned was your current pregnancy?' You said that your pregnancy was [...] Please tell me why you chose this alternative. How do you interpret/When would you have chosen 'Highly planned' instead? How do you interpret/When would you have chosen 'Quite planned' instead? How do you interpret/When would you have chosen 'Neither planned nor unplanned' instead? How do you interpret/When would you have chosen 'Quite unplanned' instead? How do you interpret/When would you have chosen 'Highly unplanned' instead? Are there any circumstances that you think conform to a planned pregnancy? Are there any circumstances that you think conform to an unplanned pregnancy? Did you take any actions before becoming pregnant to improve health during pregnancy? Did your partner take any actions before becoming pregnant to improve health during pregnancy

All interviews were performed by a female registered nurse (JD) with previous education in qualitative methods and interviewing technique. The interviews were supervised by an experienced qualitative researcher and nurse-midwife (MER).

A qualitative thematic analysis was used to analyse the data (Burnard, Gill, Stewart, Treasure & Chadwick, 2008). First, the interviews were reviewed thoroughly. In the open coding phase, a summary of what was being said, a code, was written next to the text segment. Text that clearly had no relevance for the purpose of the study was considered as dross and was not coded. A list with all the codes was compiled and duplicates were removed. The remaining codes were grouped with similar codes. Each group was given a category name and a colour. The codes and the category names were worked through until all codes belonged to a category and no codes belonged to multiple cat-

egories. In the final step, all interviews were read through again and the transcriptions were highlighted with the colour of the category that the text belonged to, in order to see that no text was left out or belonged to more than one category.

The analyses were triangulated by separate analyses conducted by the three researchers. Two of the researchers (JD and BW, the latter a registered nurse and highly experienced qualitative researcher) analysed all the interviews, while MER analysed a smaller sample of them. When assessments or category names were not consistent between the researchers, they were discussed until agreement was reached.

### Study III

A pilot study of the Swedish Pregnancy Planning Study was used to investigate the association between childhood abuse and pregnancy-related pain. Eighteen ANC's were chosen, by convenience, for participation. Inclusion criteria for the pilot study were being pregnant, coming for enrolment to a participating ANC and being able to understand and speak Swedish. Data collection took place between October 2011 and April 2012. Midwives kept records of all pregnant women who were registered at the clinics. The enrolment process is described in Figure 1.

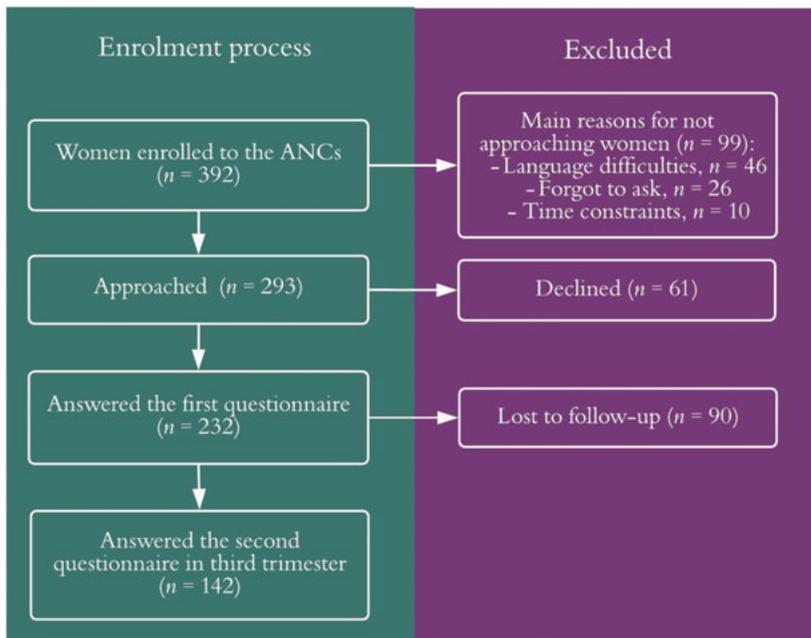


Figure 1. The enrolment process for the pilot study of the Swedish Pregnancy Planning study.

Approached women received verbal and written information about the study and women who wanted to participate gave their informed consent. The first questionnaire was handed out to women in early pregnancy at registration to the ANC. It was given to the participants by the midwife to be answered in the waiting room or at home. The second questionnaire was sent to them by post, together with a postage-free envelope, during their third trimester. Two reminders were sent.

Some of the variables included in the first questionnaire were monthly income (Swedish krona), completed education (< 12 years/> 12 years), gestational age (weeks), gravidity (*n*), parity (*n*), country of birth (Sweden/other country), and lifestyle habits. A drawing of the body was used for mapping pain locations experienced in the preceding week, along with date for onset of pain. The pain drawing was divided into 41 predetermined areas (not visible to the respondent) to indicate the distribution of the pain. Having pain was defined as reporting any pain location on the pain drawing. Reporting a pain location covering more than one pain area was registered as having pain from the number of pain areas that the pain location involved. Drawing multiple pain locations within one pain area was registered as having pain in one pain area. Pain locations with pain onset before the current pregnancy were excluded. Present pain intensity and worst pain intensity in the preceding week were measured on visual analogue scales (VAS), 0 mm (no pain) – 100 mm (worst possible pain).

The second questionnaire measured ACEs using 19 items, which have been described in detail elsewhere (Anda et al., 1999). The items covered eight categories of ACEs: emotional abuse (3 items), physical abuse (2 items), sexual abuse (4 items), parental separation (1 item), witnessing domestic abuse (4 items), household mental illness (2 items), incarcerated household member (1 item), and household substance abuse (risk consumer of alcohol/alcoholic/illicit drug user, 2 items). When measuring childhood emotional and physical abuse, only behaviours performed by adult household members were enquired about. With regard to childhood sexual abuse, participants were asked about behaviours performed by adults, older relatives, friends to the family, and strangers. Exposure to an ACE category was defined as reporting experiences to any of the events of the items related to the respective ACE categories. An ACE score was given by the number of ACE categories that a woman had experiences of: between 0 and 8. The follow-up questionnaire contained the same items measuring pain locations and pain intensities as the baseline questionnaire.

## **Analyses**

Participants' characteristics were presented using frequencies and percentages or means and 95% confidence intervals. The pain intensities and pain locations reported in the third trimester were used for the analyses. Correlations between

variables at the nominal level were analysed using chi-square tests and correlations between variables at the ordinal level were analysed using Spearman's correlation. For studying associations between ACEs and pain experiences, logistic regression was used for dichotomous outcome variables and general linear model when the outcome was continuous. Analyses were performed using the IBM SPSS Statistics 20 (IBM, Armonk, NY, USA) and the SAS program package version 9.3 (SAS Institute, Cary, NC, USA). For hypothesis testing, two-tailed tests were used and a significance level ( $\alpha$ ) of 0.05 was applied.

## Study IV

Data from a large prospective cohort study, the Norwegian Mother and Child Cohort Study (MoBa), was used for this study. The MoBa study was conducted by the Norwegian Institute of Public Health and recruitment to the cohort took place in Norway in 1999–2008 in connection with routine ultrasound examinations during the second trimester (Magnus et al., 2006; Magnus et al., 2016). There were no exclusion criteria for participation, but questionnaires were only available in Norwegian. Forty-one percent of the approached women consented to participate. The cohort includes about 112,000 pregnancies, 114,000 children, 95,000 mothers and 75,000 fathers (Magnus et al., 2006).

In the MoBa study, three questionnaires were sent to the women and returned by mail during pregnancy. The first questionnaire was sent to the women in gestational week 15, and included questions about socio-demography, pregnancy planning status, general health, mental health, lifestyle and reproductive history. A second questionnaire concerning food habits was sent out in gestational week 22. The third questionnaire was sent to the participating women in week 30, and included questions about experiences of emotional, physical, and sexual abuse.

The 10<sup>th</sup> version of data available within the MoBa study represented 112,745 pregnancies. Some pregnancies were excluded before the analyses (in the following order): Duplicates due to multiple gestations ( $n = 10,561$ , 9.4%), pregnancies with previous maternal participation ( $n = 15,467$ , 15.1%), non-responders to the third questionnaire ( $n = 7,787$ , 9.0%), non-responders to items concerning pregnancy planning and/or childhood abuse ( $n = 2,577$ , 3.3%) and having a maternal age <18 years or missing ( $n = 201$ , 0.3%). The remaining 76,197 women were included in the analyses.

The outcome, pregnancy planning status, was measured through the single item 'Was this pregnancy planned?' (yes/no). A planned pregnancy was defined as responding 'yes' to this question. Women responding 'no' were considered to have an unplanned pregnancy. To not overestimate the risk of having an unplanned pregnancy, ticking both 'yes' and 'no' ( $n = 118$ ) was considered to be a planned pregnancy.

Main exposures were experiences of emotional, physical and sexual abuse during childhood. Experiences of childhood abuse was assessed using four statements: ‘Someone has over a long period of time systematically tried to subdue, degrade or humiliate you’ (mild emotional abuse); ‘Someone has threatened to hurt you or someone close to you’ (severe emotional abuse); ‘You have been subjected to physical abuse’ (physical abuse); and ‘You have been forced to have sexual intercourse’ (sexual abuse). Participants responded by ticking any of the pre-specified response alternatives (‘No, never’, ‘Yes, as a child (under 18)’, or ‘Yes, as an adult (over 18)’). Being exposed to childhood emotional, physical or sexual abuse, respectively, was defined as having answered ‘Yes, as a child (under 18)’ to the corresponding statement.

Other variables that were measured were previous pregnancies and their outcomes (e.g., spontaneous abortion, terminated abortion, and live birth), marital status, and highest completed education level. By linkage to the Medical Birth Registry of Norway, age and country of birth (Norway/other) was obtained.

### **Analyses**

The participants’ characteristics were presented descriptively. Frequencies and percentages were used for categorical data, and means and standard deviations (SD) were used for continuous data.

To study the association between childhood abuse and pregnancy planning, a modified Poisson regression analysis was used, with robust standard errors. Results were presented as relative risks (RRs) with accompanying 95% confidence intervals. The regression models were constructed based on assumptions made in a directed acyclic graph (DAG). The DAG suggested that country of birth, age, and education were potential confounding variables that should be adjusted for in the regression models.

To study if any association between childhood abuse and pregnancy planning was caused by the separate effects of the categories of abuse or their joint effects, the relative excess risk due to interaction (RERI) was calculated. The RERI was calculated for all two-way combinations of the categories of childhood abuse, and were adjusted for age, country of birth, education level, and the third category of childhood abuse. Separate Poisson regression analyses and calculations of the RERI were performed for all women ( $n = 76,197$ ) and for the subgroup of nulliparous women ( $n = 41,779$ ).

A potential collider-stratification bias, induced by selection, was identified using the DAG. It was hypothesized that both pregnancy planning status (outcome) and childhood abuse (exposure) would influence the likelihood of having an induced abortion, as well as the likelihood of being invited to the research study. In order to study the effect of childhood abuse on pregnancy planning while taking a possible collider-stratification bias into account, sensitivity analyses were performed (p.24, Smith & VanderWeele, 2018). For

these analyses, all induced abortions were assumed to be unplanned pregnancies and the probability of having an induced abortion for unexposed women was assumed to be 0.2. The latter was assumed based on registry data showing that 20.0% of all registered pregnancies during the years of recruitment were terminated by an induced abortion (spontaneous abortions not included; The Medical Birth Registry of Norway, 2018; The Norwegian Registry of Pregnancy Termination, 2018). The relative probabilities of terminating a pregnancy by having an induced abortion for exposed and unexposed women in the MoBa study were calculated based on self-reported parity and number of induced abortions.

The statistical analyses were performed using the IBM SPSS Statistics (version 24) and R (version 3.5.1) together with the packages ‘geepack’ (version 1.2-1), ‘sandwich’ (version 2.5-0) and ‘epiR’ (version 0.9-99).

## Ethical considerations

Sexual and reproductive experiences, as well as experiences of abuse, belong to the uttermost private sphere of a person’s life. Asking women to share this sort of information for the purpose of research should therefore be done carefully and with particular respect paid to their integrity. This means that the researcher should be perceptive to signals of reluctance to participate and be careful not to persuade or embellish participation. Still, women wanting to share their experiences and contribute to research should be welcomed to do so. In order to keep women autonomous in this decision-making, those eligible for participation must be properly informed about the study in advance. For the studies featured in this thesis, participation was preceded by written (Studies I–IV) and verbal (Studies I–III) information about the purpose of the study, the procedures, how data would be stored, and that participation being voluntary. Informing women about participation being voluntary and non-participation not influencing future care has been especially important in these studies, as all participants were first approached by their caregiver. All participating women gave their consent.

Participation does not come with any specific benefit to the participating women. However, it is reasonable to assume that that participation does not entail any greater costs for the participants. Participation in the studies in question was not expected to bring any serious consequences for the participating women, but it may have caused milder discomfort as women with difficult experiences were reminded of them. Educated researchers and health care personnel were available to provide support to participants in need thereof.

All studies were approved by the Regional Ethical Review Board in Uppsala, Sweden (2010/085, 2015/083, 2017/496) and Study IV was also approved by the Regional Committee for Medical and Health Research Ethics in Norway (2017/1338).

# Results

## Study I

### Psychometric evaluation of the LMUP model

The normed  $\chi^2$  value (5.932,  $p < 0.001$ ) and the normalised residuals (Min. = -2.458, Max. = 2.808) indicated that the model fit of the LMUP is not acceptable. All other fit indices indicated a good model fit and were as follows: CFI = 0.988, SRMR = 0.022, and RMSEA = 0.046; 90% CI: 0.035–0.059.

Three of the items, 'Contraceptive use', 'Desire for pregnancy', and 'Partner agreement', had response alternatives with endorsement rates  $> 80\%$ . All the LMUP items contributed to measuring pregnancy planning ( $p < 0.001$ ), but to varied extents. 'Pre-conception preparations' showed the lowest item reliability ( $R^2 = 0.106$ ) together with 'Contraceptive use' ( $R^2 = 0.186$ ), while 'Intention to become pregnant' and 'Partner agreement' showed the highest item reliability ( $R^2 = 0.777$  and  $R^2 = 0.635$ , respectively). 'Timing' ( $R^2 = 0.357$ ) and 'Desire for pregnancy' ( $R^2 = 0.315$ ) showed non-satisfactory item reliability. The average variance of the LMUP items explained by pregnancy planning, the AVE, was low (0.396). The composite reliability of the LMUP was acceptable (0.780).

### Test-retest reliability and split-half reliability

Both the LMUP and the SPPS showed large test-retest reliability ( $r_s = 0.63$  and  $r_s = 0.83$ , respectively). The split-half reliability for the LMUP items was acceptable, the Spearman-Brown coefficient was 0.752.

### Construct validity of the LMUP and the SPPS

There was a difference in pregnancy planning level depending on the extent of thoughts of having an abortion, regardless of if the LMUP ( $\chi^2_4 = 308.8$ ,  $p < 0.001$ ) or the SPPS ( $\chi^2_4 = 299.8$ ,  $p < 0.001$ ) was used for measuring pregnancy planning. There was an inverse correlation between the level of pregnancy planning and thoughts of having an abortion (LMUP:  $r_s = -0.350$ ;  $p < 0.001$ ; SPPS:  $r_s = -0.346$ ;  $p < 0.001$ ), indicating a medium high construct validity. There were no differences, in a statistical meaning, between the assessments of the LMUP and the SPPS for pregnancies initiated using ARTs (OR = 2.0;  $p = 1.000$ ).

## Comparison of the assessments of the LMUP and the SPPS

In the main study group, 1.1% had an unplanned pregnancy according to the LMUP, compared with 11.3% according to the SPPS. The ambivalent pregnancies constituted 28.6%/13.9% and the planned pregnancies 70.4%/74.8% according to the LMUP/SPPS. The agreement between the measurements in measuring pregnancy planning was substantial,  $\kappa_w = 0.63$ .

## Study II

Seven categories emerged after analysing how women interpreted the SPPS and what they took into account in responding to the measurement: their life situation; intention to become pregnant; desire to become pregnant, actions to prepare for or avoid pregnancy, the timing of the pregnancy, having discussed having a child with partner, and reactions after learning of the pregnancy.

### Life situation

The participants took into account their situation in life, e.g., their economic and educational situation and their relationship status. Some stated that in order to have a planned pregnancy, they would have to have the resources that are necessary to take care of a child, or a plan for getting them. Some of the resources or aspects of the life situation mentioned were employment, economy, time, accommodation, having a partner and age. Some women stated that a stable socioeconomic situation implied a higher level of pregnancy planning, while others argued that a highly unplanned pregnancy could also occur among people with a high and stable socioeconomic situation. There were also disagreements when it came to whether having a partner affected the level of pregnancy planning or not. Some women said that being younger in age (e.g., “teenage pregnancies” or ages below 24), contributed to a lower level of pregnancy planning.

### Desire to become pregnant

Having a desire to become pregnant or to have a child were mentioned when women responded to the SPPS. Sometimes this was the woman’s own desire, at other times it applied to a common desire in both her and her partner. Not having a desire to become pregnant or having conflicting desires within the couple were seen as aspects that lowered the level of pregnancy planning.

## Intention to become pregnant

Some women spontaneously mentioned that they had tried, aimed to become pregnant or agreed with their partner to become pregnant before conception. A 'highly unplanned' pregnancy was characterised as having a lack of such intention. Some argued that the partner's intention did not affect the level of pregnancy planning, while others talked about the joint intention of the woman and her partner. The response alternatives of the SPPS were for some seen as a grading scale from 'Highly planned' to 'Highly unplanned', while others saw that the middle alternative 'Neither planned nor unplanned' as having no intention or as having an intention but not placing any importance on timing. Another description of the middle response alternative included an awareness of the risk of becoming pregnant but having a negligent attitude towards it.

## Timing

When the pregnancy occurred earlier or later than expected, it was seen as something that contributed to a lower level of pregnancy planning. This includes trying to conceive but succeeding sooner than expected. Conceiving at the expected time contributed to a higher level of pregnancy planning. Pregnancy planning was described by some as the final step in a sequence of life events (like finishing your education, starting to work, getting permanent employment and then planning a pregnancy), where the order of the things had importance.

## Actions to prepare for or avoid a pregnancy

As the participants responded to the SPPS, some of them mentioned actively ceasing to use contraception, scheduling intercourse, seeking medical care and using ARTs in order to conceive. It was only during the semi-structured interviews that any lifestyle habits were mentioned. Illicit drug use and alcohol consumption at conception were mentioned when describing highly unplanned pregnancies. Reading about pregnancy and scheduling intercourse based on ovulation described highly planned and quite planned pregnancies. Spontaneous references to food and poor health habits were only mentioned briefly by the participants. Using ARTs and seeking medical care indicated pregnancy planning according to the women and some stated that all pregnancies initiated using ARTs should be regarded as 'highly planned' pregnancies.

## Discussing reproduction with partner

Participants mentioned discussions with the partner on parenthood, having a child or not, adaptations needed to prepare for a larger family and responsibilities that come with having a child. Not having talked about having a child or only having joked about it indicated a lower level of pregnancy planning.

## Reactions after learning of the pregnancy

In the think-aloud interviews, feelings of joy, panic, mixed feelings and not knowing what to feel were described. Reactions such as considering an induced abortion were also described. In the semi-structured interview, a planned pregnancy was described as not coming as a surprise and being met with a positive reaction. The response alternative 'Neither planned nor unplanned' was described as welcoming the pregnancy while having feelings of being surprised and being in need of support. 'Quite unplanned' and 'Highly unplanned' pregnancies were described with negative reactions, becoming shocked and seeing the pregnancy as a problem that needed to be handled. However, positive reactions and finding the situation manageable were not necessarily excluded. These reactions referred the participants' own situation or those of women in general.

## Study III

### Characteristics of the participants

The pregnant women responded to the first questionnaire at a mean of 9.6 completed gestational weeks and the follow-up questionnaire at a mean of 32.7 completed gestational weeks. The mean age for participating women was 30.7 years of age and a majority of the women, 74%, had completed a university education. Fifteen percent of the women were born outside of Sweden and all women responding to the item had a partner ( $n = 141$ ). The participants' mean monthly income was 25,443 SEK. At the baseline measurement, almost half of all participating women (45%,  $n = 63$ ) had experienced pain during the preceding week.

### Exposure to Adverse Childhood Experiences

Sixty-two percent ( $n = 88$ ) of all women had experienced at least one category of ACE. The exposures to ACEs are presented in Table 4. Emotional abuse (33%), parental separation (32%), and physical abuse (20%) were the most commonly reported ACEs. The least commonly reported exposures were mother being treated violently (5%), sexual abuse (4%), and having an incarcerated household member (2%). The women had experienced 0-5 ( $m = 0$ )

ACE categories (and exposed women had experienced 1–5 categories with a median of 2).

Table 4. *The exposure of the respective categories of Adverse Childhood Experiences (ACEs) for the study participants (n = 142).*

<b>Exposure</b>	<b>Proportion (%)</b>
Emotional abuse	33
Physical abuse	20
Sexual abuse	4
Mother being treated violently	5
Parental separation	32
Household mental illness	16
Household substance abuse	12
Incarcerated household member	2

### Experiences of pregnancy related pain in third trimester

In the third trimester, 72% ( $n = 102$ ) of all women experienced pain. Among women experiencing pain, the median current pain intensity was 24 mm (range 0–79 mm) and the median worst experienced pain intensity during the preceding week was 59 mm (range 0–98 mm). Among women experiencing pain, the median number of involved pain locations was 5, ranging from 1 to 36. Pelvic pain was experienced by 57%, leg pain by 46%, sacral pain by 43%, and back pain by 37% of all women.

### The relationship between exposure to ACEs and development of pain during pregnancy

The median worst reported pain intensities during the preceding week was 48 mm for women exposed to any ACE compared with 23 mm for unexposed women ( $p = 0.01$ ). As regards current pain intensities, no difference was found ( $p = 0.13$ ). There was also a correlation between the sum of experienced categories of ACE and the number of pain areas involved ( $r_s = 0.19$ ,  $p = 0.02$ ).

The results from the univariate linear regression analyses showed that the ACE score, country of birth, and reporting pain in early pregnancy were associated with the number of areas from which women experienced pain (see Table 5).

The association between the ACE score and the number of pain areas remained after controlling for pain in early pregnancy and country of birth ( $\beta = 0.75$ ,  $p = 0.007$ ) in a multiple linear regression analysis. The multiple linear regression model explained 17% of the variation in the number of involved pain areas.

Table 5. Results of univariate and multiple linear regression analyses with the number of involved pain areas as the outcome.

Independent variables	$\beta$	$R^2$	$p$
<u>Univariate analyses</u>			
ACE score (0 to 8)	0.79	0.05	0.007
Birth country (Sweden/other)	-2.74	0.04	0.02
Age (years)	-0.17	0.03	0.05
Education (<12 years/>12 years)	-0.56	0.01	0.16
Income (Swedish krona)	0.00	0.00	0.82
Reported pain in early pregnancy (no/yes)	3.00	0.11	<0.0001
<u>Multiple linear regression</u>			
ACE score (0 to 8)	0.75		0.007
Birth country (Sweden/other)	-2.2		0.05
Reported pain in early pregnancy (no/yes)	2.7		0.0002

## The relationship between childhood physical abuse and reporting sacral pain

Compared with women reporting no childhood physical abuse, women exposed to childhood physical abuse reported higher proportions of sacral pain (72% vs. 35%,  $p = 0.0003$ ) and pelvic pain (76% vs. 52%,  $p = 0.02$ ), back pain (52% vs. 33%,  $p = 0.06$ ), and leg pain (62% vs. 42%,  $p = 0.06$ ). No other separate ACE category showed differences ( $p < 0.05$ ) in relation to specific pain locations between exposed and unexposed. The association between childhood physical abuse (independent variable) and experiencing sacral pain at follow-up (dependent variable) was assessed in both simple and multivariable logistic regression. After adjustment for age, education level, income, and birth country, childhood physical abuse remained associated with sacral pain (OR 4.4, 95% CI 1.7–11.4).

## Study IV

The participants with/without experiences of childhood abuse had a mean age of 28.9 (SD 5.0)/29.8 (SD 4.5) years, 55.6%/54.7% were nulliparas and 51.7%/64.2% had completed college or university studies.

Table 6. The proportions of the participants ( $n = 76,197$ ) who reported exposure to the categories of childhood abuse or combinations thereof.

Exposure	Proportions (%)
Emotional abuse	13.7
Physical abuse	5.4
Sexual abuse	6.7
Emotional and physical abuse	3.6
Emotional and sexual abuse	3.0
Physical and sexual abuse	2.6
Emotional, physical and sexual abuse	1.8

Experiences of at least one category of childhood abuse were reported by 18.7%. The participants' exposure to childhood abuse is presented in Table 6. In total, 18.6% of all pregnancies were unplanned. The proportions of unplanned pregnancies among women exposed and not exposed to the categories of childhood abuse are presented in Figure 2.

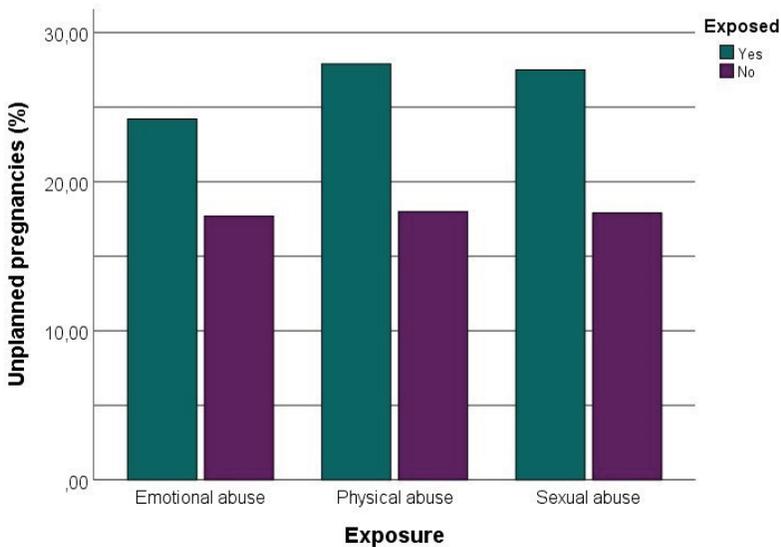


Figure 2. The proportions of the pregnancies that were unplanned for women exposed and unexposed to the three categories of childhood abuse.

### The effects of the separate categories of childhood abuse on pregnancy planning

Exposure to childhood emotional abuse (RR 1.37, 95% CI 1.32–1.43), physical abuse (RR 1.55, 95% CI 1.47–1.63), and sexual abuse (RR 1.53, 95% CI 1.46–1.61) increased the risks for having an unplanned pregnancy compared

to unexposed. After adjusting for country of birth, age, education level, and the other categories of childhood abuse, separate effects remained for childhood emotional abuse (RR 1.16, 95% CI 1.11–1.21), physical abuse (RR 1.09, 95% CI 1.02–1.16), and sexual abuse (RR 1.22, 95% CI 1.15–1.29).

### The joint effects of the categories of childhood abuse on pregnancy planning

For all two-way combinations of categories of childhood abuse, exposure to both categories resulted in larger effect-sizes than being exposed to a single category (Table 7). For example, being exposed to emotional and sexual abuse, compared to being unexposed to both categories, resulted in an increased risk for having an unplanned pregnancy (RR 1.83, 95% CI 1.72-1.95) compared to being exposed to just emotional abuse but not sexual abuse (RR 1.28, 95% CI 1.22-1.34), or vice versa (RR 1.39, 95% CI 1.30-1.49). However, the RERI estimates suggested that the two-way combinations of exposures did not demonstrate interactive effects on having an unplanned pregnancy (Table 7). After adjusting for country of birth, age, and level of education, the risk for having an unplanned pregnancy increased for women exposed to one (RR 1.21, 95% CI 1.16-1.26), two (RR 1.34, 95% CI 1.25-1.42), or three (RR 1.47, 95% CI 1.36-1.60) categories of childhood abuse, compared with women with no experiences of childhood abuse. This suggests that the combinations of different categories of childhood abuse have additive but no joint effects on having an unplanned pregnancy.

Table 7. *The effect-sizes and RERI estimates describing the relationships between the different two-way combinations of categories of childhood abuse and having an unplanned pregnancy.*

Categories	Crude RR (95% CI)	Adjusted RR* (95% CI)	Adjusted RERI* (95% CI)
<b>Emotional and physical abuse</b>	1.65 (1.56-1.76)	1.22 (1.14-1.32)	-0.14 (-0.31 to 0.03)
Emotional but no physical abuse	1.29 (1.23-1.35)	1.18 (1.13-1.23)	
Physical but no emotional abuse	1.48 (1.35-1.62)	1.19 (1.07-1.31)	
No emotional or physical abuse	1.0	1.0	
<b>Emotional and sexual abuse</b>	1.83 (1.72-1.95)	1.38 (1.27-1.49)	-0.05 (-0.21 to 0.11)
Emotional but no sexual abuse	1.28 (1.22-1.34)	1.17 (1.12-1.23)	
Sexual but no emotional abuse	1.39 (1.30-1.49)	1.25 (1.17-1.35)	
No emotional or sexual abuse	1.0	1.0	
<b>Physical and sexual abuse</b>	1.79 (1.67-1.91)	1.29 (1.20-1.39)	-0.11 (-0.29 to 0.07)
Physical but no sexual abuse	1.38 (1.28-1.49)	1.14 (1.05-1.24)	
Sexual but no physical abuse	1.40 (1.32-1.49)	1.26 (1.18-1.34)	
No physical or sexual abuse	1.0	1.0	

\*Adjusted for country of birth, age, education level, and the third category of childhood abuse

All previously reported regression analyses were also performed for the subgroup of nulliparas women. The results were very similar to the results for all women (data provided in manuscript).

### Sensitivity analysis

We performed sensitivity analyses using an approach suggested by Smith and VanderWeele (p.24; 2018) for estimating the true RR, taking a possible selection bias into account. We calculated separate estimates of the true RR for the effects of the different categories of childhood abuse on pregnancy planning, based on crude estimates. Assumptions were made that all pregnancies ending in an induced abortion were unplanned, and that 20% of pregnancies conceived by women with no exposure to childhood abuse ended in an induced abortion (excluding spontaneous abortions). The latter assumption was made based on Norwegian registry data for the corresponding years of recruitment to the MoBa study, which showed that 20% of the registered pregnancies ended with an induced abortion (The Medical Birth Registry of Norway, 2018; The Norwegian Registry of Pregnancy Termination, 2018).

Given that the risk for having an abortion was equal or higher for women exposed to childhood abuse, no situations were found that would explain the crude effects. The probability of having an induced abortion for women exposed to childhood emotional abuse had to be below 0.13 in order to lower the RR to 1.0. Women exposed to childhood physical and sexual abuse needed to have probabilities for induced abortions below 0.10 in order for the collider stratification bias to explain the effects. This scenario was contradicted by the RR for having an induced abortion based on reported parity and induced abortions of the study population. Participants exposed to emotional (RR = 1.31), physical (RR = 1.52), and sexual abuse (RR = 1.50) had higher risks of reporting pregnancies terminated by induced abortions compared to unexposed women. Given the assumptions made, the crude effects of the categories of childhood abuse could not be explained by the potential collider stratification bias.

# Discussion

## Measuring pregnancy planning

The LMUP showed an acceptable model fit, but four of the six items showed low item reliability, with pregnancy planning explaining only 11–36% of the variance of the items. Both the LMUP and the SPPS show large test-retest reliability and their assessments correspond reasonably well. Responding to the SPPS, women took into account one or more factors out of seven: their life situation, any desire to become pregnant, any intention to become pregnant, the timing of the pregnancy, any actions taken to prepare for or to avoid pregnancy, having discussed reproduction with the partner, and reactions after learning of the pregnancy.

There was a substantial agreement between the assessments of the LMUP and the SPPS and both have a medium high construct validity, indicating that they are both measuring the same concept: pregnancy planning. However, slight differences in categorizations and the results of the qualitative study support the notion that they measure slightly different aspects of pregnancy planning. The SPPS measures pregnancy planning based on the subjective view of the participant, while the LMUP measures it based on six predefined aspects influenced by pregnancy planning. Furthermore, the LMUP takes all of its six aspects into account but for the SPPS, the number of categories taken into account by women varies. These distinctions should be considered when selecting which measures of pregnancy planning to use.

The results from the think-aloud interviews suggest that health-related preparations (e.g., healthy food habits) only contribute to measuring pregnancy planning to a small extent, and are poorly captured by the SPPS. Together with previous research, the results indicate that health-related preparations are not seen as an integral part of pregnancy planning. Previous research has shown that reproductive intention does not necessarily correspond with reproductive behaviour (Barrett & Wellings, 2002; Borrero et al., 2015). It is also common not to perform health-related preparations when pregnancies are planned (Stephenson et al., 2014; Stern et al., 2016). Barrett and Wellings (2002) found preconceptional preparations to be peripheral for women reporting their pregnancy planning status. This is a drawback from a clinical standpoint as preconception health is important for the pregnancy-related health of the woman and the child (Cnattingius et al., 2013; De-Regil et al., 2015; Fleming et al., 2018; Stephenson et al., 2018).

However, the SPPS also captures aspects into which insight is not gained by using the LMUP, i.e., a broader perspective of the situation in life and reactions after learning of the pregnancy. Antenatal care entails more than providing biomedical care. Good antenatal care also offers person-centered emotional and psychosocial support (WHO, 2016). The life situation, and reactions after learning of the pregnancy, are two aspects not gained by using the LMUP but they are also important from a psychosocial point of view and therefore clinically relevant.

Low item loadings were found for four of the LMUP's six items. The lowest loadings were shown for item 1 (contraception use) and item 6 (contraception preparations) with 19% and 11%, respectively, of the variations in the items explained by pregnancy planning. Items 1 and 6 have also stood out in previous research evaluating the LMUP. They have had the lowest item-total correlations, low factor loadings and high endorsement frequencies in some studies (Borges et al., 2016; Goossens et al., 2018; Hall et al., 2013; Morof et al., 2012; Rocca et al., 2010; Roshanaei et al., 2015). The low item reliability for items 1 and 6, and the high endorsement frequency for the first item, call the LMUP model into question, as well as the need for including contraceptive use and pre-conception preparations therein. Both items concern pregnancy planning behaviours, and as previously discussed, this may have to do with reproductive behaviours not always conforming with pregnancy intention.

Consistent with our findings, previous studies have found all observed items in the LMUP to load onto one construct (Borges et al., 2016; Goossens et al., 2018; Morof et al., 2012). However, in two low-income settings, item 1 (contraceptive use) has been shown to load onto a separate component (Rocca et al., 2010; Hall et al., 2013). It is reasonable that differences in the results from evaluations of the LMUP can to some extent be ascribed to cultural and societal differences between study populations. As culture and access to safe abortion and contraception methods differ, it is likely that the impact of pregnancy planning on the observed items in the LMUP model will vary. For instance, regardless of pregnancy planning and reproductive intentions, contraceptives will not be used unless they are easily accessed. Likewise, pre-conception preparations will not be useful for measuring pregnancy planning unless there is an awareness of beneficial pre-conception preparations and unless pregnancy planning encompasses actions taken to improve the pregnancy-related health before conceiving.

Neither the SPPS nor the LMUP fully captures all aspects of the TPB or TDIB theoretical frameworks (Ajzen, 1991; Miller, 1994). Starting with the TPB, the SPPS and the LMUP model may be considered to measure the attitude of the behaviour (any desire to become pregnant) and subjective norms as they capture social pressure from the partner agreeing or not agreeing to become pregnant. Both the SPPS and the LMUP capture the intention to become pregnant and behaviours carried out to become pregnant. However, the perceived behavioural control is not captured using either the LMUP or the

SPPS. With regard to the TDIB, the SPPS and the LMUP both capture traits, childbearing motivations, and desires to become pregnant. Miller (1994) explains that both the woman's and their partner's desires, feelings, and situational considerations are important in forming an intention to become pregnant. Both the SPPS and the LMUP measure desires and include the partner's position. The SPPS also captures situational considerations, but this is not the case with the LMUP. Reproductive intention and behaviours are captured by both the SPPS and the LMUP. In summary, neither the LMUP nor the SPPS measure the perceived behavioural control that influence the behaviour according to the TPB (Ajzen, 1991). The SPPS covers all the aspects included in the TDIP framework but the LMUP does not cover the situational considerations that Miller (1994) suggests influence if a desire is transitioned into a reproductive intention.

## Methodological consideration

Studying pregnancy planning measurements, we recruited pregnancies from ANCs, excluding induced abortions. This is a limitation of this work and means that the results cannot be generalized or transferred to settings outside of antenatal care.

Some adjustments of the LMUP measurements were made to item six in Study I. Additional response alternatives were added to elicit a more detailed picture of how participants had (or had not) taken steps to improve their health during the preconception period. These additional response alternatives may have prompted higher reports of behavioural changes than would have been otherwise obtained.

As there are no gold standard methods for measuring pregnancy planning, we had to use other means when studying the construct validity of the LMUP and the SPPS. With regard to the testing of our hypotheses, pregnancies conceived using ARTs should be considered as planned pregnancies since ARTs only are available for people intending to become pregnant. By comparison, assessing a person's thoughts of having an induced abortion as an indicator of an unplanned pregnancy may not be as valid, since such thoughts may occur for other reasons following conception. Due to a lack of better alternatives, abortion-related thoughts were used to assess the construct validity of the SPPS and the LMUP.

The think-aloud interviews made it possible to capture participants' thoughts when responding to the SPPS. However, there was a variation in how well the concurrent think-aloud method could capture the participants' interpretations of the SPPS. Some of the respondents responded very quickly, sometimes with no or just a few words, indicating that they recalled an already formed judgement (Sudman et al., 1996). For these situations, the semi-structured interviews were of great importance, as they provided a possibility to capture how the SPPS was interpreted.

Study II is a qualitative study. The trustworthiness of a qualitative study depends on its credibility, dependability, transferability, and confirmability (Graneheim & Lundman, 2004; Lincoln & Guba, 1985).

Credibility refers to the confidence that data and the interpretations of the data are true (Lincoln & Guba, 1985). Triangulation of the analyses increased the credibility. All three researchers were involved in analysing the data and performed the analyses independently before reaching consensus when there were disagreements. Participants of different ages, marital status, educational achievements, parity, and countries of birth were interviewed to shed light on the interpretation of the SPPS from different points of views. At the end of the interviews, the interviewer summarised what she had understood to be the core of what the participant had been communicating. Then, the participant was given the opportunity to correct the interviewer and add any important aspects. Data collection continued until the researchers agreed that no new information had emerged in the last couple of interviews. This contributed to increasing the credibility of the study. The full interviews lasted a rather short time, between 9 and 34 minutes. It is possible that this may have led to some aspects not being captured when it comes to how the participants interpreted the SPPS and what they took into account when responding to it. However, the SPPS consists of only one item and the participants first conducted a concurrent think-aloud, then a retrospective think-aloud, followed by a semi-structured interview, thus providing several opportunities for interpretations to emerge.

Dependability is the ability to get consistent findings if a study is replicated (Lincoln & Guba, 1985). The material gained through data collection, transcriptions of interviews, and the analyses have all been stored. All the steps of the analyses can be traced back to the citations from the interviews.

Transferability refers to the ability to transfer the findings to other, similar contexts (Lincoln & Guba, 1985). In order for others to judge the transferability to other contexts, the participants' background characteristics and the recruitment process have been presented in detail. It is a limitation that the number of approached women are unknown. However, the fact that everyone approached after their consultation with a midwife agreed to participation indicates that the participants do not have any special characteristics.

Confirmability implies the confidence that the findings have emerged from the data rather than from the researcher (Lincoln & Guba, 1985). It is hard to perform interviews and analyses without being influenced by your own background and experiences. However, the researchers' backgrounds and experiences were reflected upon throughout the phases of the research process.

## The effect of childhood abuse on later reproductive health

Childhood emotional, physical, and sexual abuse, each appear to have separate effects on pregnancy planning. However, the RERI estimates indicated a lack of joint effects. The RRs ranged from 1.09 to 1.22 for the separate categories, after adjustment for age, education, country of birth, and the unpaired (third) category of childhood abuse. Despite not finding joint effects, exposure to multiple categories of childhood abuse corresponded with higher risks for having an unplanned pregnancy, suggesting that exposure to different combinations of categories of childhood abuse have additive effects. Selection bias in Study IV, caused by not including pregnancies terminated by induced abortions, did not explain the effects found on pregnancy planning.

In Study III, greater exposure to ACEs was associated with higher pain distribution and women exposed to ACEs reported higher worst pain intensities compared to unexposed. No differences ( $p < 0.05$ ) in current pain intensity were found for women exposed/unexposed to ACEs. Furthermore, the prevalence of pain in specific regions did not differ for women with or without experiences of separate ACE categories. An exception was found for childhood physical abuse, which was associated with having sacral pain (OR 4.4, 95% CI 1.7–11.4) after adjustment for potential confounding variables.

The stated aim of Study III was to study the association between ACEs and pregnancy-related pain. In retrospect, it is unclear if this was the true aim of the study. If this association truly was of interest, then there would be no need to adjust for confounding variables (Hernán, 2018). Instead, comparing outcomes for those exposed and unexposed would have been sufficient to find an association. Rather, a more accurate assessment of the underlying aim may have been to study causal effects of ACEs, and specific categories of ACEs, on the development of pregnancy-related pain.

In accordance with previous studies (Felitti, 2009; Norman et al., 2012; Senn & Carey, 2010), we found indications of an effect of ACEs, including categories of childhood abuse, and poorer health outcomes later in life. The results correspond with other research that has found adverse childhood experiences and childhood abuse to increase the risk for experiencing pain (Anda et al., 2010; Eriksen et al., 2016; Gelaye et al., 2016; Lukasse et al., 2009), and having an unplanned pregnancy (Dietz et al., 1999; Lukasse et al., 2015), respectively.

Women with ACEs reported higher worst pain intensities ( $m = 48\text{mm}$ ) in the preceding week compared to unexposed women ( $m = 23$ ,  $p = 0.01$ ), but no difference was found when looking at the current pain intensity ( $p = 0.13$ ). However, stating that no difference was found, based on a  $p$ -value above 0.05, is problematic as it does not exclude differences in the underlying data but rather, may be the result of having less precise data (Amrhein, Greenland, & McShane, 2019; Wasserstein & Lazar, 2016). Possible reasons for ‘not finding

a difference' ( $p < 0.05$ ) when measuring the current pain intensity, but finding differences in worst pain intensities the last week, include the small sample size and that the current pain intensity was a point prevalence measure (instead of maximum intensity for a time period). In addition, most women were likely sitting down while they completed the questionnaire, and pregnancy-related pain often intensifies with strain (Kristiansson, 2014).

Although the results suggested an effect of ACE scores on the number of pain areas, the increase was modest and the regression model could only explain 17% of the variation in the number of pain areas. Thus, there are unmeasured variables that contribute to explaining the variations in pain distribution.

The different categories of childhood abuse and ACEs have somewhat varying effects on pregnancy planning and pregnancy-related pain. It is reasonable that the effects of being verbally abused as a child are milder compared to becoming a victim of sexual violence, as the latter may be considered as a combination of emotional, physical, and sexual abuse. This is supported by previous studies showing that changes in the cortex brain structures are related to the type of sensory abuse experienced (Teicher et al., 2016). It is also likely that the different categories of ACEs have different effects on later reproductive health. In general, being exposed to sexual abuse by someone in the household is likely to be more stressful than experiencing parental separation. This, together with the low exposure for some of the ACE categories and the small study sample, may explain why physical abuse was the only category that showed an association with sacral pain. These studies have not taken into account the dose of the exposure, defined as the number of events, the severity of the abuse and the perpetrator's relation to the victim. This is important to take into account when interpreting the results

The exposures in Study III and IV differed somewhat in prevalence, with lower proportions of childhood abuse reported by women in Study IV compared to Study III. For childhood emotional abuse (14% vs 33%), single events of a milder nature (such as cursing and insults) were considered as abuse in Study III but not in Study IV. Childhood physical abuse (5% vs 20%), was measured using specific actions in Study III, whereas in Study IV respondents were asked if they had been exposed to childhood physical abuse. However, participants in Study IV reported higher exposure to childhood sexual abuse compared to Study III (7% vs 4%), despite it not including sexual touching and attempts of sexual assaults to the definition of sexual abuse, as study III does.

## Methodological considerations

The effects found cannot be the result of reverse causation. The exposures are restricted to events happening at ages below 18 years of age and the outcomes

take place at data collection (or within a couple of months thereof) for participants  $\geq 18$  years of age.

There is always a risk of unmeasured confounding when studying causal effects. Childhood social context was identified as a confounder that we were not able to fully adjust for in Study IV. It cannot be excluded that childhood social context or some other unmeasured confounding could explain the effect; it probably does explain at least some of the effect. However, if it is a confounder, some of the confounding effect is already accounted for in Study IV since own education level, a factor closely related to parental education (Davis-Kean, 2005), is included in the model. The lack of adjustments for family characteristics and childhood social context is not exclusive to these studies, but a limitation relevant also for the previous research studying the effect of childhood abuse on pregnancy planning (Dietz et al., 1999; Lukasse et al., 2015).

Studies III and IV differ in their approaches to identifying confounding variables. Study III may be affected by more unmeasured confounding. The multivariate regression model was set up based on statistical testing and not using a hypothetical underlying structure to identify potential confounders. As a consequence, unfortunate adjustments were made for pain in early pregnancy although pain in the first and third trimesters is probably mediated by the same mechanisms affected by childhood trauma. Pain in early pregnancy was the independent variable that had the strongest association with pregnancy-related pain and the adjustment has probably led to an underestimation of the effect of ACEs on experiences of pain.

The effect of the separate categories of childhood abuse on pregnancy planning may also be underestimated as we controlled for education although it is possible that some of the effect is mediated by education level. However, this adjustment was made in order to be able to adjust for some of the unmeasured confounding caused by maternal education level.

Both the exposures and the outcomes are probably misclassified to some degree, due in part to recall bias. As the participants' ability to remember the exposures is believed to be non-differential with respect to the outcomes, this may have resulted in somewhat underestimated effects. Specific actions were used to measure the exposure to abuse in both studies, except for one item in Study IV that asked about experiences of 'physical abuse'. This may also have led to some misclassifications.

Studying the effect of childhood abuse on pregnancy planning using only pregnancies still ongoing in the second trimester is problematic as the pregnancy planning level, and perhaps also any exposure to abuse, are likely to be different among pregnancies reaching and not reaching ANCs. Pregnancies terminated with induced abortions are more likely than other pregnancies to be unplanned. By performing a sensitivity analysis, we were able to estimate this selection bias. However, we have not taken into account that due to subfertility, not all pregnancy planning leads to conception. Thus, it is possible

that some bias induced by selection still remains as only successful conceptions have been studied and taken into account.

Study III had a small study sample, while Study IV, in contrast, had a large study sample. The small study sample of Study III entails a lower precision of the effect estimates.

## Implications

### Implications for society and healthcare

The results of this thesis suggest that preventing childhood abuse may have a positive effect on pregnancy planning later in life and reducing pregnancy-related pain. Since ACEs and childhood abuse appear to influence future health, efforts to reduce such exposures are of great importance and require the provision of adequate resources from society, as well as the agencies working with parents-to-be, children and families. Providing a safe and nurturing environment throughout childhood is of utmost importance. From a public health perspective, the results indicate that the preconception period should be considered to start before the time of reproductive intention, but rather already in childhood.

The results of the thesis combined with previous research also have implications for healthcare. As women exposed to ACEs experience higher pain intensities and more unplanned pregnancies, they form an identifiable risk group that deserve special attention from healthcare providers. Exposure to the separate categories of childhood abuse increased the risk for having an unplanned pregnancy by between 37–55% compared with unexposed, indicating larger unmet needs of contraception care for victims of childhood abuse. In Swedish antenatal care, midwives already routinely ask women at registration if they have experiences of abuse (The Swedish Pregnancy Register, 2018). Women affected by childhood abuse should be provided with the opportunity to discuss their experiences. In such instances, midwives may play a key role in the provision of support. If a woman is in need of more psychosocial support than the midwife may provide, the midwife has the possibility to refer the woman for additional care. As our results suggest that exposure to childhood abuse has effects on pregnancy planning later in life, these women may also be in extra need of psychosocial support to handle reactions deriving from an unplanned pregnancy. Women experiencing pregnancy-related pain may get pain relief and increased function through physical activity (Vleeming et al., 2008). For women exposed to ACEs, encouraging physical activity and involvement of a physiotherapist may be particularly useful as they reported higher pain intensities compared to unexposed.

Measuring pregnancy planning in antenatal care may be useful in counseling for identifying support needs. It may provide an opportunity for the

woman to share a broader picture of the context in which the pregnancy was conceived and to address any concerns. The LMUP has shown good psychometric properties and may be useful in antenatal care, but an item reduction would probably be beneficial to the utility of the measurement. Such a reduction would also better facilitate use in ANCs where time is limited. The SPPS has also been shown to have good psychometric properties and may be especially useful for understanding the psychosocial aspects of the pregnancy and preparations that have been made. However, clinicians should be mindful that women report different aspects when responding to it, and that health-related preconception preparations in particular are not well captured by it.

The results in Studies I and II indicate a lack of awareness of pre-conception health that is consistent with previous research (Stephenson et al., 2018). Healthcare and municipalities should ensure that preconception care is readily accessible to both adolescents and adults throughout their fertile years.

Measuring pregnancy planning and asking about experiences of abuse in antenatal care should serve to be of benefit to the woman and the foetus. Our health, and especially our reproductive health, is generally considered to be a very personal issue. Individuals should be offered counselling without it being imposed upon them and with respect to the integrity of the individual.

## Implications for future research

The LMUP would probably benefit from item reduction. Preferably, pre-conception preparations (item 6) would be removed first and contraceptive use (item 1) thereafter, if necessary. The new model should be evaluated after each step to study what happens. It is reasonable to exclude pre-conception actions to improve the pregnancy-related health from the pregnancy planning concept and instead view preconception preparations and contraceptive use as possible consequences thereof. Folic acid supplementation and other proceptive behaviours are important for health during pregnancy, but are not very helpful in determining the pregnancy planning status. This is also supported by the results in Study II, showing that women did not take into account any lifestyle-related preconception preparations when they read and responded to the SPPS. Perhaps preconception behaviours will more helpful in measuring pregnancy planning in the future, but preconception care probably has to become more widespread before pregnancy planning will have a significant influence on behaviours related to pregnancy planning.

However, there are also arguments for keeping the LMUP without item reduction. The main argument for this is that preconception actions and contraceptive use may be of interest to measure for other reasons (i.e., the behaviours are of interest for the reproductive health) despite currently being of little use for measuring pregnancy planning.

Until now, the SPPS has not been used in routine antenatal care but for research purposes. If the SPPS is used in antenatal care, it is of interest to study how it is used and how the pregnant woman and the midwives perceive it.

For ethical reasons we will never be able to study the effects of childhood abuse using randomised controlled trials, and so must rely on observational data. Further observational studies are needed to study the relationship between categories of childhood abuse on pregnancy planning and pregnancy-related pain. Preferably, the categories of interest are studied as exposures separately to isolate the effects of the separate stressors. These studies should adjust for the childhood social context, as this is likely confounding the effect of childhood abuse on pregnancy planning. Variables confounding an association between childhood abuse and pregnancy-related pain would first have to be identified using a DAG. The frequency of the exposure, its severity, and the relation to the perpetrator, should be considered in further studies to assess the effects of childhood abuse, and a potential dose-response relationship. Future studies should aim for a large enough sample needed to study the effects of separate categories of abuse with high precision.

Although the results suggest an effect of childhood abuse, far from all women exposed to childhood abuse develop pregnancy-related pain or have unplanned pregnancies later in life. It is of interest to learn what makes some resilient. It is recommended that future studies investigate mediating and moderating factors of the relationships between childhood abuse and later reproductive health. Results of such studies may be useful for the development of interventions to reduce the effects of childhood abuse.

## Conclusion

The LMUP and the SPPS may be useful in antenatal care to measure pregnancy planning. They both measure pregnancy planning and there is a substantial agreement between their assessments. Both the LMUP and the SPPS show good validity and test-retest reliability, but the LMUP model would benefit from item reduction. Measuring pregnancy planning using the SPPS may be useful for the midwife during individual counselling as it captures preparations made before conceiving and psychosocial aspects of the pregnancy. However, the SPPS poorly captures health-related preconception preparations. Measuring pregnancy planning in antenatal care using the SPPS may help to identify support needs and ultimately lead to better provision of care for the pregnant woman.

The findings presented in this thesis suggest that exposure to various categories of childhood abuse and ACEs has a negative effect on adult pregnancy planning and pregnancy-related pain. As such, preventing child abuse may improve later reproductive health. Furthermore, victims of childhood abuse are in greater need of support from healthcare providers in order to reach their later reproductive goals and increase their reproductive health. From a public health perspective, the results of this thesis support the idea that the preconception period should be considered to start already in childhood, rather than at the time of reproductive intention.

# Svensk sammanfattning

Ungefär fyra av tio graviditeter i världen beräknas vara oplanerade. Oplanerade graviditeter exponerar kvinnor för onödiga hälsorisker förknippade med graviditet, missfall samt aborter. Vid oplanerade graviditeter mister man även möjligheten att förbereda sig inför en kommande graviditet. Graviditetsplanering är svårt att mäta direkt, det mäts i dagsläget på flera olika sätt. London Measure of Unplanned Pregnancy (LMUP) och Swedish Pregnancy Planning Scale (SPPS) är två skalor som använts i tidigare forskning för att mäta graviditetsplanering. Dessa skalors psykometriska egenskaper för att mäta graviditetsplanering har aldrig tidigare studerats i en svensk kontext.

Adverse Childhood Experiences (ACE) är ett koncept som innefattar åtta olika kategorier av händelser under barndomen (<18 år), alla förknippade med stress: Känslomässigt våld, fysiskt våld, sexuellt våld, ens mamma utsätts för våld, missbruk i hemmet, vuxen lider av psykisk ohälsa, föräldrarna separerar, samt att en familjemedlem sitter i fängelset. ACE och barnmisshandel kan påverka barnet på kort sikt men forskning tyder på att de också kan ha långsiktiga konsekvenser på hälsan, även på hälsan i vuxen ålder.

Syftet med denna avhandling var att psykometriskt utvärdera LMUP och SPPS och att jämföra deras mätningar av graden av graviditetsplanering. Avhandlingen syftade även till att studera sambandet mellan potentiellt stressfulla händelser i barndomen, inklusive barnmisshandel, samt den reproduktiva hälsan senare i livet.

Studie I undersökte LMUPs och SPPS psykometriska egenskaper och jämförde deras mätresultat med varandra. Urvalet kvinnor bestod i huvudsak av 2314 gravida kvinnor i tidig graviditet som rekryterades i samband med inskrivning vid mödravårdscentraler i Sverige 2012-2013. Både LMUP och SPPS visade på acceptabla resultat gällande deras begreppsvaliditet samt tillförlitlighet vid upprepade mätningar. Alla enkätfrågor som ingår i LMUP bidrog till att mäta graviditetsplanering men generellt sett bidrar de i låg grad till att förklara variansen av resultatet.

I studie II studerades hur gravida kvinnor tolkade SPPS och vad de tog i beaktande när de svarade på skalan. Tjugofem kvinnor rekryterades vid fyra mödravårdscentraler i ett landsting. Kvinnorna fick svara på SPPS samtidigt som hon sa sina tankar högt. Detta följdes av en semi-strukturerad intervju. Resultatet visade att kvinnorna tog en eller flera av sju olika kategorier i beaktande när de läste och svarade på SPPS: Livssituationen, intentionen, önskan om att ha barn, tajming, handlingar för att förbereda sig för eller undvika

en graviditet, att ha diskuterat en graviditet med sin partner samt reaktioner efter att ha fått ett graviditetsbesked.

Studie III undersökte sambandet mellan ACE och graviditetsrelaterad smärta. Gravida kvinnor ( $n = 142$ ) svarade på två enkäter i tidig respektive sen graviditet. I sen graviditet rapporterade 62% att de upplevt någon form av ACE, 72% rapporterade smärta i åtminstone någon del av kroppen. Det fanns ett samband mellan större antal kategorier av ACE och ett högre antal av områden på kroppen som man upplevde smärta från (justerad  $\beta = 0.75$ ,  $p = 0.007$ ). Kvinnor som upplevde smärta och hade erfarenhet av ACE rapporterade högre värsta smärtintensitet senaste veckan än kvinnor utan dessa erfarenheter ( $m=48\text{mm}$  vs  $m=23\text{mm}$ ,  $p = 0.01$ ). Kvinnor exponerade för fysisk barnmisshandel hade ökad risk att uppleva smärta från sacrum (OR 4,4, 95% CI 1,7-11,4).

Studie IV hade syftet att studera de separata samt gemensamma effekterna av känslomässigt, fysiskt respektive sexuellt våld under barndomen, på graviditetsplanering i vuxen ålder. Därutöver undersöktes det i en sensitivitetsanalys om att ha ett urval av graviditeter ( $n = 76197$ ) som inte innefattar graviditeter som avslutats med abort, skulle kunna förklara effektstorleken. Resultaten visade på att kategorierna barnmisshandel hade separata men inga gemensamma effekter på graviditetsplanering. De ökade riskerna för en oplanerad graviditet kunde inte förklaras av att graviditeter som slutade i abort inte rekryterades till studien.

Både LMUP och SPPS visade generellt på goda psykometriska egenskaper. Båda mäter graviditetsplanering men utifrån olika perspektiv. LMUP skulle troligtvis förbättras av att ta bort en eller två frågor. Kvinnorna tog inte livsstilsrelaterade förberedelser inför en graviditet i beaktande när de svarade på SPPS.

Resultaten stödjer en bild av att ACE och kategorier av barnmisshandel påverkar graviditetsplanering och utveckling av graviditetsrelaterad smärta senare i livet. Resultaten tyder på att prevention av barnmisshandel kan få följder som förbättrad reproduktiv hälsa på lång sikt.

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