Promoting normal birth amid modern technology: Opportunities and challenges in Iceland

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Thesis for the degree of Philosophiae Doctor

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A woman in harmony with her spirit is like a river flowing. She goes where she will without pretense and arrives at her destination prepared to be herself and only herself.

Maya Angelou

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Ágrip

Inngangur: Mikilvægi þess að stuðla að eðlilegu ferli fæðingarinnar er vel þekkt. Samt sem áður hefur notkun inngripa í fæðingar stóraukist á undanförnum árum. Á tímum tæknivæðingar er það því áskorun fyrir heilbrigðisstarfsfólk sem sinnir barneignarþjónustu að finna árangursríkar leiðir til að stuðla að eðlilegu ferli fæðingarinnar.

Markmið: Markmið þessarar rannsóknar var að auka skilning og þekkingu á því hvernig megi stuðla að eðlilegu fæðingarferli meðal kvenna sem eiga von á sínu fyrsta barni á Íslandi.

Aðferðir: Í *rannsókn I* notuðum við gögn úr Fæðingaskrá Íslands til að meta notkun inngripa (keisaraskurður, gangsetning, utanbastsdeyfing, áhöld) fyrir allar fæðingar á tímabilinu 1995-2014 (N=86933). Við notuðum Poisson aðhvarfsgreiningu til að meta breytingar yfir tímabilið og tókum tillit til bakgrunns- og meðgöngutengdra þátta móður. Í *rannsókn II* notuðum við alþjóðlegan, þýddan og staðfærðan spurningalista sem við sendum á konur sem ekki höfðu átt barn fyrir og voru ekki barnshafandi þegar þær svöruðu listanum (N=410). Við mátum samband milli fæðingarótta, öryggi varðandi eigin fæðingarþekkingu og viðhorfa til notkunnar inngripa í fæðingum með lógístískri tvíkosta aðhvarfsgreiningu. *Rannsókn III* var kerfisbundin samantekt yfir íhlutandi rannsóknir um fæðingarótta og kvíða. *Rannsókn IV* lýsti þróun og innleiðingu íhlutunar í meðgönguvernd (foreldrahópar) sem sameinar kosti hefðbundinnar meðgönguverndar og hópmeðgönguverndar. Markmið foreldrahópanna var að styrkja jákvætt viðhorf til eðlilegra fæðinga meðal kvenna sem áttu von á sínu fyrsta barni. Í *rannsókn V* mátum við áhrif foreldrahópa á lækkun fæðingarótta á meðgöngu með óslembiröðuðu tilraunasniði (N=92).

Niðurstöður: *Rannsókn I:* Milli 1995-2014 voru 81389 ráðgerðar fæðingar og 5544 valkeisarar. Meðal frumbyrja varð aukning í nýgengi gangsetninga (12.0% to 26.3%; leiðrétt áhættuhlutfall [relative risk] 1.78 [CI 1.67-1.91) og utanbastsdeyfinga (37.2% to 56.9%; leiðrétt áhættuhlutfall 1.40 [CI 1.36-1.45]). Einnig varð aukning á gangsetningum og utanbastsdeyfingum með kvenna með háþrýsting en engin breyting sást meðal kvenna með sykursýki. Nýgengi keisaraskurðar og áhaldafæðinga hélst stöðugt yfir tímabilið. *Rannsókn II:* Konur með lítinn fæðingarótta voru líklegri til að vilja náttúrulega fæðingu miðað við konur með meðal (20.8% m.v. 8.3%; leiðrétt áhættuhlutfall

2.83 [CI 1.48-5.41]) og mikinn (20.8% m.v. 8.3%; leiðrétt áhættuhlutfall 4.86 [CI 1.37-17.27]) fæðingarótta. Konur með mikið öryggi varðandi eigin fæðingarþekkingu voru líklegri til að vilja náttúrulega fæðingu miðað við konur með meðal (22.7% m.v. 8.8%; leiðrétt áhættuhlutfall 2.81 [CI 1.51-5.22]) og lítið (22.7% m.v. 7.7%; leiðrétt áhættuhlutfall 3.42 [1.43-8.18]) öryggi varðandi eigin fæðingarþekkingu. *Rannsókn III:* Kerfisbundin leit skilaði fimm rannsóknum sem sýndu fram á marktækar breytingar á fæðingarótta/kvíða vegna íhlutunar. Meðal kvenna með mismikinn fæðingarótta/kvíða í byrjun meðgöngu höfðu námskeið (á sjúkrastofnun og utan) og jógaiðkun á meðgöngu marktæk áhrif. *Rannsókn IV:* Ekki fannst marktækur munur á fæðingarótta meðal kvenna í foreldrahópum eða hefðbundinni meðgönguvernd (Cohen's d=-0.15). Foreldrahóparnir báru þó árangur í að lækka fæðingarótta meðal kvenna sem ekki sóttu sér námskeið utan meðgönguverndar (n=25; Cohen's d=-0.84).

Ályktun: Mikil aukning varð á gangsetningum og utanbastsdeyfingum meðal íslenskra kvenna án áhættuþátta á rannsóknartímabilinu, en tíðni keisaraskurða og áhaldafæðinga stóð í stað. Að takast á við fæðingarótta og auka öryggi varðandi eigin þekkingu er mikilvægur þáttur í því að styrkja jákvætt viðhorf kvenna til fæðinga án inngripa. Niðurstöður okkar gefa til kynna að þrátt fyrir að foreldrahóparnir hafi ekki lækkað fæðingarótta meira en hefðbundin meðgönguvernd, þá báru þeir árangur í að lækka fæðingarótta meðal kvenna sem ekki sóttu sér námskeið utan meðgönguverndar.

Lykilorð:

Inngrip í fæðingar, fæðingarótti, hópmeðgönguvernd, foreldrahópar, ljósmóðurfræði

Abstract

Background: The importance of promoting and protecting the normal physiologic processes of childbirth is supported by decades of research. Despite this, the use of obstetric interventions has increased rapidly over the past years. Hence, finding an effective balance to emphasize the normality of childbirth in an era of medical technology is one of the key challenges of modern day maternity care.

Aim: The overall aim of this thesis was to provide knowledge and understanding of ways to promote normal birth among women in Iceland expecting their first child.

Material and methods: In *study I* we used data from the Icelandic Medical Birth Registry to calculate the incidence of cesarean section, labour induction, epidural analgesia, and instrumental delivery for all births in 1995-2014 (N=86933). We used Poisson regression to study relative risk adjusted for maternal and pregnancy-related characteristics. *In study II* we used an internationally validated instrument to survey pre-pregnant women (N=410) about their attitudes towards birth and then used log binomial regression to calculate adjusted relative risk for natural birth intentions by high, moderate and low childbirth fear and confidence in birth knowledge. *Study III* was a systematic review of non-pharmacological antenatal interventions for childbirth related anxiety and fear. In *study IV* we designed and implemented an intervention, Enhanced Antenatal Care (EAC), which combines elements from one-to-one and group antenatal care models, to promote natural birth intentions. In *Study V,* we tested the effectiveness of the intervention in terms of lowering childbirth fear during pregnancy with a quasi-experimental design (N=92).

Results: *Study I:* There were 81389 planned vaginal births and 5544 planned cesarean sections between 1995-2014. Among women having their first child in 1995-2014, we observed a marked increase across time for labour induction (12.0% to 26.3%; adjusted RR 1.78 [CI 1.67-1.91]) and epidural analgesia (37.2% to 56.9%; adjusted RR 1.40 [CI 1.36-1.45]). We observed a similar trend of smaller magnitude among women with hypertensive disorders, but not among women with diabetes. Incidence of cesarean and instrumental delivery remained stable across time. *Study II:* Nulliparous women with low fear of birth were more likely to have natural birth intentions

when compared to women with moderate (20.8% vs 8.3%; adjusted RR 2.83 [CI 1.48-5.41]) and high (20.8% vs 5.7%; adjusted RR 4.86 [CI 1.37-17.27]) fear. Women with high confidence in their birth knowledge were more likely to have natural birth intentions compared with women with moderate (22.7% vs 8.8%; adjusted RR 2.81 [CI 1.51-5.22]) and low (22.7% vs 7.7%; adjusted RR 3.42 [1.43-8.18]) confidence in their birth knowledge. *Study III:* Five of seven studies included in our systematic review reported significant changes in fear/anxiety, as a result of the intervention and interventions that were effective for pregnant women with a range of different fear/anxiety levels were childbirth education at the hospital, antenatal yoga, and an antenatal education course. *Study IV:* There was no difference between childbirth fear reduction in EAC compared to usual care (Cohen's d=-0.15). EAC was effective in lowering childbirth fear among women who did not attend any educational classes alongside antenatal care (n=25; Cohen's d=-0.84).

Conclusion: We observed considerable increases over time in the use of labour induction and epidural analgesia among low-risk women, while cesarean and instrumental delivery rates remained stable. Addressing childbirth fear and confidence in birth knowledge is an integral part of promoting natural birth intentions among women expecting their first child. While EAC did not reduce childbirth fear beyond usual care, EAC was effective in lowering childbirth fear among women who did not attend any educational classes alongside antenatal care.

Keywords:

Obstetric interventions, childbirth fear, group antenatal care, Enhanced Antenatal Care, midwifery.

Acknowledgements

From conception to birth. From protocol to thesis. Just like pregnancy, this process towards a finalized thesis has been filled with surprises, excitement, anxiety and joy. And most importantly, with extraordinary people, to whom I am eternally grateful.

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Shared experiences are powerful moments for friendship and this doctoral study has provided for many such opportunities. Therefore, when I will think back on this time, I will think of the conferences, summerschools, seminars and all those (long!) days at the office. The last few months are especially memorable, as Maríanna, Hildur, Álfheiður and I were writing our theses at the same time. Because of you three, I looked forward to those long evenings and early mornings of writing, where we celebrated successful moments, and frustration was quickly dissolved into bouts of belly-laughs. Similarly, my midwifery-science buddies, Valgerður Lísa and Berglind, provided invaluable friendship, support and input throughout the birth of this thesis. My dear friends, thank you from the bottom of my heart.

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Contents

List of abbreviations

BMI	Body mass index
CFPP	Childbirth Fear Prior to Pregnancy
CFQ	Childbirth Fear Questionnaire
CI	Confidence interval
EAC	Enhanced Antenatal Care
FOB	Fear of birth
FOBS	Fear of Birth Scale
ICD-10	The International Classification of Diseases, tenth revision
MFS	Meðganga – fæðing – sængurlega
NICE	National Institute for Health and Care Excellence
NOMESCO	The Nordic Medico-Statistical Committee
NCSP	The Classification of Surgical Procedures
OECD	Organization for Economic Co-operation and Development
OR	Odds ratio
RCT	Randomized controlled trial
RR	Relative risk
SOC	Sense of Coherence
SPIRIT	Standard Protocol Items: Recommendations for Interventional Trials
UK	United Kingdom
USA	United States of America
W-DEQ	Wijma Delivery and Expectancy Questionnaire
WHO	World Health Organization

List of figures

List of tables

List of original papers

This thesis is based on the following original publications, which are referred to in the text by their Roman numerals (I-V):

I. **Swift EM**, Tomasson G, Gottfredsdottir H, Einarsdottir KE, Zoega H. Obstetric interventions, trends, and drivers of change: A 20-year population-based study from Iceland. *Birth*. 2018 Apr. doi:10.1111/birt.12353

II. **Swift EM**, Gottfredsdottir H, Zoega H, Gross ME, Stoll K. Opting for natural birth: A survey of birth intentions among young Icelandic women. *Sex. Reprod. Healthc*. 2017 June. Doi: 0.1016/j.srhc.2016.09.006

III. Stoll K, **Swift EM**, Fairbrother N, Nethery E, Janssen P. A systematic review of nonpharmacological prenatal interventions for pregnancy-specific anxiety and fear of childbirth. *Birth*. 2018 March. Doi:10.1111/birt.12316

IV. **Swift EM**, Zoega H, Stoll K, Avery M, Gottfredsdottir H. Combining individual and group antenatal care: A study protocol for the Enhanced Antenatal Care model [submitted for publication]

V. **Swift EM**, Zoega H, Stoll K, Avery M, Gottfredsdottir H. Enhanced Antenatal Care and childbirth fear: A quasi-experimental controlled study [manuscript].

All papers are reprinted by kind permission of the publishers.

Other publications published during the course of study

1. Stoll K, Hauck Y, Downe S, Edmonds J, Gross MM, Malott A, McNiven P, **Swift EM**, Thomson G, Hall WA. Cross-cultural development and psychometric evaluation of a measure to assess fear of childbirth prior to pregnancy. *Sex. Reprod. Healthc. 2016. Doi:*10.1016/j.srhc.2016.02.004

2. Stoll K, Edmonds J, Sadler M, Thomson G, McAra-Couper J, **Swift EM,** Malott A, Streffing J, Gross MM, Downe S, the ICAPP study team. A cross-country survey of attitudes toward childbirth technologies and interventions among university students. *Women and Birth* [in press].

Declaration of contribution

I wrote this doctoral thesis under the guidance of my supervisors and the doctoral committee. In collaboration with my supervisors and co-authors, I planned the studies and applied for appropriate approvals from national ethical and research authorities. I also collected data and conducted statistical analyses for all studies in collaboration with my supervisors and a statistician. Furthermore, I designed and implemented the intervention for study IV. I drafted manuscripts for the papers that form the foundation for this thesis and revised manuscripts in close collaboration with my co-authors.

1 Introduction

The use of technology is supported by ideologies promoting modernisation and progress (1). Therefore, when technology is available, societies tend to seek solutions to problems with more rather than less invasive technologies (1). This is evident within obstetrics as more medical technology has become available in middle and high-income countries, and simultaneously the use of obstetric interventions has increased rapidly (2-6). This phenomenon is commonly described as “too much, too soon” and contrasted with the underuse in developing countries (too little, too late) (6).

The importance of promoting and protecting the normal physiologic processes of childbirth is supported by decades of research (7-12). Hence, finding an effective balance to emphasize the normality of childbirth in an era of medical technology is one of the key challenges of modern day maternity care.

1.1 Theoretical perspectives

This first chapter will provide an overview of the theoretical perspectives that were used to inform our research, starting with the definition of normal birth that will be used throughout this thesis.

1.1.1 Normal birth: A definition

The terms physiologic birth, normal birth and natural birth are often used interchangeably but usually refer to birth which has not been managed by medical intervention (13-16). Over the years healthcare organizations have strived to find a definition as well as debated the appropriate terminology for childbirth without intervention.

In 1996 the World Health Organization (WHO) defined normal birth as spontaneous in onset, low-risk at the start of labour and remaining so throughout labour and delivery. The infant is born spontaneously in the vertex position between weeks 37 and 42 completed weeks of pregnancy. After birth, mother and baby are in good condition (14). Later, the Maternity Care Working Party, a collection of United Kingdom maternity care organizations (including the Royal College of Midwives and the Royal College of Obstetricians and Gynaecologists) reached a practical and needed definition which can be better used to encourage and measure normal birth (15). They

defined normal birth as labour that starts spontaneously, progresses spontaneously *without drugs* and results in a spontaneous birth (15). This definition excludes women who experience any one or more of the following: induction of labour, epidural or spinal analgesia; general anaesthetic; forceps or ventouse; cesarean section; or episiotomy. The Euro-Peristat Project has defined childbirth without obstetric interventions similarly to the Maternity Care Working Party's definition of normal birth (16). Throughout this thesis, we will use the term normal birth as defined by the Maternity Care Working Party, unless otherwise specified.

1.1.2 The social model of maternity care

The social model of maternity care is influenced by philosophy that pregnancy and childbearing are usually natural, physiological processes (17, 18), which means that for the majority of women, little or no medical intervention is needed for a normal and safe birth and that women who are not expected to have a normal birth can be predicted and selected appropriately (19). This has been contrasted with the medical model, which assumes that every pregnancy is at risk unless proven normal retrospectively; an attitude which justifies the use of medical technology and obstetric intervention (19-22). Table 1, which has been adapted from a previously published table by Bryers et al. (19), lists and compares some of the accepted notions of the two different maternity care models. While both models strive for a healthy mother-baby dyad, the social model also emphasizes the social-emotional aspects of becoming a mother (19). The models further differ in terms of the relationship between care provider and pregnant woman, in the use of obstetric interventions and in pain management (22, 23).

These differences tend to be explicit at a theoretical level in academic papers and books, but in practice, their edges are blurred (24). The theoretical framework that informs the research in this thesis is the social model for maternity care, which recognises that pregnancy and childbirth are normal physiological processes but also that they are more than just physical experiences. Another core assumption that informs our work is that social and emotional adaptation is required with the transition to a new role and new responsibilities associated with parenthood (25).

Table 1 A comparison of accepted notions of social and medical models in maternity care. Adapted from Bryers et al (2010).

Social model	Medical model
Physiological/natural – *pregnancy and birth as normal, natural life event; all will be well until something goes wrong*	**Scientific** – *pregnancy and birth can only be defined as normal after the event when nothing has gone wrong*
Social – *family and community orientated; health and social care should not be considered seperately*	**Medical** – *aims to reduce maternal and infant mortality; to cure rather than prevent*
Holistic approach – *acknowledgement of link between social structures and health care to attain state of well-being*	**Treat the problem** – *treatment of disease (pregnancy) rather than care of the whole; expect problems*
Environment – *central to model*	**Environment** – *peripheral to model*
Outcome - *aims at live, healthy mother and baby and satisfaction of mother/family*	**Outcome** - *aims at live, healthy mother and baby*

1.1.3 The theory of salutogenesis

The medical model, the dominant paradigm at present, is largely based on pathogenesis; an approach where health is generated through the elimination of risks for diseases (Table 2). Salutogenesis, on the other hand, focuses on finding aspects that could strengthen resourses for health and health promotion processes (26, 27).

Salutogenesis is a term coined by Aaron Antonovsky (1923-1994), a professor of medical sociology (26). Salutogenesis is an approach that highlights factors supporting human health and wellbeing, in contrast to factors that cause disease. More specifically, the salutogenic model is concerned with the relationship between health, stress, and coping. Antonovsky's theories rejected the traditional medical-model dichotomy separating health and illness and described the relationship as a continuous variable, which he called the "health-ease versus dis-ease continuum" (26). Antonovsky proposed that it was more important to focus on peoples'

resources and capacity to create health than the classic focus on risks, ill health, and disease (26, 28). He further proposed that this could be reached by creating environments and societies characterized of clear structures and empowering environments. This forms the basis of the theory of salutogenesis.

Table 2 A comparison of salutogenesis and pathogenesis (29).

Salutogenesis	Pathogenesis
Health and disease on a continuum	Medical dichotomy between health and disease
Describes the origin and pathways of health	Describes the origin and pathways of disease
What creates health?	What causes disease?
About reaching potential	About avoiding problems
Proactive – presence health	Reactive – absense of disease
For gain or growth	Against pain or loss

Salutogenesis and public health promotion have developed hand in hand (30). After World War II, the establishment of the World Health Organization (WHO) served the purpose of creating conditions for global community and welfare societies (31). The WHO defines health as: ‘not only the absence of disease but a state of complete wellbeing in a physical, mental, and social meaning’; this aligns well with the salutogenic model that health is seen on a continuum and not a dichotomy between the two (30). The river of life has been used as a metaphor in health promotion (Figure 1). Within the medical model, health promotion is conceptualized as preventative and curative; interventions are aimed at preventing people from falling into the river by building bridges and curative means saving people from drowning. However, according to Antonovsky it is not enough to build bridges to keep people from falling into the river. Instead, people need to learn how to swim.

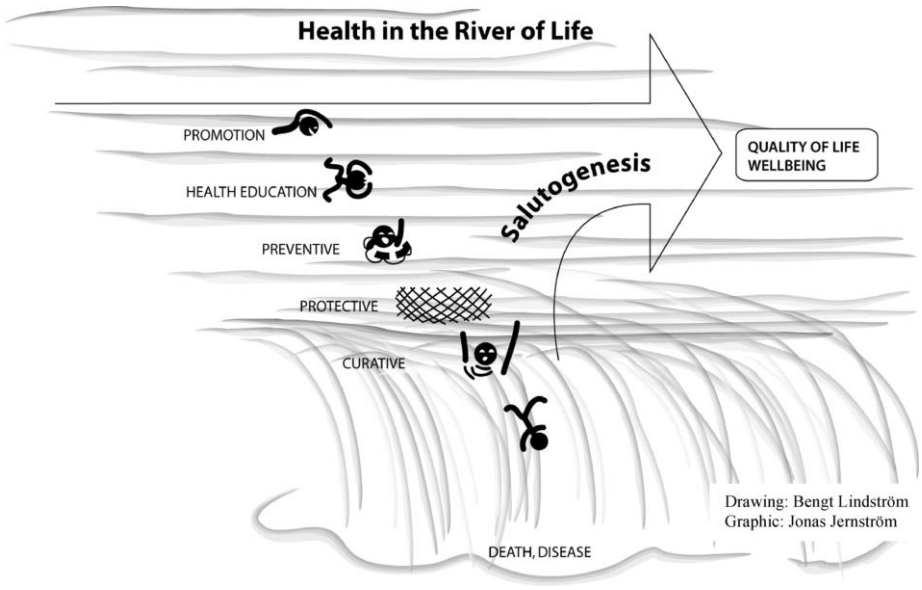

Figure 1 Health in the river of life: A salutogenic interpretation of health promotion. Figure reprinted from Health Promotion International with permission from the publisher.

This can be interpreted as health education or promotion. From a salutogenic perspective, the flow of the river of life is different. Instead of starting at the top of the waterfall and flowing downstream, the direction is across our view of the picture. At birth, we are dropped into the river and we float with the stream across the picture. Some are born where we can easily float, and resources are plentiful. Others are born close to the edge of the waterfall, where struggle for survival is harder and the risk of going over the rim is greater. The river is full of risks and resources and the outcome is largely based on our ability to identify and use these resources (30).

The theory of salutogenesis aligns well with the social model of maternity care (32). Both models view the person through a biological, psychological, social and cultural lens and health promotion is seen as strengthening resources rather than a medical view of risk assessment and cure (11).

1.1.4 Salutogenic outcomes and maternity care research

Most research outcomes within maternity care focus on pathology or adverse outcomes (11, 32). In fact, in a systematic review of studies on intrapartum interventions in the Cochrane database, salutogenically focused outcomes represented 8% (135 outcomes out of 1767) of the outcomes compared to

92% non-salutogenically focused outcomes (33). However, the definition of salutogenesis was very broad and reflected all positive health outcomes rather than illness or adverse event prevention/avoidance, hence the true number of papers reporting salutogenic outcomes is likely even smaller. To illustrate this point, a recently published scoping review of maternity care papers using salutogenic theory found only eight papers (32) and only one of them reporting on using salutogenic theory and outcomes within antenatal care research (34).

These two reviews were the first steps in identifying the need for developing a core set of salutogenically focused maternity care outcomes. This development is now underway, and a protocol of the process for a core set of intrapartum outcomes has been published (35). A core set of salutogenic antenatal outcomes has not been established but could be of great benefit. Examples of maternity care specific salutogenic outcomes identified in the two reviews included sense of coherence, confidence, satisfaction with care, positive relationship with infant or intact perineum while non-salutogenic outcomes included the more traditional outcomes, such as maternal blood loss, infection or birth trauma (24, 32)

A first step for salutogenic researchers is to ask “how can we facilitate this person towards better health?” and “what can we use to measure the effect?” (36). Using this approach allows for the use of salutogenic theory within maternity care regardless of womens health status or pregnancy risk. Increasing the application of salutogenic framework to maternity care research may help bring attention towards enhancement of health instread of the current norm of surveillance and risk aversion. Incorporating salutogenic outcomes opens the possibility of capturing aspects of maternity care, such as satisfaction with care, that are central to research based on the social model of care.

1.2 Common obstetric interventions

The definition of normal birth excludes women who experience induction of labour, epidural analgesia, cesarean section and instrumental delivery (15). The following chapter will provide a historical overview of the use and technological advances of these four most common obstetric interventions.

1.2.1 Cesarean section

Cesarean section delivery has been part of human culture since ancient times although the procedure was, in the beginning, only performed in an

attempt to save the child when the mother had died or was dying (37-39). With increased urbanization in the 20th century, the growth of hospitals and the introduction of anesthesia, cesarean section delivery began to be performed routinely (39). With increased knowledge of asphyxia as a cause of fetal brain damage and the rapid acceptance of electronic fetal monitoring in the 1960s, the cesarean section rates for fetal indications soared (39). However, soon thereafter feminists and consumer activists questioned the need for the increased rates of cesarean sections, especially for indications such as breech position and previous cesarean section, pointing to poor quality of data supporting these indications (40).

In 1985, The World Health Organization (WHO), stated that there was no justification for any country to have cesarean section rates higher than 10-15% (41). This was based on ecological studies comparing population based cesarean section rates and maternal and neonatal mortality. Similarily, a more recent ecological study using worldwide country level data from 159 countries concluded that a cesarean section rate higher than 10% was not associated with decreases in maternal and neonatal mortality rates (42). A review based on data collected between 2005-2012 for all 194 WHO member states slightly increased this recommendation to 19% (43).

Despite these recommendations, middle- and high-income countries have experienced a rapid rise in cesarean section rates over the past 30 years (2-5), with rates varying considerably between countries (5, 6, 44) as illustrated in Figure 2 (5). For example, within Europe the cesarean section rate ranges from 15,5% to 53,1% (5, 45). While the cesarean section is a life-saving procedure when certain complications arise during pregnancy and labour, it is major surgery and associated with both short- and long-term maternal and perinatal risks (44). Therefore, using this important resource appropriately to optimize the health of both mother and infant is imperative.

Several factors have been cited as possible explanations for this increase, including fear of litigation, financial incentives related to methods of payment, privatization of healthcare, changing maternal characteristics (such as higher proportions of older mothers), women's requests for caesarean births, and the perception that a caesarean section is a safe procedure (45).

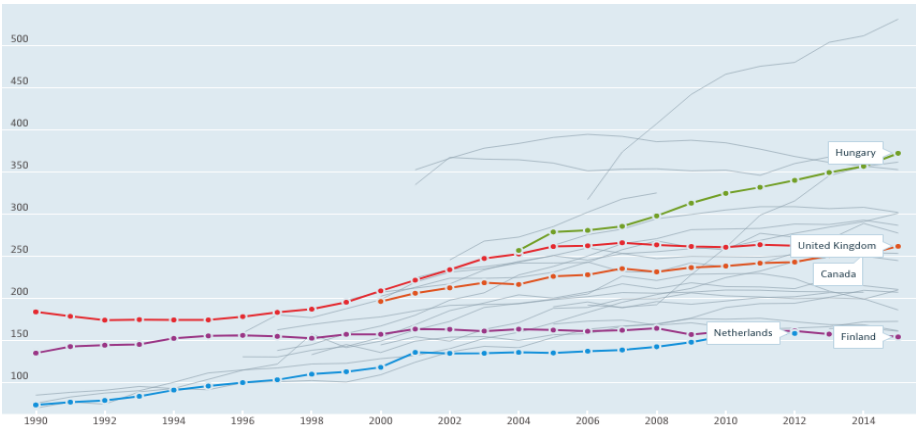

Figure 2 Trends in cesarean section rates for selected OECD countries 1990-2014. Picture obtained from OECD Caesarean sections (indicator). doi: 10.1787/adc3c39f-en (Accessed on 30 September 2018).

1.2.2 Labour induction

The desire to control the timing of delivery is ancient and the history of labour induction dates back to Hippocrates when it included mechanical dilation of the cervical canal, mammary stimulation, strong enemas and folk medicines (46). Nowadays, two different approaches to labour induction are used, often in combination: one relies upon pharmacological agents to modify cervical form with or without stimulating uterine contractions, and the other uses mechanical stimulation to provoke cervical effacement, dilatation and ultimately uterine contractions (47).

Common indications for inducing labour include post-dates (with various definitions), hypertensive disorders of pregnancy, intramniotic infection, fetal distress, diabetes mellitus and chronic renal disease (47, 48). However, labour induction is contraindicated when vaginal delivery can endanger the mother or the unborn child, for example with placenta previa, transverse fetal lie, prolapsed umbilical cord and prior classical uterine insicsion (47, 48).

Labour induction is a widely debated issue within maternity care and balancing the risks and benefits of continuing to term (and beyond) or delivering early is not always straightforward. The goal of earlier induction is often to prevent adverse perinatal outcomes, and it is not surprising that many clinicians are drawn to this idea. Intuitively, earlier induction makes sense because when a pregnancy comes to an end, the unborn baby will no

longer be at risk (49). However, this must be balanced with the increased longer-term harm associated with early term births (50). Furthermore, a large, multicenter randomized controlled trial published earlier this year found that induction of labour at 39 weeks for healthy nulliparous women with healthy pregnancies did not result in a significantly lower frequency of adverse perinatal outcomes (51).

Induction of labour rates vary considerably across countries (45). Within Europe, the rates range from 6.8% in Lithuania to 27.9%-33.0% in Belgium (45) and the variation is probably explained by a combination of differing definitions of labour induction and cultural differences or beliefs regarding the use of elective obstetric interventions (for example medical vs social maternity care models).

1.2.3 Epidural analgesia

Women's quest to relieve the pain of childbirth is timeless (52) and so is the debate about the use of pain relief in labour. The debate is centered around concepts such as empowerment, agency and control (grounded in the theory of feminism) and the role pain plays in birth (grounded in differing views on the medical and social models of birth). On the one hand pain may be regarded as part of the normal process of birth (social model), but on the other hand pain implies suffering and therefore requires treatment or elimination (medical model).

The oldest effective form of pain medication was opium, which was likely first cultivated in Mesopotamia around 3400 BC. First administered by smoke or opium tea, and then later when the active ingredient, morphine, was isolated administered by injection as described by Alexander Wood in 1855 (53).

A significant part of the debate about the use of pain relief is rooted in the feminist discourse. The first wave of feminist activists demanded access to pain relief as a woman's right and popularized the use of 'twilight sleep', a combination of morphine and scopolamine first introduced in Germany in early twentieth century (54). However, after reports of adverse effects, including deaths, the technique was withdrawn.

Epidural analgesia was introduced in Spain in 1921 and popularized as pain relief in labour by an American anesthesiologist in the 1940s (54). The procedure is a central nerve block technique achieved by injection of a local anaesthetic close to the nerves that transmit pain and is widely used as a form of pain relief in labour (55). From the 1960s, as epidural analgesia

became more popular, a second wave of feminists took the opposite position, calling for a return to non-medicalised, women-centered, natural childbirth and, in some cases, emphasizing the importance of the pain experience as empowering for women. However, from the 1990s, a third wave of feminist activism began to emerge, revalidating a woman's right to choose a technological, pain-free birth, rather than a natural one (54).

While the present day debate about the use of epidural analgesia is reminiscent of the third wave feminist position, other issues such as the potential side effects of using epidural analgesia (55) and the role of epidural analgesia in the cascade of interventions that may follow epidural analgesia play a role in the discussion. Furthermore, while eliminating childbirth pain may seem of obvious benefit when viewing childbirth from the medical model's point of view, addressing childbirth pain from the social model's viewpoint is quite different. The social model considers the cultural understanding of pain, the meaning of pain, and women's perceptions of pain and addresses pain with a variety of comfort measures. In any case, the WHO global perspective lists access to non-pharmacological or pharmacological pain relieve an essential component of a positive childbirth experience (56).

Worldwide, there is great variation in the use of epidural analgesia, ranging from 11.3% in the Netherlands to 61% in the United Kingdom, 71% in the United States and 82% in France (57, 58). Among nulliparous women in Sweden between 1992-2005 the rate was 40.1% (59), Australia in 2000-2002 46.4% (60) and in Finland between 2000-2010 66.6% (61).

1.2.4 Instrumental vaginal delivery

The use of instruments to facilitate birth is an age-old process and today, assisted vaginal delivery is an integral part of obstetric care worldwide (62, 63). Indications for the use of instruments (ventouse or forceps) are both maternal (exhaustion, prolonged second stage) and fetal (malpositions, distress) and associated complications include maternal fecal incontinence, postpartum hemorrhage and fetal intracranial hemorrhage (62).

The incidence of instrumental vaginal delivery has been reported in population-based studies in the Nordic countries (6.5-8.1% in 2000-2011) (64), in the United States (6% between 2005-2013) (65) and the UK (10-13% between 2001-2009) (62, 63). The difference in incidence may be explained by a variety of factors, such as inaccurate registration into databases or provider culture. However, the use of other interventions may also play a

significant role. For example, epidural analgesia has been observed to be associated with an increased risk for instrumental vaginal delivery (66, 67). But on the other hand, high rates of cesarean section will likely decrease the need for instrumental vaginal delivery. This is a good example of why obstetric interventions are best observed collectively (instead of reporting on one intervention at a time) when the aim is to provide and interpret population-based information of the overall use of obstetric interventions.

In conclusion, the use of obstetric interventions has increased rapidly in most middle- and high-income countries. When the use of technology is associated with modernization and progress and rates are increasing, normal physiologic birth may seem like the less popular choice for healthy childbearing women, compared to a highly interventive birth. However, while obstetric interventions may be effective or even life-saving when used appropriately, their over-use (without a clear medical indication) can introduce harm (6).

1.3 Childbirth fear

Childbirth fear has emerged as an important factor when considering women's intentions and preferences regarding normal childbirth. However, ever since childbirth fear was first described in the literature in the 19th century, clinicians and researchers have struggled to find a definition for the concept. This may be due to the fact that some level of childbirth fear is considered a normal and protective response to an unknown situation (68) and the majority of women will express some fears relating to pregnancy or childbirth (69).

Differentiating normal and adaptive fears from clinical fears or phobias has been on the basis of several criteria, including whether or not the expressed fear is age or stage-specific, persists over an extended period of time, and/or significantly interferes with everyday functioning (68). As pregnancy and childbirth are transformative life experiences, it can be expected that most pregnant women will experience mixed feelings of joy and excitement along with worry and anxiety.

While there are no universal definitions of normative (i.e. low or moderate) childbirth fear, clinical (i.e. severe) childbirth fear has been characterized as a "disabling fear that interferes with occupational and domestic functioning, as well as social activities and relationships" (70). Tokophobia or fear of contractions (tokos: uterine contractions, phobia: fear) (71) has also been used to describe a pathological fear of pregnancy and can lead to avoidance

of childbirth (72). Childbirth fear is furthermore classified as primary or secondary childbirth fear. Women with no previous experience of pregnancy would be classified with primary childbirth fear and secondary childbirth fear develops after a traumatic obstetric event in a previous pregnancy or childbirth (72).

The following chapter will provide an overview of the literature on measuring childbirth fear, prevalence of childbirth fear, background factors associated with childbirth fear as well as birth related outcomes.

1.3.1 Measuring childbirth fear

There are many instruments available to measure childbirth fear, and they have been developed for broad as well as more specific populations. This section will provide an overview of the most common instruments and dicuss their strengths and limitations.

The *Wijma Delivery Expectancy/Experience Questionnaire* (W-DEQ) is the most commonly used childbirth fear scale with considerable evaluation of its reliability and validity (73, 74). It consists of a 33-item questionnaire and is scored from 0-165 points with higher scores indicating higher childbirth fear (73). However, studies using the W-DEQ have used widely differing definitions for *severe fear, anything* from “66 points or greater” to “greater than 100 points” making comparison difficult (75). Most studies have identified scores above 85 points as high childbirth fear (75). The questionnaire has been used in various populations, including Icelandic women (76) and measures the construct more clearly in multiparous than nulliparous women (73). The W-DEQ has received criticism for lack of readability, length, difficulty in translation and content (77-80).

The standardized, patient rated *Fear of Birth Scale* (FOBS) is a simple and easy to use two-item 100mm visual analog scale (Figure 3). The FOBS asks the respondent to place a mark on a visual analog scale, responding to the question “How do you feel right now about the approaching birth?” (81). The anchors for each of the two scales are defined as a) calm/worried and b) no fear/strong fear (81). The two scores are averaged to create a score ranging from 0 to 100, with high scores indicating higher levels of childbirth-related fear (81). When used in a large Australian study the FOBS was found to have a sensitivity of 89% and specificity of 79% against the W-DEQ (73, 74). Using a cut-off point of 54 correctly identified the majority of women who were classified as highly fearful (>100 points) using the WDEQ-A (74). More recently, a more conservative cut-off score of 60 on the FOBS scale has

been suggested (82, 83). Several other Likert type scales, consisting of one to six questions have been developed to measure childbirth fear (75). However, they have not been found to show the same strong correlation to the W-DEQ as the FOBS (75). The FOBS has been translated to Icelandic and was used in the Icelandic survey Childbirth and health (84).

The *Childbirth Fear Questionnaire* (CFQ) is a 40-item measure of childbirth fear (85). The CFQ scale provides an overall fear score as well as scores for nine separate domains of childbirth fear. The CFQ furthermore includes a seven-item interference scale, which measures the degree of interference in daily activities that can be attributed to childbirth fear. The Chronbach's alpha for the 40-item CFQ scale was 0.94 (85).

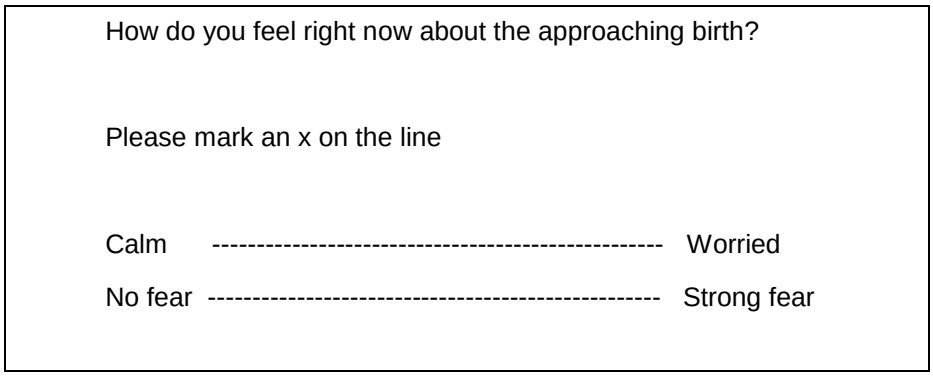

Figure 3 The Fear of Birth Scale (FOBS)

While most studies have used self-report questionnaires to measure childbirth fear, a Finnish cohort study (n=788.317) (86) reported the incidence of childbirth fear using registration in a Medical Birth Registry by the International Classification of Diseases (ICD) code O99.80 (87).

A short childbirth fear scale has been developed for assessing childbirth fear among women and men prior to pregnancy (88). The Childbirth Fear - Prior to Pregnancy (CFPP, Table 3) is a uni-dimensional scale with good internal consistency reliability, convergent and discriminant validity. The CFPP consists of ten questions with six response options: (1) strongly disagree, (2) disagree, (3) somewhat disagree, (4) somewhat agree, (5) agree and (6) strongly agree and incorporates three dimensions of fear: fear of labour pain, fear of bodily damage and fear of complications. The intention of the scale is that it can be used to identify and address modifiable factors that are linked to the development of childbirth fear.

Table 3 The Childbirth Fear Prior to Pregnancy (CFPP) scale

1.	I am worried that labour pain will be too intense.
2.	I feel I (my partner) will not be able to handle the pain of childbirth.
3.	I am afraid that I (my partner) might panic and not know what to do during labour & birth.
4.	I am fearful of birth.
5.	I am worried that harm might come to the baby.
6.	I am afraid that I (my partner) will be out of control during labour and birth.
7.	I fear complications during labour and birth.
8.	Birth is unpredictable and risky
9.	I am afraid of what the labour and birth process will do to my (my partner's) body.
10.	I am afraid that my (my partner's) body will never be the same again after birth.

1.3.2 Prevalence

A newly published systematic review reported a widely varying country prevalence of high childbirth fear, ranging from 3.6-31.1% (75). Childbirth fear has been studied predominately in the Scandinavian countries, but studies from Australia, Canada, the United States, Switzerland and Croatia were also included in the review. This variation in prevalence is likely due to the fact that the studies used different definitions of fear, utilized different measurement tools as well as reported a range of cut-off scores for high or severe fear. However, when comparing only studies assessing fear with the most widely used measurement tool (W-DEQ) and reporting the same cut-off score for childbirth fear (>85 points) the country rates still varied, ranging from 6.3-14.8% (75).

These findings are in agreement with previous results from the BIDENS study (76), the first cross-sectional study to compare childbirth fear in six European countries using the same instrument. Lukasse et al. (2014) found a significant difference in the childbirth fear prevalence across countries, ranging from 4.5% in Belgium to 15.6% in Estonia for nulliparous women and from 7.6% in Iceland to 15.2% in Sweden for multiparous women.

Similar findings have been reported for the pre-pregnant population (89), in a study of six countries using the same assessment tool. These studies suggest that there is a difference between countries in terms of childbirth fear. Reasons for this are unknown and further research is necessary,

although previous studies have also highlighted a concern of whether poor translation of scales from one language to another may contribute to the difference in prevalence found (77).

1.3.3 Background factors associated with childbirth fear

Several researchers have attempted to identify factors associated with high childbirth fear, but this has not proven straightforward. While high childbirth fear is associated with psychological symptoms, such as anxiety and depression (86, 90-92), eating disorders (92) and low childbirth self-efficacy (93), studies have been inconclusive when it comes to its association with parity, gestational age, education or overall socio-economic status.

Most studies find that nulliparous women are more likely to express high childbirth fear compared with multiparous women (76, 94-97), although some report the opposite (86) or find no difference with parity (98). Similarly, childbirth fear may increase with gestational age (94) or not at all (91, 99). Young maternal age (91, 98, 100) as well as advanced maternal age (86, 99), has been found to predict high childbirth fear, as well as lower educational status (91, 98, 100) and higher socioeconomic status (86, 95). Women with a history of abuse are more likely to have high childbirth fear (92, 101). Negative and traumatic birth experiences also increase the likelihood of high childbirth fear almost five times (102). Interestingly, women with negative birth experience are more likely to have high childbirth fear than women experiencing medical complications during birth (102), indicating that a medical complication handled compassionately by caregivers is not necessarily considered a tramatic event by women.

The contrasting findings may be a result of varied study settings or may, again, be dependent on the definition of fear used in the studies as well as the instrument used to measure childbirth fear. In summary, identifiying women at risk for high childbirth fear on background factors alone is not an effective strategy. In addition, some childbirth fear may be considered a normal and protective response to an unknown situation (68) and the majority of women will express some fears relating to pregnancy or childbirth (69). Therefore, finding effective ways to address childbirth fear for all women during pregnancy is an essential part of providing antenatal care to women within the social model of maternity care.

1.3.4 Birth related outcomes

High childbirth fear has been associated with a preference for cesarean section (99, 103) and a higher likelihood of caesarean section delivery (86,

100, 104-106). This finding is based on population based data from Norway including all women delivering in Norway between 1999-2008 (the MoBa study cohort; N=58 881) (103), a study using data from four geographical areas in Sweden in 2006 (N=1635) (99) and a Finnish study using registry based data for all births in Finland (N=788 317) between 1997-2010 (86). While the association with cesarean section was strong in all studies the odds ratio differed widely (OR from 3.3 to 27.0). The wide variation is likely explained by a variety of measures or definitions of childbirth fear used in the studies. Similarly, in a large study in six European countries, nulliparous and multiparous women with severe childbirth fear were 1.66 (95%CI: 1.05-2.61) and 1.87 (1.30-2.69) times more likely to deliver by elective cesarean section (100).

Induction of labour has also been found more common among women with high fear of childbirth (16.5% compared with 9.6%, $p<0.001$) (106) and women with high childbirth fear are significantly more likely to prefer (OR=4.2; 95%CI: 3.0-5.8) (107) and use epidural analgesia during labour (105, 108). These two studies from Canada (N=624) and Sweden/Australia (N=386, N=123) both found that high childbirth fear significantly increased the odds of having an epidural (OR=1.9; 95%CI: 1.1-3.2) (105), also when controlling for maternal age, parity, infant macrosomia, previous cesarean section, fatigue, anxiety, sleep deprivation and available support (OR = 2.02; 95% CI: 1.26-3.22; $p = 0.003$) (108).

High childbirth fear is furthermore associated with a longer active stage of labour (109, 110) and an increase in the total amount of pain relief needed during active labour (110). However, emergency caesarean section was not found to be associated with high childbirth fear (111, 112). These studies represent our current understanding of the association of childbirth fear with labour and delivery preferences and outcomes and highlight the importance of addressing childbirth fear as an essential part of promoting normal birth.

1.4 Group antenatal care

In most Western countries, antenatal care traditionally involves a schedule of one-to-one visits with a care provider, where there is great emphasis on risk assessment and screening (12, 113); a model that is well aligned with the medical model of maternity care. Alongside antenatal care some women (for example, 34% in the United States (114) and 60% in Iceland (115)) attend a variety of educational classes including hospital or community-based childbirth education classes, yoga and physical therapy to prepare emotionally for childbirth and parenthood.

However, a maternity care model that aims to combine the physical, educational, emotional and social needs of women has emerged as a popular alternative among pregnant women (116, 117) and midwives (118, 119). This alternative to one-to-one care, *group antenatal care*, is grounded in the social model for maternity care and is well aligned with the salutogenic framework as group care offers increased contact time with the midwife with unique opportunities for expanding knowledge, building skills, receiving reassurance, and developing relationships with other expecting parents and maternity care providers (120, 121). The following section will provide an overview of group antenatal care.

1.4.1 A social model of antenatal care

Group antenatal care was originally developed in the United States in the 1970s and evolved as a response to provider and consumer frustration with the traditional model of care (122). Since then, the group model has been implemented in various settings around the world (116, 117, 123, 124). In essense, group care models are multi-faceted models that integrate the three major components of antenatal care: health assessment, education and social support into a unified programme as shown in Figure 4 (122).

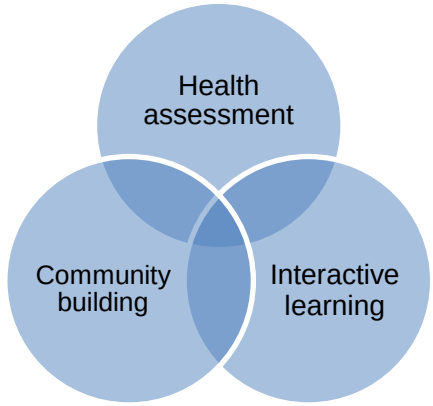

Figure 4 The three components of group antenatal care

Women with similar gestational ages are brought together, learning care skills, participating in a facilitated discussion, and developing a support network with other group members. Each pregnancy group meets according to routine antenatal care schedules throughout pregnancy and sometimes into early postpartum for 90-120 minutes at a time. Women have their first visit individually with their provider where history is obtained, physical

assessment is performed, and risk factors are evaluated. Then they are assigned to a group of 6–12 women (the numbers vary between individual programmes) who share similar due dates. Two healthcare providers share the responsibilities of facilitating discussion and completing standard physical health assessments. Within the group setting education is delivered in a facilitative rather than didactic method to promote patient empowerment and self-efficacy, an important difference between group antenatal care and conventional one-on-one antenatal care or antenatal classes (122).

While group care models are similar in that they group women together according to gestational age, follow a facilitative discussion format and emphasize the collective importance of health assessment, education and community support, some differences between settings have been highlighted. For example, the length of each session, whether self-assessments are included within the group session, the number of women in each group, whether the one-to-one visit occurs within the group space or in private, and whether partners are invited to the groups vary internationally (116, 121, 125).

Sharing concerns, questions and stories in a supportive and dynamic group environment facilitated by a midwife not only increases opportunities for education and support (10, 116, 126), but sharing and hearing other women share concerns that mirror their own may also help women normalize their experience of pregnancy (116, 127, 128). As such, using the group as part of antenatal care has the potential to promote normal birth and fits well into the social model of maternity care.

1.4.2 A feasible model of antenatal care

A recent Canadian survey of 477 women with low-risk pregnancies found that about half of them would be interested in a group antenatal care model (129). They were more likely to show interest in participating if they had at least post-secondary education (adjusted OR 1.8 [95% CI:1.05–3.24]), had not discussed labour with their care provider (adjusted OR 1.67 [95% CI:1.12–2.44]), and valued woman-centeredness (adjusted OR 4.10 [95% CI:2.45–6.88]). High importance was placed on the learning components of group antenatal care and by the majority of women a preference was placed on being with similar women, especially in terms of age. About two-thirds preferred to have support persons attend the group sessions and over half were comfortable with male partners (129).

Furthermore, feasibility studies have suggested that group antenatal care is a more efficient model to deliver better outcomes at a lower cost (130, 131). However, these results should be interpreted with caution when generalizing as both studies are from the USA, where the healthcare system is vastly different from other healthcare systems, such as the Nordic countries.

1.4.3 A model with good maternal and neonatal outcomes

A Cochrane review comparing individual and group antenatal care, found group antenatal care associated with comparable health outcomes for women and for their babies (123). A critical review of the literature furthermore found group antenatal care to be safe and effective and promote evidence-based practice (132). Women in group sessions were also more likely to receive comprehensive antenatal care, had significantly better antenatal knowledge and felt more ready for labour and delivery compared to women in usual care according to a randomized trial on group care (133). Salutogenic outcomes, such as breastfeeding initiation and greater satisfaction with care was higher among women in group care compared with women in individual care (133).

In fact, several studies have shown high levels of satisfaction with participating in group antenatal care (116, 117, 133). This is likely the result of increased social support, education, continuity of care and personal connection with healthcare providers which women value in antenatal care services (134). In some settings, this may also be the result of reduced waiting times for group care visits (134). Importantly, group care also meets parents' needs for antenatal physical assessment and screening (116).

Non-randomized studies with control groups have shown that group antenatal care can have a positive overall effect on psychological wellbeing, especially among women with greater stress or lower personal coping resources (126, 135). However, the model has not been shown to have a positive effect on reducing anxiety among teenage mothers (136). This finding could be explained by the use of the *The Pregnancy Distress Questionnaire*, an instrument to measure pregnancy anxiety among the teenagers, that may measure concepts more closely related with financial burdens than psycho-social burdens with questions such as worries about "paying for baby's clothes, food or medical care" or about "working after the baby comes" (136, 137).

In summary, elements of the group antenatal care model align well with the social model for maternity care. These elements have the potential to normalize childbearing for women and their partners amidst increasing use of obstetric technology and childbirth fear.

1.5 The Icelandic setting

In Iceland, an island in the North-Atlantic with a population of 348.450 inhabitants, about 4000 births occur annually. Maternity services for low to moderate risk pregnancies are provided by midwives in collaboration with general practitioners and obstetricians when needed and women with high-risk pregnancies receive care from midwives and obstetricians in high-risk facilities. While maternity services are provided in 45 primary care centers around the island, the majority of births (>70%) take place at Landspitali University Hospital in Reykjavik (138).

Traditional health outcomes such as maternal and neonatal morbidity and mortality are excellent in Iceland (138). However, it may be debated whether those measures are adequate as the only measures of successful antenatal care in a high-income country with publicly funded healthcare and collaborative midwifery and obstetric services. Maternity care in Iceland may benefit from further assessment of care based on salutogenic outcomes, such as patient satisfaction and level of patient participation in healthcare (10, 11, 139).

1.5.1 Social and medical models

The foundation of the maternity care system in Iceland is based on the social model of birth, as evidenced by the emphasis on midwifery-led care. However, the closing of low-risk midwifery-led units over the past twenty years may be evidence of a general shift towards a more medicalized model in Iceland. In 1995, the Reykjavik birth center (Fæðingarheimili Reykjavíkur) closed its doors, in 2006 a successful and popular model of continuous midwifery-led care within the Landspitali University Hospital (known as MFS) was closed and in 2014 the low risk unit (Hreiðrið; e: The Nest) within the Landspitali University Hospital was also closed. In 2013, 23% of women delivering at the University hospital gave birth in the Nest (140). At present Landspitali University Hospital, where the vast majority of births occur, has only one birthing unit, which is a mixed-risk high-risk unit serving healthy and sick mothers. In addition, there has been a trend in Iceland for the past years of centralizing maternity care and closing rural birthing units.

However, in the last few years there has also been a shift back to the social model. The homebirth rates increased to 2.2%, which is high compared to most European countries (141) and in 2017 a small privately run birthing center was opened in the Reykjavik area, emphasizing normal birth. These are small, yet significant efforts in moving maternity care towards the social model and promoting normal birth among the next generation of pregnant women.

1.5.2 Common obstetric interventions in Iceland

In 2016, the cesarean section rate in Iceland was 18,3%, which is low compared to most OECD countries as seen in Figure 2 (5, 142). While the cesarean rate is low in Iceland, information on selected obstetric interventions recorded in the Icelandic Medical Birth Registry and published in national annual reports since 2004 suggest that other obstetric interventions may be on the rise (142). For example, in 2016 the induction rate in Iceland was 32% (142), which was high compared to rates in many middle and high income countries (143). Similarly, the epidural rate seems to have inreased rapidly, from 36.3% in 2007 to 57.8% in 2016 (142).

Previous studies have hypothesized that rising intervention rates may be because of changing demographics of pregnant women, i.e. higher numbers of pregnant women with conditions known to increase the risk of cesarean section such as advanced age (142, 144) or obesity (142, 145). Similarly, an increase in lifestyle-related illness in the population, such as diabetes or hypertension (146, 147) may contribute to an increased use of interventions, as diabetes and hypertensive disorders are indications for labour induction and cesarean delivery (148, 149). However, to draw meaningful conclusions about the reasons for the rising intervention rates, there is a need to test empirically whether these assumptions are true.

1.5.3 Antenatal care in Iceland

In the Reykjavik capital area there are eighteen primary care centers, providing antenatal care services to healthy women with low to moderate risk pregnancies while antenatal care for high-risk pregnancies is provided at Landspitali University Hospital. All visits are one-to-one visits and continuity of care is emphasized in clinical guidelines. This has, however, not been quantified or evaluated. All antenatal services are publicly funded and free of charge. Clinical guidelines offer recommendations about appropriate screening and education throughout pregnancy and emphasize that care should be tailored to each woman (113). The

guidelines recommend that healthy nulliparous women have ten clinical visits during pregnancy (113) and the initial visit (usually at 8-12 weeks) should last about one hour (Table 4). Subsequent visits last about 20-30 minutes.

First time mothers are more likely to seek out education and support than multiparous women and the majority (80%) of nulliparous women in the country attend childbirth education and breastfeeding classes, which are offered for a fee by public and private organizations (115). In a recent Icelandic population-based longitudinal study, most women had expectations regarding information about birth in early pregnancy, but postnatally, 41% reported that those needs were insufficiently met in conventional antenatal care (115). In essence, they felt too little time had been spent on childbirth education during antenatal care. This finding was particularly evident in young women or first-time mothers. Participation in a structured antenatal education class did not change their experience of whether enough time had been spent on birth-related information during antenatal care, indicating that many women would like to receive more information about the birth during antenatal care.

There is great emphasis on risk assessment and screening within antenatal care (12, 113). Table 4 is an example of information provided to pregnant women when they enter antenatal care and may enforce the idea further that the main purpose of antenatal care is physical assessment and surveillance (150-152). However, women also value those components within antenatal care that encourage autonomy and confidence (153) and effective communication (154) as these bring them a feeling of control throughout the childbirth process. Research with Canadian women showed women's sense of autonomy and ability to lead decisions around their care is associated with average length of antenatal appointments, i.e. women with antenatal appointments less than thirty minutes long reported reduced autonomy in decision-making (155).

Women furthermore value professionals who allow time to talk, encourage questions, have an empathic conversational style, and are willing to take the initiative in ensuring women that they will receive appropriate care (154).

Table 4 Antenatal care schedule in Iceland. Multiparous women are recommended seven visits and nulliparous ten (visits recommended for nulliparous women only are marked in gray)

< 12 weeks	Detailed health assessment including blood pressure, weight and height, urine sample and blood sample.
16 weeks	Discuss previous health assessments. Assess blood pressure and urine sample.
25 weeks	Assess fundal height, blood pressure and urine sample.
28 weeks	Assess fundal height, blood pressure, urine and blood sample for anemia. Offer screening for antibodies for Rh negative women.
31 weeks	Fundal height, blood pressure and urine sample.
34 weeks	Fundal height, blood pressure and urine sample.
36 weeks	Fundal height, blood pressure and urine sample. Assess fetal position. Offer screening for antibodies for Rh negative women.
38 weeks	Fundal height, blood pressure and urine sample. Assess fetal position.
40 weeks	Fundal height, blood pressure and urine sample. Assess fetal position.
41 weeks	Fundal height and fetal position, blood pressure and urine sample. Offer to sweep membranes.

2 Aims

The overarching aim of this PhD thesis was to provide knowledge and understanding of ways to promote normal birth among Icelandic women expecting their first child. We divided the research into four parts, resulting in five scientific papers (see Papers I-V; Table 5). The specific aims for each study were as follows:

1. To determine the use of four common obstetric interventions (cesarean delivery, labour induction, epidural analgesia, and instrumental delivery) over a 20-year period (1995-2014) in Iceland. Furthermore, to assess whether changes in maternal characteristics and pregnancy-related conditions were associated with changes in intervention use.

2. To explore factors associated with womens' intentions prior to pregnancy to have a natural birth (i.e. vaginal birth without epidural analgesia) and to draw attention to parameters that could be emphasized within midwifery care when promoting natural birth.

3. To provide a systematic review of high quality studies of nonpharmacological antenatal interventions that are linked to reductions in pregnancy specific anxiety and childbirth fear during pregnancy.

4. To create, implement and test an intervention within antenatal care designed to promote normal birth intentions and lower childbirth fear among low to moderate risk nulliparous women.

Table 5 Overview of studies included in this PhD thesis: Design, data collection and study participants

Aim	Paper	Title	Design	Data collection	Population/participants
1	I	Obstetric interventions, trends, and drivers of change: A 20-year population-based study from Iceland	Population based, observational cohort study	Nationwide Medical Birth Register	86933 women giving birth between 1995-2014
2	II	Opting for natural birth: A survey of birth intentions among young Icelandic women	Cross-sectional, survey	Survey sent to students at the University of Icland	410 pre-pregnant women
3	III	A systematic review of nonpharmacological prenatal interventions for pregnancy-specific anxiety and fear of childbirth	Systematic review	PubMed and Mendeley databases searcehed with 42 search terms	NA
4	IV	Combining one-to-one and group antenatal care: A study protocol of the Enhanced Antenatal Care	Protocol description	NA	NA
4	V	Enhanced Antenatal Care and childbirth fear: A quasi-experimental controlled study	Quasi-experimental intervention	Pre and post test with comparison group	92 nulliparous women

3 Materials and methods

This thesis consists of four independent studies and five papers. The first study described and analysed the use of obstetric interventions in Iceland. The second outlined factors that are associated with natural birth intentions. The third study was a systematic review of interventions to lower childbirth fear during pregnancy and the fourth study was presented in two papers; paper IV described the protocol for a quasi-experimental intervention study and paper V analysed the effectiveness of the intervention in terms of lowering childbirth fear among nulliparous women (Table 5).

3.1 Study I: A population-based study of obstetric interventions

To determine the incidence of four common obstetric interventions, we conducted a nationwide study of all women giving birth in Iceland in 1995-2014 using registry-based data (Paper I).

3.1.1 Data sources

The Icelandic Directorate of Health collects comprehensive data on childbirth in Iceland through an electronic and centralized nationwide database, the Icelandic Medical Birth Registry. The Icelandic Medical Birth Registry has complete coverage of all births of infants weighing >500g or born after the 22nd week of gestation with information such as time and place of birth, gestational length, and information on maternal and paternal factors such as age, occupation and marital status. The Icelandic Medical Birth Registry furthermore collects information on obstetric interventions performed such as cesarean section, instrumental delivery, epidural analgesia and labour induction as well as clinical diagnoses for the mother, including diabetes and hypertension. Information on obstetric interventions during labour and delivery is registered in the Medical Birth Registry according to the recommendations of the Nordic Medico-Statistical Committee (NOMESCO), the Classification of Surgical Procedures (NCSP), the International Classification of Diseases, tenth revision (ICD-10) (87) as well as with variables defined in the maternity and birth records. The variables used in our analysis are described in detail in Paper I (156).

We used the Icelandic Medical Birth Registry to describe prevalence and temporal trends of four common birth interventions (cesarean delivery, labour induction, epidural analgesia, and instrumental delivery) in the Icelandic population over a 20-year period (1995-2014).

3.1.2 Study population

The study population included all births in Iceland as registered in the Icelandic Medical Birth Registry over a 20-year period; 1995-2014 (N=86 933 births). We counted deliveries of multiples as one single birth as the aim was to assess obstetric interventions and not newborn outcomes. We retrieved information about the obstetric interventions, as well as maternal socio-demographic factors and information on maternal diagnoses of chronic and pregnancy-related hypertensive disorders and diabetes from the Icelandic Medical Birth Registry using the ICD-10, NCSP codes as well as the variables defined in the Icelandic Medical Birth Registry (156).

3.1.3 Study measures

We calculated the incidence of elective cesarean sections as the number of planned cesarean sections during the relevant year per 100 (%) births in the population. An elective cesarean section was defined as a cesarean planned at least eight hours in advance of the birth and performed during regular daytime hours (138). We then calculated the incidence of induction of labour, epidural analgesia, emergency cesarean section and instrumental delivery among intended vaginal births (excluding elective cesarean section), as the number of births with an obstetric intervention during the relevant year per 100 (%) births in the population, by women's socio-demographic and pregnancy related characteristics. We excluded elective cesarean sections from this part of our analysis as women with a planned cesarean section are not eligible for the other obstetric interventions analysed.

3.1.4 Analysis

We used Poisson regression analysis for time-dependent count data to assess temporal trends in the use of obstetric interventions among all women giving birth over the study period (1995-2014). We then reported the relative risks (i.e. prevalence ratio, RR) and corresponding 95% confidence intervals (CI) for induction of labour, epidural analgesia, emergency cesarean section and instrumental delivery by calendar-period (2000-2004, 2005-2009, 2010-2014) using 1995-1999 as a reference period. Our analysis was stratified by parity. We first estimated crude measures, and then adjusted the model for women's socio-demographic characteristics including age (continuous),

citizenship, marital and employment status, singleton pregnancy and birthplace. We furthermore assessed temporal trends with Poisson regression for continuous years and evaluated the *p* value for trend. Finally, we divided the analyses by diagnosis of diabetes or hypertensive disorders to detect whether temporal trends in use of obstetric interventions varied by women's underlying diagnosis. We reported adjusted relative risks for the total population.

To assess changes in normal birth over the study period, we furthermore report prevalence of normal birth (defined as birth without the use of labour induction, epidural analgesia, instruments or cesarean section). We used RStudio statistical software (version 0.98.953) to analyse all data.

3.2 Study II: A cross-sectional survey of childbirth fear and birth interventions

To explore factors associated with pre-pregnant womens' attitudes towards natural childbirth, we conducted a web-based cross-sectional survey (Paper II). The survey was developed for an international collaboration to examine attitudes towards birth among young men and women in eight OECD countries; Australia, Canada, Chile, England, Germany, New Zealand, United States and Iceland (88, 157). These countries represent a range of different maternity care systems (midwifery coverage is high in Iceland, England, Chile and New Zealand and low in Canada and the United States), and a range of rates of childbirth interventions. For example, in 2015 Iceland had the lowest cesarean section rate (15.2%) among OECD countries, while Chile was among the highest (44.7%) (5).

3.2.1 Sample frame

We focused our analysis on a sample of Icelandic women, as previous studies with the pre-pregnant population had revealed important gender differences in birth attitudes and childbirth fear (88, 89). A recruitment email with a link to the online survey was sent to the whole student population of the University of Iceland (N=9805) on November 1, 2014 and a reminder email was sent one week later. The survey items were adapted from a Canadian instrument (89) and translated to Icelandic using forward-backward translation. The survey included questions about attitudes towards birth and preferences for birth interventions and maternity care. Of the 792 students who completed the survey, 410 met inclusion criteria (i.e. were female students less than 40 years old, who were not pregnant at the time of the survey and did not yet have any children but wished to have at least one child in the future).

3.2.2 Study measures

We assessed the two main exposure factors, 'childbirth fear' and 'confidence in own birth knowledge', using the *Childbirth Fear Prior to Pregnancy* scale (CFPP) and the statement "I feel confident about my level of knowledge around pregnancy and birth" on a six-point Likert scale. The CFPP scale was recoded into a categorical variable; where low fear was defined as the lowest quartile of the scale (10–29 points), high fear as the highest quartile (42–60 points) and the remaining two quartiles as moderate fear (30–41 points). Confidence in birth knowledge was recoded into low confidence (strongly disagree and disagree), moderate confidence (somewhat disagree and somewhat agree) and high confidence (agree and strongly agree).

We defined natural birth intentions as preferring a vaginal birth without use of epidural analgesia and used responses to two survey questions to create this variable as shown in Figure 5. We used the term natural birth intentions, instead of normal birth intentions, because we did not assess women's preferences regarding labour induction or instrumental delivery, which is otherwise included in the definition of normal childbirth used throughout this thesis.

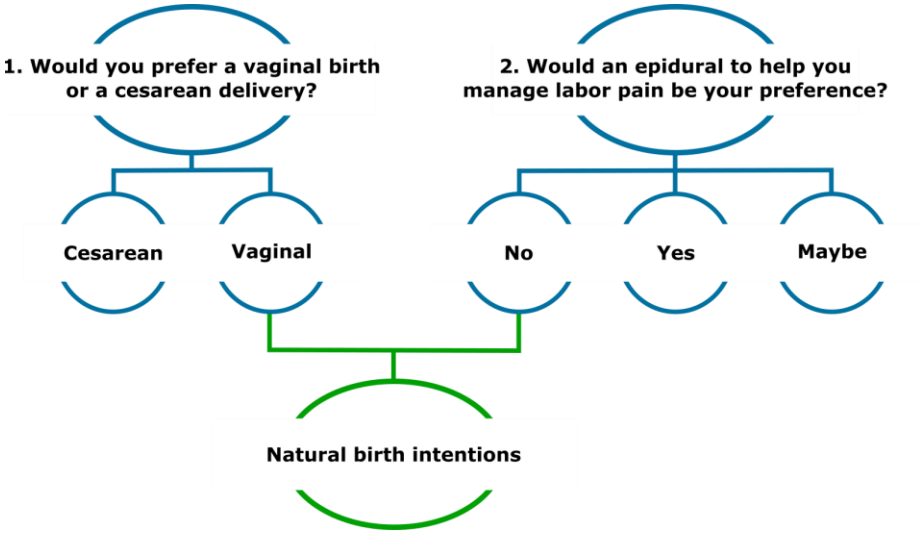

Figure 5 The outcome variable, natural birth intentions, was created using responses to two survey questions regarding preferences for mode of birth and the use of epidural analgesia

3.2.3 Analysis

The association between level of childbirth fear and natural birth intentions was assessed by using log binomial regression to calculate the crude and adjusted relative risks (RR) and corresponding 95% confidence intervals (CI). We chose the log binomial for our dichotomous outcome as it produces an unbiased estimate of the adjusted relative risk and reporting relative risk as opposed to odds ratios is appropriate when reporting associations for common outcomes (>10%). The models were adjusted for differences in the socio-demographic (age, relationship status and education level) and psychological profile (depression, stress and anxiety) of students. A *p*-level of 0.05 was considered significant. The association between confidence in birth knowledge and normal birth intentions was assessed in the same manner. IBM SPSS 22 was used for data analysis

3.3 Study III: A systematic review of interventions to lower childbirth fear

To provide an overview of high quality studies of nonpharmacological antenatal interventions that might be linked to reductions in pregnancy specific anxiety and childbirth fear during pregnancy we conducted a systematic review (Paper III).

3.3.1 Data sources and selection criteria

We searched the PubMed and Mendeley databases on April 29, 2016 and again on March 15, 2017 using 42 combinations of search terms. We included research published in any country and on any date and the inclusion criteria for the systematic review were:

- One of the study outcomes should be pregnancy specific anxiety or childbirth fear
- The article must report on an intervention, educational component, or treatment regime for pregnancy specific anxiety or childbirth fear
- The study design should include a control group
- Pregnancy specific anxiety or childbirth fear must have been measured at least twice during pregnancy (at baseline and post-intervention).

Search words included childbirth fear, fear of birth, fear of childbirth, pregnancy anxiety, birth anxiety, childbirth anxiety AND intervention,

treatment, RCT, childbirth education, antepartum education, antenatal education, and antenatal education. We then searched the bibliographies of relevant papers that were identified during the review and the grey literature. Two authors (Emma Swift and Kathrin Stoll) independently reviewed 206 articles found in PubMed and Mendeley. In total, 16 papers met eligibility criteria and moved on to the quality assessment stage.

3.3.2 Analysis

Two co-authors (Nichole Fairbrother and Patricia Janssen) independently assessed study quality, with the Effective Public Health Practice Project Quality Assessment Tool (158-160) along six dimensions: selection bias, study design, confounding, blinding, data collection, and withdrawal/attrition. Each article was rated on each dimension as weak, moderate, or strong, based on instructions from the quality assessment dictionary. Articles with no weak ratings on any of the dimensions were categorized as strong, articles with one weak rating were considered of moderate quality and articles with two or more weak ratings were deemed weak. We only included studies with moderate or strong quality ratings in our review.

Discrepancies between reviewers were resolved by first checking each assessment, to ensure discrepancies were not a result of errors in interpreting the instructions, and then by involving a third co-author, to review the assessments against the article. In a final stage, raters met to discuss remaining discrepancies and agreed on a final rating for the discrepant articles. In the paper, we present a narrative summary of seven high quality studies (see Figure 1 in Paper III), rather than a meta-analysis, because of heterogeneity of measurement tools, populations, and interventions.

3.4 Study IV: A quasi-experimental intervention study of the Enhanced Antenatal Care model

The fourth study was a quasi-experimental controlled intervention study designed to compare a new model of care for nulliparous women, Enhanced Antenatal Care (EAC) with usual care to assess feasibility and efficacy in terms of normalizing natural childbirth. Two manuscripts have resulted from this study, one describing the intervention and the study protocol (Paper IV) and the other reporting on the efficacy of the intervention in reducing childbirth fear among nulliparous women (Paper V). We used the Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT)(161) checklist when writing the protocol and Paper IV and the trial was registered with the ISRCTN Registry (ID ISRCTN47233250).

In addition to describing the study (data collection and analysis) this section will describe the model as well as the development and implementation of the model in three healthcare centers in the Reykjavik area.

3.4.1 The intervention: Enhanced Antenatal Care

We developed an intervention, Enhanced Antenatal Care, combining elements from one-to-one and group care models and, to our knowledge, this was the first model to do integrate both componentents.

In Enhanced Antenatal Care (EAC), nulliparous women were offered six one-to-one visits and four group sessions instead of the usual ten one-to-one visits (Figure 6). The one-to-one visits were offered in the first and second trimesters and allowed enough time for screening and testing for disease, as well as designing and implementing care plans for women with risk factors. The 90-minute group sessions were offered between gestational weeks 25-36, providing ample time for discussion about pregnancy, childbirth and parenthood, health assessment and community building. After the four group sessions, one-to-one care resumed until the birth of the baby.

Scandinavian models of group antenatal care have generally formed smaller groups than their American or British counterparts. We followed their lead and formed groups with four to six nulliparous women expecting a baby within the same calendar month (125). Partners were invited and encouraged to participate as well. Group sessions were facilitated by two midwives, one was the primary midwife providing antenatal care throughout pregnancy for the expecting parents in the group and I provided support with facilitating conversation in the group.

When attending the group sessions, women also had a 5-15 minute antenatal check-up in private with their primary midwife to assess fetal and maternal wellbeing according to the Icelandic national guidelines on antenatal care (113). To empower women to take ownership of their health, they were encouraged to engage in self-assessment activities during the group session, such as measuring their own blood pressure and writing results of the check-up in their handheld maternity record.

Increasing contact time with the midwife and other pregnant women is a key element in EAC, as this creates opportunities for education, facilitated discussion and developing a support network with participants. While expecting parents are interested in educational topics throughout pregnancy, they tend to seek out information about parenting and childbirth mostly

towards the end of pregnancy (162, 163) and thus we offered the group sessions in the third trimester. Table 6 illustrates the difference between the two models with regards to time spent with the midwife.

The nuts and bolts of Enhanced Antenatal Care

- EAC follows the Icelandic Antenatal guidelines for routine antenatal care.
- EAC offers six one-to-one visits and four group sessions
- Two midwives attend each group session
- To promote continuity of care, the primary midwife will attend women one-to-one and during the group session whenever possible
- Four to six women will be in each group
- Partners are invited to participate in groups
- Each group session is 90 minutes minutes long
- Each session will have pre-determined themes to prompt discussion
- If a participant is unable to come to group, she will be offered a one-on-one session instead
- The room should be large enough for a circle of 14 chairs, a table in one corner with information leaflets and blood pressure cuffs, a scale etc.
- One-on-one time within the group session is provided in a private space, such as a closed off corner in the group space or a room near by.

Figure 6 The nuts and bolts of setting up Enhanced Antenatal Care

While each group session varied depending on the group needs, the EAC protocol outlined a recommended structure and discussion topics for each session (Figure 7). More importantly, the sessions focused on salutogenic wellbeing rather than a pathogenic view of risk and illness. The following areas identified by Greer et al. (2014) to promote normal birth and decrease fear were used as a framework for the dicussions:

- Perceived riskiness of normal birth needs to be counterbalanced with more positive dialogues about normal birth
- The perception that medical interventions in low-risk pregnancy increases safety for mothers and babies needs to be challenged
- Fearful women and their partners need credible alternatives to medical interventions if they are to cope with childbirth in a more salutogenic way (164).

The content of each group session was chosen to reflect this need with two sessions specifically targeting birth related topics and two sessions focusing on breastfeeding and parenting-related topics (163). The need for discussion, and not only didactic teaching, among expecting parents about these topics is explicit (162) and so the small group model was chosen to facilitate conversation and peer-learning.

The topics were discussed within the framework of the social model of care, which assumes that pregnancy and birth are normal processes. In line with the salutogenic approach, discussions furthermore emphasized finding solutions and resources. The group discussions were intended to spark an interest in topics the participants may not have considered otherwise, and the conversation thus enhanced the education beyond what was possible in one-to-one midwifery visits. As such, within EAC, the group dynamic is the true instrument in the intervention.

Table 6 A comparison between Enhanced Antenatal Care and usual care

	Enhanced Antenatal Care	Usual care
Continuity of care	√	√
Midwifery care	√	√
Total visits	10	10
Initial one-hour visit	1	1
One-to-one visits	5	9
Group sessions	4	0
Time spents with midwife alone		
Initial one-hour visit	60 min	60 min
One-to-one visits	20-30 min each visit	20-30 min each visit
Group sessions	5-10 min each visit	NA
Time spent in groups	90 min per group visit	0
Total contact time with midwife	10 hours	4 hours
Health assessment at each visit	√	√
Community building	√	
Possibility to schedule extra visits	√	√

Table 7 Discussion themes and educational material recommended for each group session within Enhanced Antenatal Care

Session	Discussion topics	Educational material
1	Overview of the physiology of anatomy and labour Signs of labour and an overview of the stages of labour	Models of a pelvis, baby, placenta and uterus. Anatomy books/pictures Books with birth stories
2	Place of birth Breastfeeding: Anatomy and physiology, benefits for mother and baby, practical advice The first days after giving birth: Support in the early days Newborn care Home visits from the midwife	Models of a pelvis, baby, placenta, and uterus Model of a newborns stomach in the first week of life Pictures and books on anatomy, Parenting books Books with birth stories
3	Managing pain during labour with and without medication The known and unknown aspects of labour and birth Early labour – when to call What to prepare (i.e. birth bag) Writing a birth plan	Models of a pelvis, baby, placenta, and uterus Information leaflets on pain management with and without medication Sample birth plans
4	Pregnancy to parenting transition Emotional adjustment Newborn care and safety Seeking support Birth control Breastfeeding	Parenting books Breastfeeding books Books on fatherhood Model of a newborns stomach in the first week of life

3.4.2 Implementation

The implementation of EAC was in close cooperation with midwives and other staff members at the primary healthcare clinics. I hosted a three-hour workshop for the primary midwives at intervention sites about facilitating group sessions in Enhanced Antenatal Care. The workshop was inspired by a UK workshop led by Octavia Wiseman and Nickie Leap for the Research for Equitable Antenatal Care and Health (REACH) project in London. The workshop in Iceland provided midwives with basic facilitation skills and support for the planning and evaluation of group sessions. Midwives were provided with folders with informational pamphlets for expecting parents, an information packet about Enhanced Antenatal Care, including session structure, evaluation sheets and information about obtaining informed consent for the study.

At each clinic a room was set up for the groups with enough chairs for all participants (women and partners), with access to a bathroom and access to an examination room for one-to-one visits (Figure 7).

Figure 7 Group session room at one of the Reykjavik area healthclinics

The timing (day of the week and time of day) of the groups was chosen by the midwies at each clinic. One clinic chose mornings (9-10.30) and the other two clinics chose afternoons (14.30-16). The secretary staff was informed about the groups so that they could direct participants to the group space. The secretaries were furthermore in charge of keeping a folder with completed informed consent forms so that the research team could pick up the forms periodically. The midwives provided water and coffee and the research team provided snacks. Two clinics provided their own teaching models of a pelvis, baby and placenta but one clinic did not have such teaching material in their possesion. The research team provided the teaching models for the groups for the third clinic. A selection of books and pamphlets about pregnancy, birth and parenting was provided by the research team to encorouage conversation (Figure 8).

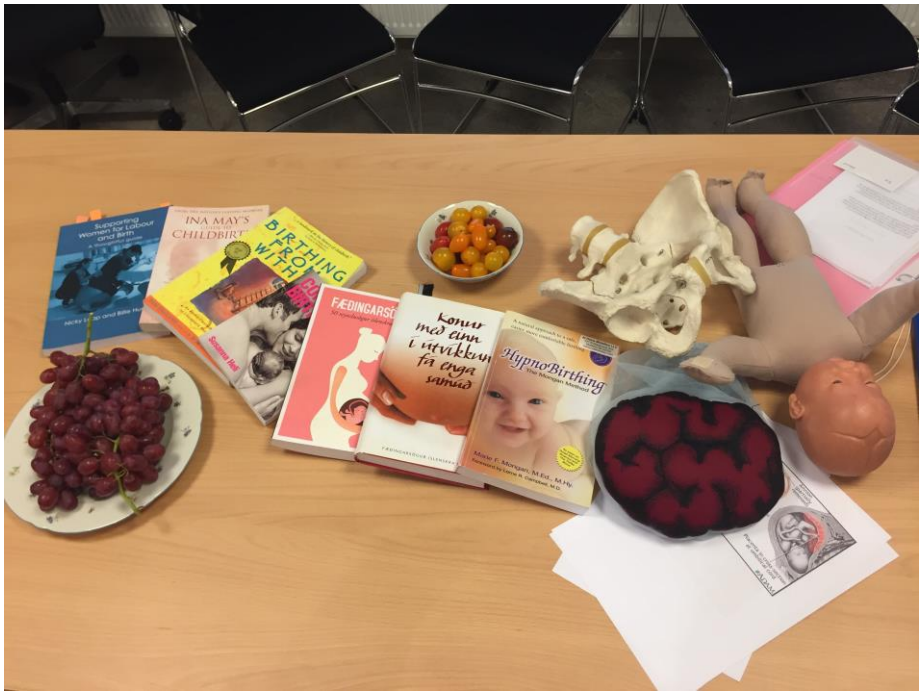

Figure 8 A selection of books and educational material was provided during the group sessions

3.4.3 Study population and participants

Participants in the study were nulliparous women receiving antenatal care at six healthcare clinics in the Reykjavik area (H1-H6). Three healthcare clinics served as intervention sites (H1-H3) and three clinics as comparison sites (H4-H6) providing antenatal care as usual. All healthcare clinics (H1-H6) were similar in size, serving a similar demographic, with two or three midwives providing antenatal care for women with low or moderate risk pregnancies living in the neighborhoods surrounding the clinics (113). As women with high-risk pregnancies, such as those with chronic illnesses, drug or alcohol abuse problems and severe mental illness (12, 113) receive antenatal care at Landspitali University Hospital, they were exluded from the study by design. Inclusion criteria were: nulliparous women (>18 years old) attending clinics H1-H6 for antenatal care and able to communicate in Icelandic.

During the first antenatal visit, midwives provided eligible participants with written and verbal information about the study purpose and informed them that they could withdraw from the study at any time. Potential participants were reassured that their decision not to take part in the study or to withdraw from the study would in no way affect the care they received. Participants then received an email with a link to the first online survey and a second (post-intervention) survey was sent at 36 weeks gestation.

3.4.4 Data collection

Our multiphase data collection involved 1) three surveys (pre-intervention at 12-16 weeks; post intervention at 36-40 weeks and six weeks postpartum), 2) focus groups with women and partners two to three months postpartum, 3) interviews with midwives, 4) collection of maternity records and 5) participant observation (Figure 9). Data collection methods, measures and timing of data collection are described in detail in Paper IV while Paper V presents findings from two of the surveys, sent at baseline and post intervention. Results from other data that we have collected throughout the study will be described and analysed at a later date.

The objective of the baseline survey was to assess socio-demographic characteristics of the participants, as well as sense of coherence and childbirth fear in early pregnancy. The second survey collected data on childbirth fear, childbirth intentions and attitudes towards birth and parenthood along with participant's experience of antenatal care including

their sense of autonomy and respectful care. Participants completed eac survey in about 10-15 minutes.

3.4.5 Analysis

We described categorical demographic characteristics of the study sample by reporting absolute and percentage frequencies and the mean and standard deviation (sd) for continuous variables. We reported absolute and percentage frequencies for women with high childbirth fear; using a conservative cut-off score of 60 points on the FOBS to define high childbirth fear (82, 83). We furthermore described the continuous dependent variable childbirth fear in terms of range, mean and standard deviation at both timepoints by EAC and usual care. We also calculated change scores (childbirth fear at T2 – childbirth fear at T1) for both EAC and usual care.

We assessed the effectiveness of EAC in reducing childbirth fear in three ways: 1) We used chi-square to assess statistical difference between the change in number of women with high childbirth fear (>60 points) at time points T1 and T2 between EAC and usual care groups; 2) We used a one-way between groups analysis of covariance where the independent variable was group allocation and the dependent variable was the difference in participants fear score at T2 and T1. Women's childbirth fear at baseline was used as the covariate and the model was furthermore adjusted for gestational age, a characteristic which was unequally distributed between the intervention and comparison arm at baseline; 3) Finally, we determined the effect size (Cohen's d) by dividing the mean change score for the two by the standard deviation (165).

To control for the effect of attending other classes alongside antenatal care, we restricted the main analysis to women who had not attended classes alongside antenatal care (i.e. excluding women who attended parenting/birth/ breastfeeding and yoga classes alongside antenatal care). The same statistical analysis as described above was repeated for the restricted subgroup. We collected all data using the Research Electronic Data Capture (REDCap) tool hosted at the University of Iceland (166) and used Rstudio for statistical analysis (167). A *p*-level of 0.05 was considered significant for all statistical tests.

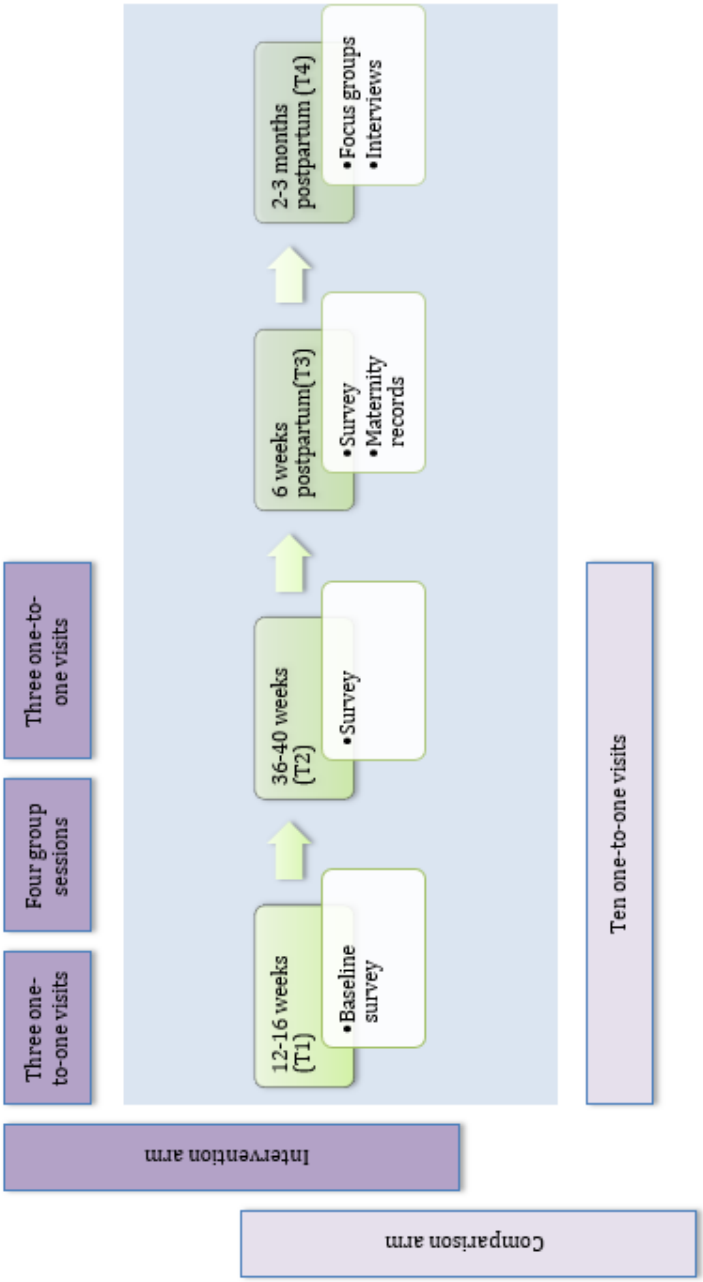

Figure 9 Distribution of one-to-one visits and group sessions in intervention (EAC) and comparison arm

3.5 Ethical considerations

1. Ethical approval for Study I was obtained from the National Bioethics Committee (VSNb2012040011/03.07) and the Icelandic Data Protection Authority (2014081095TS/--, 2012050619AT/-).
2. Ethical approval for Study II was obtained from the Icelandic Data Protection Authority (S36964/2014) and Hannover Medical School (Nr. 2431-2014).
3. No ethical approval was needed for Study III.
4. Study IV was approved by the Icelandic National Bioethics Committee (VSNb2017030007/03.01) and Vísindanefnd Heilsugæslu höfuðborgarsvæðisins og Háskóla Íslands (e. Reykjavik Area Primary Healthcare Clinics and the University of Iceland Bioethics Committee).

4 Results

The results from the four individual studies can be found in the corresponding papers (I-V). A summary of the results is presented here.

4.1 Study I: A population-based study of obstetric interventions

The main results from our first study indicated an increase in labour induction and epidural analgesia among 81389 intended vaginal births in Iceland over the study period (1995-2014). However, there were minimal changes in cesarean section and instrumental delivery incidence

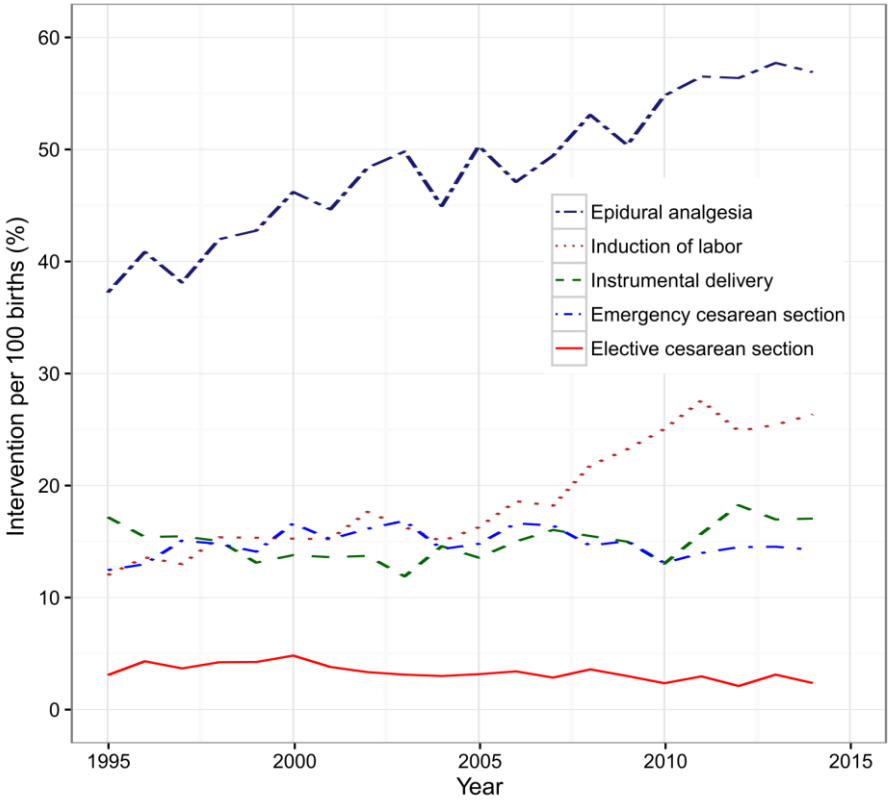

Figure 10 Prevalence of common obstetric interventions among nulliparous women in Iceland in 1995-2014

During the study period, 6.4% of all births were planned cesareans (5544 out of 86 933) and in 2014, the overall rate of labour induction was 24.0%, epidural analgesia 39.8%, cesarean section 15.8% and instrumental delivery 8.6%.Throughout the study period, obstetric interventions were more common among nulliparous than multiparous women and among women with hypertensive disorders or diabetes than women without such diagnoses, with the exception of instrumental delivery, which appeared to have similar prevalence throughout the study period for women with or without a diagnosis (Paper I, supplementary table). We stratified all results by parity and Table 8 and Figure 10 illustrate results for nulliparous women. Results for multiparous women are presented in Paper I.

Table 8 Prevalence per 100 women (%) and annual increase of induction of labour, epidural analgesia, emergency cesarean section and instrumental delivery among primiparous women planning a vaginal delivery (n=33 313) in 1995 and 2014

	Annual prevalence per 100 women (%)		Annual increase in prevalence*
	1995	2014	
Induction of labour	12.0	26.3	4.4
Epidural analgesia	37.2	56.9	2.1
Emergency cesarean section	12.3	14.3	0.0
Instrumental delivery	17.0	17.1	0.6

*Percentage points

During the study period there was a decrease in normal birth prevalence (defined as birth without the use of induction, epidural analgesia, instrumental or cesarean section delivery). Among nulliparous women the prevalence of normal birth decreased from 45.7% in 1995 to 29.0% in 2014. Similarily, the prevalence of normal birth decreased from 65.3% in 1995 to 47.0% in 2014 among multiparous women (Figure 11).

In our analysis of factors that might contribute to the changes in obstetric interventions over time, we found that increases in induction and epidural analgesia were most pronounced for women without a diagnosis of diabetes and hypertensive disorders. The rise was furthermore not explained by maternal characteristics such as advanced age, citizenship, marital or employment status (Paper I).

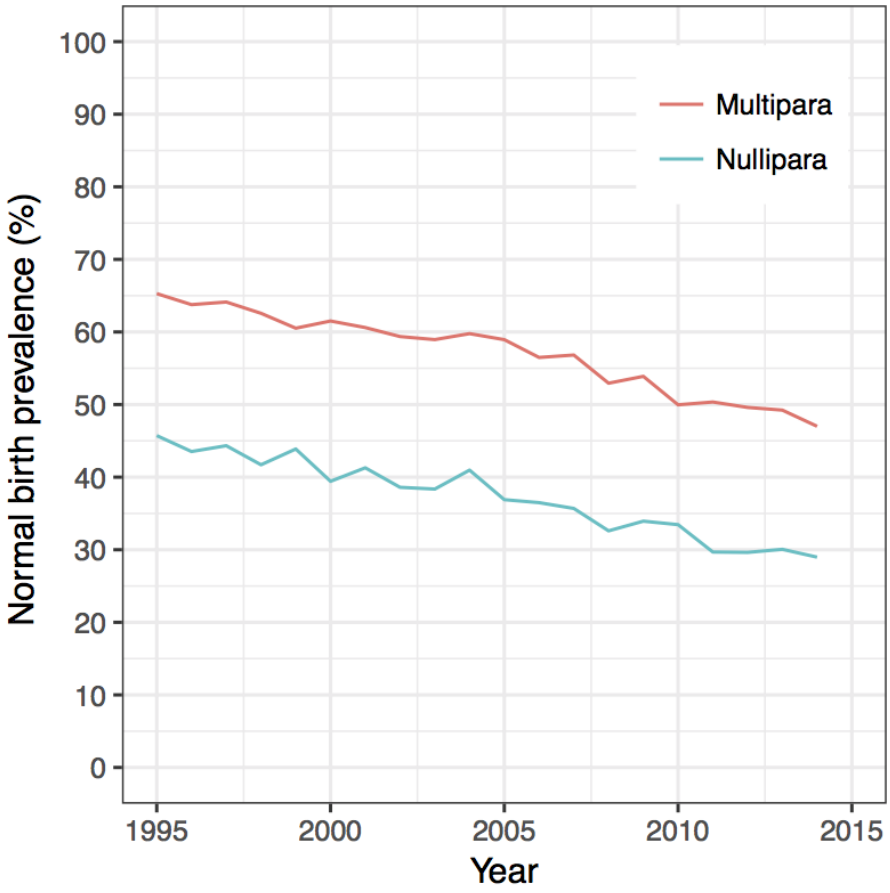

Figure 11 Prevalence of normal birth among nullipara and multipara women in Iceland 1995-2014

4.2 Study II: A cross-sectional survey of childbirth fear and birth interventions

The main results from our cross-sectional survey, which was completed by 410 participants, were that vaginal birth was preferred by most participants and epidural analgesia preferred or considered by the majority of participants as well (Figure 12). One in ten women reported natural birth intentions (i.e. preferred vaginal birth without using an epidural).

Women with low childbirth fear were more likely to have natural birth intentions when compared with women with moderate and high childbirth fear (adjusted RR 2.83 [95%CI: 1.48-5.41] and adjusted RR 4.86 [95%CI: 1.37-17.27], respectively). Women with high confidence in their birth knowledge were more likely to have natural birth intentions compared with women with moderate and low confidence (adjusted RR 2.81 [95%CI: 1.51-5.22] and adjusted RR 3.42 [95%CI: 1.43-8.18], respectively).

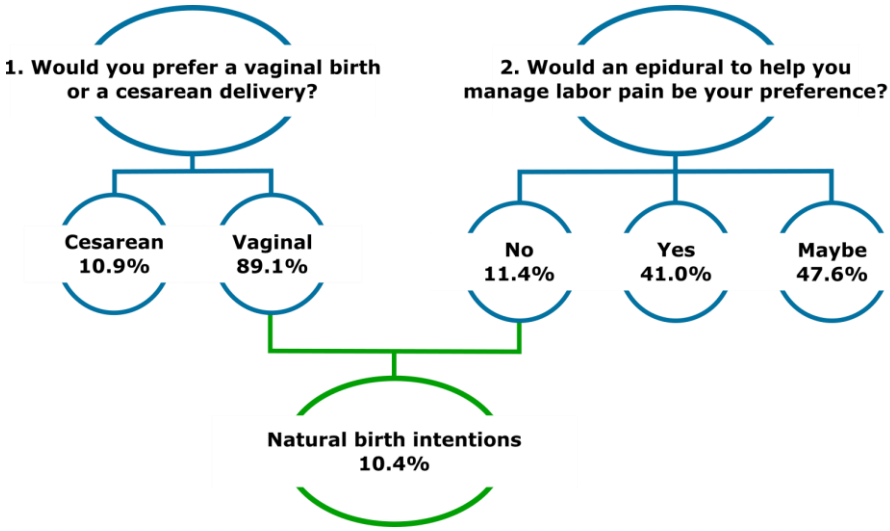

Figure 12 Birth intentions among 410 women who have not yet been pregnant but wish for a child in the future

4.3 Study III: A systematic review of interventions to lower childbirth fear

We included seven studies in our systematic review of nonpharmacological antenatal interventions for pregnancy-specific anxiety and childbirth fear (Table 9). Six were randomized controlled trials (RCTs) and one was a quasi-experimental study. Five studies received moderate quality ratings and two a strong rating. The studies were conducted in Australia, Finland, Germany, Turkey, United Kingdom and United States and all but one (a dissertation), were published in peer-reviewed journals. While three RCTs randomized women with elevated childbirth fear or elevated pregnancy distress to either the intervention or control group, the other studies did not require that women meet a minimum threshold for pregnancy-specific anxiety or childbirth fear to participate in the studies. In Paper III we describe each study briefly.

Table 9 Summary of studies included in a systematic review of nonpharmacologic antenatal inventions to reduce childbirth fear and pregnancy specific anxiety

Authors and title	Location	Study design	Overall rating
Cole-Lewis Testing the effect of a group prenatal care intervention on pregnancy anxiety	USA	Cluster RCT	Strong
Saisto et al. A randomized controlled trial of intervention in fear of childbirth	Finland	RCT	Strong
Sercekus et al. Effects of antenatal education on fear of childbirth, maternal self-efficacy and parental attachment	Turkey	Quasi experimental study	Moderate
Haapio et al. Effects of extended childbirth education by midwives on the childbirth fear of first-time mothers: an RCT	Finland	RCT	Moderate
Newham et al. Effects of antenatal yoga on maternal anxiety and depression: a randomized controlled trial	United Kingdom	RCT	Moderate
Toohill et al. A randomized controlled trial of a psycho-education intervention by midwives in reducing childbirth fear in pregnant women	Australia	RCT	Moderate

The main result of our systematic review was that antenatal education reduced childbirth fear significantly among women with a range of childbirth fear levels. Specifically, childbirth education delivered by midwives within the clinic, including a visit to the delivery room and exercises about pain relief

and positions for pushing (OR=0.58; 95%CI: 0.38-0.88) (168) and a series of antenatal classes covering physiological and psychological changes during pregnancy and how to cope with these changes (p<0.001) (169) were linked to significant reductions in pregnancy-specific anxiety and childbirth fear. It is unclear whether the series of antenatal classes were provided within the antenatal clinic or not, as well as whether the provider was a midwife or not. Among women with high childbirth fear, two telephone psycho-educational sessions (170) were found to significantly lower childbirth fear (p<0.001) and antenatal yoga was a sucessful strategy as well (171).

4.4 Study IV: A quasi-experimental intervention study of the Enhanced Antenatal Care model

The main result from our intervention study was that while EAC did not reduce childbirth fear beyond usual care, EAC was effective in lowering childbirth fear among women who did not attend any educational classes alongside antenatal care.

At the beginning of pregnancy, more EAC participants reported high fear (>60 points) than women in usual care (29.0% and 24.5%, respectively; Paper V). By the end of pregnancy there were fewer women with high fear of birth in EAC compared with usual care (9.7% and 14.8%, respectively). However, the difference was not significant.

The mean childbirth fear change score was -7.1 points among women in EAC and -4.3 points among women in usual care (p=0.255) and based on Cohen's criteria the effect of participating in EAC on reduction in mean childbirth fear was small (Cohen's d=-0.15) (165).

Restricting the main analysis to women who had not attended classes alongside antenatal care (n=25) resulted in a large effect size when comparing women in EAC (n=13) with women in usual care (n=12; Cohen's d=-0.84), with a change score of -14.5 points among women in EAC and 1.2 points among women in usual care (p<0.05).

5 Discussion

The five papers in this thesis contribute to knowledge about the prevalence of obstetric interventions, preferences for normal birth among young women prior to pregnancy and promotion of normal birth among women expecting their first child in Iceland. Our results indicate a stark difference in obstetric intervention trends in Iceland; a rapid increase in labour induction and epidural analgesia and a low and stable rate of cesarean section and instrumental delivery. These trends were not explained by changes in maternal characteristics or a rise in diabetes and hypertensive diseases.

A high preference for vaginal birth and epidural analgesia among pre-pregnant women in Iceland suggests that vaginal birth and epidural analgesia are highly normalized within Icelandic culture. We found that factors strongly associated with normal birth intentions were low childbirth fear and high confidence in birth knowledge. Inspired by a salutogenic view, we focused our research on factors that could strengthen normal birth intentions, rather than on factors associated with a preference for obstetric intervention.

The medical approach to childbirth fear is to screen, diagnose and treat women with high childbirth fear. However, a salutogenic approach assumes that the majority of women will express some fears relating to pregnancy or childbirth and thus addressing childbirth for all women, regardless of their level of fear, is imperative. Our systematic review identified that antenatal education and yoga were effective strategies to lower childbirth fear among women with a range of fear levels.

We then designed, implemented and tested Enhanced Antenatal Care (EAC), a new midwifery-led model of antenatal care which combined elements from group and one-to-one antenatal care. The group sessions, designed to enhance discussions and education, focused on salutogenic wellbeing rather than a pathogenic view of risk and illness. Women and their partners were provided with credible alternatives to medical interventions and the perception that medical interventions in low-risk pregnancy increase safety was challenged. We found that while EAC did not reduce childbirth fear beyond usual care, EAC was effective in lowering childbirth fear among women who did not attend any educational classes alongside antenatal care.

5.1 Obstetric interventions in Iceland

In the beginning of this thesis, normal birth was defined as labour that starts spontaneously, progresses spontaneously without any drugs and results in a spontaneous vaginal birth (15). To assess the state of normal birth in Iceland, and changes over a twenty-year period (1995-2014), we analyzed population based data from the Icelandic Medical Birth Registry. Our data reveal a stark difference in trends between the four most common obstetric interventions in Iceland: a simultaneous rise in induction of labour and epidural analgesia, while a low and stable cesarean and instrumental delivery rate was maintained. Previous studies have focused on one intervention at a time, and often cesarean sections are used as an indicator of overall trends in use of obstetric interventions. Our results, however, reveal the importance of reporting simultaneously on multiple obstetric interventions, as trends may differ. Our study is the first to describe and analyze nationwide trends in this way and our approach aims to give a more complete picture of obstetric practice within Iceland.

Similar to other population-based studies (146, 147), we found an increase in diabetes and hypertensive disorders over the study period and as expected, women with diabetes or a hypertensive disorders were more likely to receive any of the four obstetric interventions compared with women without such conditions. Surprisingly, the rising trend in labour induction and epidural analgesia was most notable among women without a diagnosis of hypertensive disorders or diabetes. The trends could furthermore not be explained by factors such as age, citizenship, marital or employment status. This warrants a further exploration of indications for labour induction in Iceland.

5.1.1 Cesarean section

Among OECD countries, there is great variation in cesarean section prevalence, with the lowest prevalence in Northern Europe (16.1%- 22.1%) and the highest in Turkey where over 50% of deliveries are cesarean sections (2-5). Notably, in Iceland the rates are both low (15.8% in 2014) and stable while the rate has increased rapidly in most other OECD countries (5, 140). However, it should be noted that in 2016 the rate was 18.3% (142) and while this may seem like a big increase, it is within the range of fluctuations in prevalence over our study period and similar to the prevalence in 2003 (18.0%). The lowest cesarean section prevalence during the study period was 14.6% in 2010. This increase is therefore not necessarily an indicator of an upward trend, although this should be monitored closely in light of the cesarean section trends worldwide.

The cesarean section rate in Iceland is within the limit of recommendations from the WHO (41, 43); a goal not achieved by many countries. The reasons behind the low cesarean section rate in Iceland are likely a combination of factors such as midwifery-led practice and careful examination of cesarean section trends and practices among midwives and obstetricians over the last decade.

To this end, the ten-group Robson classification system was implemented in Iceland in 2000 (64). The ten-group Robson classification system is a standardized, international system to monitor and compare cesarean section rates in a consistent and action-oriented manner (44, 64) and has been used successfully to systematically reduce cesarean sections and analyze the contribution of factors to changes in cesarean section rates around the world (172-174).

5.1.2 Labour induction

In contrast to cesarean section trends, the use of labour induction has increased rapidly in Iceland; a trend commonly seen in other middle and high-income countries as well (57, 175).

Current guidelines in Iceland recommend that healthy women with uncomplicated pregnancies are offered an induction of labour after 41 weeks of gestation and earlier if there is a clinical complication (113). Over a twenty-year period, the labour induction rate has nearly doubled and was 24.0% in 2014. This trend has continued, and in 2016 the induction incidence was 30.4%, according to the most recent annual Medical Birth Registry report (142). There is no worldwide recommendation on the optimal timing of labour induction, or on the optimal rate of labour induction. In fact, there is a wide range of labour induction rates in the world, and the highest rates are found in middle income countries (6). Middle-income countries are also known for their general over-medicalisation of childbirth, as evidenced by high rates of induction, cesarean section and routine episiotomy. The debate about the appropriate rate and timing of labour induction thus continues (51, 176-178).

Our results indicate that the increase in labour induction was most noticeable among low-risk women and not explained by a simultaneous rise in diagnoses of diabetes or hypertension, and not driven by an increase in socio-demographic changes. A recent Icelandic population-based study took a closer look at the induction rate among low-risk women in Iceland and found that the risk of induction increased with age, indicating a lower clinical threshold for obstetric interventions among older birthing women (179).

Advanced age increases the risk of adverse events, however advanced age alone is not a sufficient cause for intervention (156). Einarsdottir et al. (2018) speculate whether anxiety and closer monitoring of labour among older women may play a role in the higher rates of induction among this group and influence staff to lower their clinical threshold for obstetric intervention. This may also be true for labour induction in general.

Further research on optimal timing for labour induction is critical in promoting health as well as minimzing the risks to maternal and fetal health. Ideally, further evidence would inspire new guidelines which disucss the risks and benefits of labour induction at various timepoints, in terms of pathogenic as well as salutogenic outcomes. Furthermore, clinical staff may benefit from evidence-based discussions about the benefits of normal birth and a critical examination of labour induction practice in Iceland. This conversation would ideally include topics such as maternal age and the risk of stillbirth as well as how labour management, practioner's anxiety and clinical setting may influence clinical decisions.

5.1.3 Epidural analgesia

The use of epidural analgesia has increased rapidly in Iceland and in 2014 the overall rate was 39.8%. The most recently published annual Medical Birth Registry report indicates that this trend has continued, with an epidural rate of 43.4% in 2016 (142). While there is great variation in the use of epidural analgesia between countries (from 11.3% in the Netherlands to 71.0% in the USA and 82.0% in France (57)), this trend in Iceland is similar to changes in epidural use in the United Kingdom (UK), where the prevalence increased from from 17% in 1989 to 61% in 2017/18 (58, 180). Walsh et al. (2009) suggest several reasons for the epidural epidemic in the UK:

- *Availability.* Epidural analgesia is now available in most maternity care units.
- *Time.* Epidurals have now been available for more than 30 years and thus over two generations of childbearing women, contributing to the normalization of epidural analgesia for pain relief.
- *Birthstories.* Celebrity stories and media portrayals of childbirth often include epidurals.
- *Model of care.* Our society relies heavily on technology and within the medical model pain is considered either preventable or treatable.

- Movement from low to high-risk units has reinforced medical solutions to clinical symptoms (such as pain) and fragmented models of care and loss of continuity contribute to increased use of pharmacological pain relief.

There is evidence of all of the above in Iceland. There is wide availability of epidural analgesia at most birthing clinics in Iceland and over the years centralization of maternity care units, and the closing of low risk midwifery-led units (such as the Nest and MFS) have contributed to the medicalization of maternity care. While continuity of care is a cornerstone of Icelandic midwifery care, there is no continuity of midwifery care provider from antenatal care to intrapartum care for most women in Iceland. Since the closing of MFS in 2006, continuity of care through pregnancy, birth and postpartum is only available to women in rural clinics, and women who choose homebirth or birthcenter birth. With a 2.2% homebirth rate, this is a small minority of women in Iceland (141).

Our study of natural birth intentions among pre-pregnant women (Paper II) revealed that similar to findings in US (181) and Canadian (89) pre-pregnant populations, the vast majority of women in our study (89.0%) preferred vaginal birth. However, 41.0% also preferred using epidural analgesia. This reflects current obstetric practices in Iceland well; a low cesarean section rate and high epidural analgesia rate and suggests that epidural analgesia has been rapidly normalized in the Icelandic culture over two generations. A study of attitudes towards using birth technology among pre-pregnant men and women in eight countries (including Iceland) furthermore revealed that respondents had greater acceptance of childbirth technology and interventions if they were from countries with higher national cesarean birth rates (182), indicating that birth practices within a country shape attitutes among the next generation of childbearing women and their partners. Those with greater acceptance of childbirth technology and interventions also reported higher levels of childbirth fear and were more likely to report that visual media or school based education shaped their attitudes toward birth (182).

Worldwide, there is a trend towards increasing medicalization of childbirth. Therefore, promoting normal birth requires careful attention to trends as well as concrete actions to pull the pendulum back towards normal birth practices. These include implementing monitoring programmes, careful consideration of the evidence behind our maternity care practice, and strengthening of midwifery-led models of care. Our results show clearly that if care is not taken, obstetric interventions among healthy women can increase rapidly.

5.2 Childbirth fear in Iceland

Icelandic, pre-pregnant women with low fear of birth and high confidence in their birth knowledge were more likely to prefer normal childbirth (i.e. vaginal birth without epidural analgesia) compared with women with high fear or low confidence (Paper II). This is an important finding and suggests that promotion of normal birth as part of antenatal care should include addressing childbirth fear and knowledge gaps.

In our systematic review of interventions to lower childbirth fear among women, we identified five effective interventions and among women with a range of fear levels, antenatal education and yoga practice were effectice in lowering fear in pregnancy (Paper III).

Antenatal education has the potential to address gaps in birth-related knowledge and we identified several areas in our survey of pre-pregnant women that could be addressed to promote normal birth. For example, the majority of pre-pregnant women were worried about birth being unpredictable and risky. They also feared complications during labour and birth and were worried that harm might come to their baby. They furthermore underestimated the benefits of vaginal birth. Addressing these topics with pregnant women could potentially fill gaps in birth-related knowledge among pre-pregnant women, promote normal birth and lower fear (183).

However, the structure and content of antenatal education varies and a recent literature review found that antenatal education has the potential to have both positive as well as negative effects on labour and birth outcomes (184). For instance, positive effects included fewer false labour admissions, more partner involvement and less anxiety, while antenatal education also had the potentional to increase the use of induction of labour and epidural analgesia. One explanation might be that many antenatal classes are taught by hospital staff and may in fact promote dependency and compliance with hospital policies and procedures rather than promote choice and inspire confidence in women (185). Therefore, Greer et al (2014) suggested that the perceived riskiness of normal birth needs to be counterbalanced and the perception that medical interventions in low-risk pregnancy increases safety for mothers and babies needs to be challenged (158).

5.3 Enhanced Antenatal Care

We designed Enhanced Antenatal Care (EAC), a new model of midwifery-led antenatal care with elements from both group and one-to-one care to provide pregnant women with increased opportunities for a positive dialogue about

normal birth with their peers and midwife. We furthermore aimed to provide women with credible alternatives to visual media presentations and myths about pregnancy and childbirth. The following sections will first discuss the design and implementation process at three healthcare clinics in the Reykjavik area and then discuss results from Paper V.

5.3.1 Implementation

EAC was well received by women and their partners in Iceland. Similar to results from studies in Sweden and Australia (116, 117), women were interested in participating in group antenatal care. In fact, preliminary unpublished results from focus groups with EAC participants and their partners about their experience show high satisfaction with EAC and their enthusiam and positive feedback with the model serves as encouragement to further develop and implement the model in collaboration with midwives and health system authorities in Iceland.

We were pleasantly surprised by the partners‘ involvement in the group, which was evident in high attendance rates and involvement in discussions during sessions. Therefore, we added books and conversation topics about fatherhood after the first group had finished their four group EAC sessions. No other significant changes were made to the content or organization of the group sessions during the implementation phase. We then applied for and received ethical approval to invite partners to participate in focus groups postpartum about their experience of EAC.

During group sessions, we noticed that leaving the group conversation for one-to-one healthcare assessment with the midwife was sometimes difficult for women as they felt they missed important parts of the conversation. To accommodate for this, group care models elsewhere provide a private space within the group space to perform short healthcare assessments (122). This could minimize women’s time away from the group and promote the feeling of inclusion in the group.

There were some challenges when implementing EAC, mostly due to the low volume nature of primary healhcare clinics in the Reykjavik area. First, none of the clinics had any communal space that could be used for group sessions. We used a large examination room in one clinic (Figure 7), and meeting rooms (without windows) in the other two clinics. Additionally, the space was often far away from a bathroom and private examination rooms, making this arrangement even less suitable for use for pregnant women. When designing healthcare clinics and the use of space, it would be of

benefit to any group care model to have access to a bright, open but private space within the clinic. This space could be used for EAC, as well as other community building events such as group meetings of parents/babies that come to the clinic for well-baby visits (186-188). Second, to implement EAC, a clinic should have at least two midwives on staff, willing to collaborate on care for a group of women. Low volume clinics will often not meet this requirement. Therefore, midwives may consider collaborating when providing EAC and clinics may explore working in clusters. Midwives could also consider partnering with a nurse, family physician or social worker at the clinic to provide EAC within a clinic. Third, recruiting four to six women due within the same month was challenging within a low volume clinic. These are important issues that should be addressed before implementing EAC into their practice.

5.3.2 Childbirth fear

Paper V is the first paper to report results from a quasi-experimental study comparing EAC to usual care in Iceland. Similar to findings from previous studies (170, 189), we found that childbirth fear decreased over the course of pregnancy among women in both EAC and comparison groups. Interestingly, childbirth fear remained unchanged among women in usual care who did not take any classes (i.e. childbirth or breastfeeding education) alongside antenatal care, which indicates that usual care alone may not be effective in lowering childbirth fear. These results are consistent with results from our systematic review showing the benefits of antenatal education and classes alongside antenatal care in lowering childbirth fear (Paper III).

In our overall sample, 24 women (26.1%) were identified as having high childbirth fear at baseline. However, the number of women with high childbirth fear had reduced from 29.0% to 9.7% among women in EAC and from 24.5% to 14.8% among women in usual care at 36 weeks gestation. In a Swedish cross-sectional prevalence study of 133 women using the same measure (FOBS) and definition (>60 points) for high childbirth fear, 18% of Swedish-born women were identified with high fear (190). The Swedish study also found that childbirth fear decreased over the duration of pregnancy. The number of women with high childbirth fear is thus likely similar in these two Nordic countries. We chose to only compare our results to the Swedish study as it is the only study that used the same instrument and the same cut-off score. However, direct comparison is hampered as childbirth fear was measured at different time points in the two studies (at baseline and after 36 weeks in our study, and mid-pregnancy in the Swedish study).

5.4 Strengths and limitations

We used a variety of methods and data sources within this doctoral study and each design had its strengths and limitations.

The main strength of Study I was the use of data from a nationwide centralized Medical Birth Register with complete coverage of all live births and stillbirths in Iceland over the study period. While the reliability of the variables used in the study have not been assessed, the Icelandic Medical Birth Registry has a consistent approach with the Nordic Registers, which have been reported to be of high quality with compulsory notification and unique opportunities for clinical research (191). A study of the Norwegian registry found that in 2000-2002 the sensitivity (i.e. true positive rate) and specificity (i.e. true negative rate) of the Norwegian registry was 91.8% and 99.7%, respectively, in detecting obstetric sphincter tears (192). Similarily, a Danish study found that while sensitivity of detecting hypertensive disorders was moderate, specificity was over 99% in the Danish National Registry (193) The use of internationally standardized diagnostic and surgical codes further ensure that these measures and results are comparable across countries.

Study I was limited by the lack of registration of background factors in the Medical Birth Registry that may have influenced changes in the use of obstetric interventions, such as maternal body mass index (BMI) and smoking. These factors are now included in the Medical Birth Registry and future research on obstetric interventions will benefit from the availability of more detailed maternal background information. Ideally, factors such as childbirth fear and anxiety should be recorded as well.

Study II was a cross-sectional survey and the sampling frame included all students at the University of Iceland. The sampling frame was chosen so that results from this study could be compared to results from other studies included in an international cross-country comparison study. The international study included data collection via online surveys to university students at ten universities/colleges in eight countries: two universities in Canada and Germany, one university each in Australia, Chile, England, New Zealand the United States and Iceland (182). In terms of generalizability, the sampling frame of the study was strong as 70% of undergraduate and graduate students in the Iceland study at the University of Iceland and this provides some generalizability to Icelandic pre-pregnant women. However, generalizations beyond that would require a more diverse sample in terms of education and age. We were further limited by the fact that the University of

Iceland does not collect information on whether, or not, students have children and thus our sampling frame did not accurately reflect our target population: female students only, who have no children and are not pregnant at the time of answering the survey. Assessing the true response rate was thus impossible. Nevertheless, the results provided valuable information about atttitudes towards normal birth among young Icelandic women and offered interesting insights into maternity care preferences of future childbearing women.

The bias towards publishing positive results, rather than negative findings may have impacted our systematic review in Paper III. Therefore, our systematic review likely underrepresented studies with negative findings of an association between intervention and lowered childbirth fear and might have overestimated observed effects (194). However, the use of Mendeley as a research tool likely increased our chances of locating studies with negative findings as Mendeley includes unpublished papers, dissertations and articles that are not indexed.

The main strength of the Enhanced Antenatal Care study (EAC; Study IV) was that we used a pre-post test design as well as a comparison group in our quasi-experimental design. While the inability to randomly assign participants to intervention or comparison group affects conclusions about causality, obtaining pretest measurement on both intervention and comparison groups allowed us to assess difference among groups. The pretest survey revealed that the intervention and comparison groups were similar in terms of all socio-demographic factors. However, the groups answered the pretest survey at different time points in pregnancy. The intervention group answered later in pregnancy, compared with the comparison group (17 weeks vs 14 weeks gestation). This was likely to due to midwives having greater difficulty recruiting for the intervention group than the comparison group. We adjusted our analysis for this difference between the groups, by adding women's gestational age when answering the pre-intervention survey as a covariate to the regression model.

Interestingly, the intervention group had a higher proportion of women with high childbirth fear at baseline, indicating that midwives may have been more motivated to recruit women with clinical signs of high childbirth fear into the intervention group. Therefore, in our analysis we also adjusted for childbirth fear at baseline to account for this possible selection bias. Upon realizing this difference between the two groups, we furthermore performed an analysis of the effectiveness of EAC among women with high childbirth

fear (>60 points on the FOBS). Unfortunately, we did not have information about the women who did not sign up for the study, which is also a source of selection bias. However, the study was strengthened by low drop-out rates in both study arms.

We used a standardized, patient-rated instrument to measure childbirth fear (74, 81), which further strengthens our design and provides for possibilites to compare results across studies. However, the scale only assesses general fear and future studies might consider using the recently developed Childbirth Fear Questionnaire (CFQ), a 40-item measure that assesses the full range of women's childbirth fears as well as interference in daily life as a result of childbirth fear (85, 195). This scale was not yet available when we designed our study.

A potential threat to internal validity (i.e. to establishing causality) is the lack of control over other factors (such as attending classes alongside antenatal care) that may affect childbirth fear reduction during pregnancy. To assess the contribution of these factors, we collected information on a variety of background factors as well as attendance at antenatal childbirth and breastfeeding classes and yoga alongside antenatal care during pregnancy. We then included a subgroup analysis restricted to women who only attended antenatal care (and no other antenatal classes). However, we did not collect information on other factors that might have affected study outcomes, such as traumatic life events during pregnancy.

Internal validity may have been reduced by social interactions within a small community of midwives. Midwives in the comparison arm may have been motivated to provide more extensive education or resources, knowing that the purpose of the study was to assess the quality of antenatal care. Some studies address this issue by collecting all data for the comparison group prior to implementing the intervention. Therefore, eliminating the risk of bias as those providing care for the comparison group are unaware of the intervention or study outcome. However, collecting data for the intervention and comparison groups at different times might have introduced history bias into our study. For example, during data collection, a midwives' strike occurred in Iceland, creating anxiety and fear among pregnant women. If this had occurred while we collected data only for the intervention or only for the comparison group, we might have seen a spike in fear among women in that group and not the other. As a result, we could have made assumptions about childbirth fear unrelated to the intervention, and this could have affected the

results of our study. Collecting data for both intervention and comparison group at the same time thus eliminated history bias by design.

Generalizability of our results (i.e. external validity) is limited by our small and homogenous sample size and replications with larger as well as more diverse samples would improve generalizability of our results. For example, it is estimated that 12% of childbearing women in Iceland are of foreign origin (156) and since all questionnaires and group session were offered in Icelandic only, we may have excluded a significant part of the population in our study. However, while external validity was limited by our homogenous sample (all Icelandic speaking women, expecting their first baby and attending antenatal care at a clinic for women with low to medium risk pregnancies), fewer confounding factors due to heterogeneity among women in the sample may have strengthened internal validity of the sample.

5.5 Implications for policy, practice and research

The social model is the foundation for maternity care practice in Iceland, but maternity care has changed dramatically in the past twenty years and the movement is towards a medicalized model of care. Our results are evidence of this; a dramatic increase in the use of labour induction and epidural analgesia as well as a favorable attitude towards epidural analgesia among the next generation of childbearing women. Therefore, our results indicate that to promote normal birth in Iceland, system-level changes may be needed to pull the pendulum back towards normal birth practices. The following chapter will outline our recommendations for policy, practice and future research to promote normal birth in Iceland.

5.5.1 Organization of care

Our results of rapid changes in the use of obstetric technology warrant a thorough consideration of the organization of maternity care in Iceland. Over the twenty-year period many elements of midwifery practice have changed to a more medicalized approach. This is evident in the closing of midwifery-led units and the lack of continuity of care between antenatal and intrapartum care. Our results indicate that there may be reason to reconsider the organization of maternity care, with attention to evidence-based care that has been proven to lower the use of unnecessary obstetric intervention. Examples of this are high and low risk hospital wards to offer healthy women with low risk pregnancies an alternative to the mixed-risk unit model (12), which is currently where most women (>75%) in Iceland deliver (142). Furthermore, the consideration of continuity of care or case-load models

across pregnancy, birth and postpartum to bring down the intervention rates (196).

We recommend that the role of the midwife in normal physiologic birth is highlighted within maternity care. One of the pillars of the Icelandic maternity care system is the autonomous practice of midwives in antenatal, intrapartum and postpartum care (113). Midwives provide care for all women, in collaboration with obstetricians when needed and specialized midwives furthermore provide cancer screening, fetal screening and care for women with risk-factors such as substance abuse. However, the specialization of midwives has been towards the use of technology and clinical risk-factors, rather than on supporting normal birth. We therefore recommend that the specialization of normal birth within midwifery practice is made more explicit in policy, research and practice.

Our results furthermore indicate an assessment of the components of antenatal care in Iceland and whether they are promoting normal birth. The social model recognises that pregnancy and childbirth are normal, physiological processes but also that they are more than just physical experiences and that social and emotional adaptation is required with the transition to a new role and new responsibilities (25). However, the focus of modern antenatal care is on physical screening, leading many expecting parents to take childbirth education alongside antenatal care. We therefore recommend further research to ascertain how midwives can emphasize further the social and emotional as well as the physical aspects of pregnancy and childbirth.

Providing antenatal care in groups, such as EAC, may enhance elements of the social model of maternity care. However, more research is needed. We recommend that future research utilize a variety of research methods, both qualitative and quantitative to provide a more complete picture of outcomes of the model as well as the experience of women and their partners of participating in EAC. A mixed-methods study with data from interviews and focus groups, combined with our rich data from the pre/post surveys has the potential to provide information on a variety of outcomes. To assess the new model on factors that may promote normal birth, we recommend highlighting salutogenic outcomes, such as autonomy and perception of respectful care, involvement in decision making, whether content of antenatal care felt relevant as well as women's preferences and attitudes towards using medical technology during childbirth.

Finally, our results in Study II indicate that the pre-pregnant women who participated in the survey had generally well-developed attitudes towards birth. Since attitudes towards birth are shaped throughout life, education about normal birth is relevant for women and men of all ages. Therefore, we recommend an exploration of midwifery-led models to promote normal birth pre-pregnancy among the next generation of childbearing women and their partners. An example of a successful midwifery-led project for children is a German four-hour curriculum where midwives educate school-aged children about pregnancy, birth and the midwifery model of care. This model has been effective in reducing childbirth fear among third and fourth grade students (197). In Iceland, medical students have similarly taught sexual education (Ástráður (198)) and raised awareness of psychiatric disorders along with nursing students (Hugrún (199)) among high-school students in Iceland. Building upon these existing outrearch projects in Iceland and Germany, midwifery students could engage in education about and enhance conversation with students in Iceland about normal childbirth. This is an example of midwifery level outreach which has the potential to increase knowledge and lower fear of childbirth among the next generation of childbearing women in Iceland.

5.5.2 The use of obstetric technology

When technology is available, there is a tendency to use it. Over the past decades many technological advances have been introduced and their use has increased rapidly. This has resulted in the overuse of obstetric technology in many middle and high-income countries (6), sometimes resulting in iatrogenic morbidity and mortality (7-12). Our results of a stark increase in epidural analgesia and labour induction indicate such a trend in Iceland.

Therefore, we recommend that the uptake of new technology within the maternity wards should be considered carefully and implemented thoughtfully with clear guidelines referencing evidence-based practice; bearing in mind that once implemented, their use may increase rapidly. Clinical audits have been recommended to ensure that guidelines are followed and the clinical outcome for women and newborn babies are optimal (200) and this requires strong clinical and administrative or managerial leadership.

The use of obstetric interventions has clinical, psychological and economic implications. It is therefore imperative for midwives and obstetricians to be able to answer the following questions when considering the use of an intervention: Is the intervention of benefit for the individual

woman and her unborn child? Why is an intervention necessary? Is there a clear indication for the intervention? What might be the potential benefits and consequences of the intervention for the women and the unborn child?

The successful efforts to maintain a low cesarean section rate in Iceland are noteworthy and the careful examination of cesarean section prevalence, indications and outcomes could be replicated for other interventions as well. Therefore, we suggest systematic monitoring of labour induction and epidural analgesia. This should include an exploration of whether and how trends in obstetric intervention use have affected maternal and perinatal outcomes in Iceland as well as further exploration of the underlying conditions or indications for labour induction to provide a deeper understading of which groups are contributing to the stark rise in labour induction prevalence.

5.5.3 The Medical Birth Registry: A salutogenic view

First and foremost, validation of variables in the Icelandic Medical Birth Registry is pertinent. The gold standard is to compare medical records directly to entries in the registry (191), but this is a time consuming task. Therefore, the Nordic registries have opted to validate their registries for selected conditions or outcomes (192, 193), providing information on variables with high precision, as well as highlight areas that may need improvement. Similar validation of the Icelandic Birth Registry is therefore, recommended.

Second, the consideration of variables in the Icelandic Medical Birth Registry is of importance. For example, the Euro-Peristat project has announced that they will include a new marker for perinatal health in their next report; the prevalence of births without an obstetric intervention (45). This new marker will emphasize the importance of promoting normal birth. We have included this marker in our research (Study I) to highlight the importance of this marker of obstetric practice. The Icelandic Medical Birth Registry, as well as the annual reporting of birth outcomes in Iceland, should consider including this marker as well.

Third, quality recording of non-medical variables and outcomes into the database is of importance. For example, understanding what non-pharmacological comfort measures are offered to women in Iceland (such as mobilty, hydrotherapy, massage and acupuncture) will aid in understanding the full range of pain relief measures that are used during labour. Understanding the impact of these practices, whether they are being offered by midwives and/or accepted by women is imperative when assessing the

need for pharmaceutical pain relief in labour. This will furthermore emphasize the role of midwifery-led care, and possibly shed light on the sometimes invisible work of the art and science of midwifery.

The development of a salutogenic intrapartum core outcomes set is also underway (35) and will provide a framework for outcomes that should be included in the assessment of maternity care. Complementing the traditional pathogenic outcomes (i.e. mortality and morbidity) with salutogenic outcomes is essential in providing understanding of the true impact of the use of obstetric interventions. Furthermore, it will bring attention to the importance of the experience of childbirth beyond mortality and morbidity. Examples of salutogenic outcomes are satisfaction with care, autonomy, control and mobility. We recommend that this core outcome set is used to introduce salutogenic outcomes into the Icelandic Medical Birth Registry.

This year, antenatal care will be recorded in electronic records for the first time in Iceland, creating a potential goldmine for further research on antenatal care. However, including factors that are salutogenic and highlight components of midwifery-led care is essential. Not only will this enhance our knowledge of factors to promote normal birth, the way maternity care records are set up are often a framework for how care is delivered. Therefore, when promoting normal birth, it is essential that maternity care records also reflect this agenda.

These recommendations for practice, research and policy emphasize the importance of organization of maternity care, highlights the importance of collecting population-based data on midwifery practice and brings attention to including salutogenic as well as pathogenic outcomes within the Medical Birth Registry to facilitate research on midwifery care. These data would be a valuable source of research and imperative when health and childbirth is addressed within the social model of care. And then, and only then, will we be able to move maternity care closer towards the goal of optimal physical and emotional health for all.

6 Conclusions

The use of medical technology has increased rapidly in the Western world. We saw evidence of this in our Icelandic data as we observed considerable increases in the use of labour induction and epidural analgesia among low-risk women over a twenty-year period. However, in contrast to most other western countries, the cesarean rate remained low and stable. Interestingly, these changes were most pronounced among low risk women and not explained by changes in diagnoses of diabetes or hypertension or socio-demographic factors such as age, citizenship, marital, or employment status.

Young women growing up in a technocratic society are likely influenced by the increasing use of medical technology. We found, that while the majority of pre-pregnant women prefer to birth vaginally, few intend to birth vaginally without epidural analgesia. Our results furthermore indicate that women are more likely to have normal birth intentions if they report lower levels of childbirth fear and higher levels of confidence in their own birth knowledge. Strengthening these factors was identified as an integral part of efforts to reduce rates of interventions during childbirth.

Enhanced Antenatal Care (EAC), a new midwifery model that combines one-to-one visits with group sessions was designed to increase opportunities for positive and informative dialogues about labour and birth to normalize the childbearing process for expecting parents in order to promote birth. Building on the theory of salutogenesis, EAC was designed as a model for all women, recognizing that fear of childbirth is on a continuum; from low to high and that most women can benefit from an approach that emphasizes physiologic childbirth. We found that while EAC did not reduce childbirth fear beyond usual care, EAC was effective in lowering childbirth fear among women who did not attend any educational classes alongside antenatal care.

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ORIGINAL ARTICLE

WILEY BIRTH ISSUES IN PERINATAL CARE

Obstetric interventions, trends, and drivers of change: A 20-year population-based study from Iceland

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Abstract

Background: Population data on obstetric interventions is often limited to cesarean delivery. We aimed to provide a more comprehensive overview of trends in use of several common obstetric interventions over the past 2 decades.

Methods: The study was based on nationwide data from the Icelandic Medical Birth Register. Incidence of labor induction, epidural analgesia, cesarean, and instrumental delivery was calculated for all births in 1995-2014. Change over time was expressed as relative risk (RR), using Poisson regression with 95% confidence intervals (CI) adjusted for several maternal and pregnancy-related characteristics. Analyses were stratified by women's parity and diagnosis of diabetes or hypertensive disorder.

Results: During the study period, there were 81 389 intended vaginal births and 5544 elective cesarean deliveries. Among both primiparous and multiparous women, we observed a marked increase across time for labor induction (RR 1.78 [CI 1.67-1.91] and RR 1.83 [CI 1.73-1.93], respectively) and epidural analgesia (RR 1.40 [CI 1.36-1.45] and RR 1.74 [CI 1.66-1.83], respectively). A similar trend of smaller magnitude was observed among women with hypertensive disorders but no time trend was observed among women with diabetes. Incidence of cesarean and instrumental delivery remained stable across time.

Discussion: The use of labor induction and epidural analgesia increased considerably over time, while the cesarean delivery rate remained low and stable. Increases in labor induction and epidural analgesia were most pronounced for women without a diagnosis of diabetes or hypertensive disorder and were not explained by maternal characteristics such as advanced age.

KEYWORDS

cesarean, diabetes, epidural analgesia, hypertension, induction of labor, instrumental delivery

1 | INTRODUCTION

The use of some obstetric interventions without clear medical indication can contribute to adverse birth and infant outcomes.[1-4] Using these resources appropriately is thus imperative for optimal health of the mother and infant. Middle- and high-income countries have experienced a rapid rise in obstetric interventions over the past 30 years,[5-8] with rates varying considerably between countries,[8-10] raising critical questions of what has driven these changes over the past decades.[9,11-14]

In contrast to most high-income countries Iceland has a low cesarean delivery rate while maintaining excellent maternal and neonatal mortality outcomes.[8,15,16] As an example, in

Iceland, the cesarean delivery rate was about 15% in 2014[16] compared with 32.2% in the United States.[17] However, a recent study comparing labor induction rates across Nordic countries places Iceland at the top of the Nordic countries with a prevalence of 22%, a rate similar to the United States.[18] Within Europe, the labor induction rate ranges from 6.8% in Lithuania to 27.9%-33.0% in Belgium.[10] While the cesarean delivery rate is low in Iceland, suggestions that other obstetric interventions may be on the rise highlight the importance of considering trends among a variety of obstetric interventions for a more complete understanding of changes in obstetric practice.

Previous studies have hypothesized that rising intervention rates may be because of higher numbers of pregnant women with conditions known to increase the risk of cesarean such as advanced age[19] or obesity.[20] Similarly, an increase in lifestyle-related illness in the population, such as diabetes or hypertension may contribute to an increased use of interventions, as diabetes and hypertensive disorders are indications for labor induction and cesarean delivery.[21,22]

To give a more comprehensive picture of the use of obstetric interventions, we examined simultaneously the incidence of four common obstetric interventions: cesarean delivery, labor induction, epidural analgesia, and instrumental delivery in Iceland across calendar time while assessing the effect of changes in maternal characteristics and pregnancy-related conditions during pregnancy.

2 | METHODS

2.1 | Study setting, data sources, and population

We conducted a nationwide population-based study to assess changes in the use of obstetric interventions in Iceland from January 1, 1995 to December 31, 2014. In Iceland, health care is publicly funded, maternity care is accessible and mostly free of charge, and all births are attended by midwives in collaboration with obstetricians when problems arise.

Our study is based on data from the Icelandic Medical Birth Register: a nationwide centralized registry with complete coverage of all live births and stillbirths in Iceland for infants weighing >500 g or having gestational age >22 weeks. The high quality and compulsory notification of the Nordic Medical Registers has been previously described.[23] There were a total of 86 933 births (a birth with multiples was counted only once) in Iceland during the study period.

2.2 | Obstetric interventions

Information on obstetric interventions during labor and delivery is registered in the Icelandic Medical Birth Register according to the recommendations of the Nordic Medico-Statistical Committee, the Classification of Surgical Procedures (NCSP), and the International Classification of Diseases, 10th revision (ICD-10).[24] We captured induction of labor by an *onset of labor* variable as recorded in the Icelandic Medical Birth Register, ICD-10 code O83.8, and NCSP codes MASC00, MAXC02, MAXC09 (Table 1). We used NCSP codes to capture use of epidural analgesia (ZXXX30, WAA307) and instrumental delivery (vacuum and forceps extraction; Table 1). Emergency cesarean delivery was also identified with NCSP codes (MCSA10, MCSA00) and ICD-10 code O82.1. Elective (ICD-10 code O82.0) was defined as a cesarean planned 8 hours in advance and performed during regular daytime hours.[16]

We obtained information on the following maternal sociodemographic characteristics from the Icelandic Medical Birth Register: age at delivery (continuous years; ≤20, 21-29, 30-39, ≥40 years), residence (urban, rural), marital status (single/widowed/divorced, married/cohabiting), citizenship (Icelandic, other), employment (employed, student, homemaker/on disability/unemployed), parity (primipara, multipara), singleton pregnancy (yes, no), gestational age (continuous weeks; <37, 37-41, ≥42 weeks), and birthplace (capital area, outside capital area, other). Finally, we obtained information on maternal diagnoses of chronic and pregnancy-related hypertensive disorders by ICD-10 codes (O10-O11, O13-O16, I10) and diabetes (O24, E10-E14; Table 1).

2.3 | Statistical analysis

We calculated the incidence of elective cesarean among all births during the study period. Among intended vaginal births (excluding elective), we calculated the incidence of induction of labor, epidural analgesia, emergency cesarean, and instrumental delivery, as the number of births with an obstetric intervention during the relevant year per 100 (%) births in the population, by women's sociodemographic and pregnancy-related characteristics. Among intended vaginal births, we also calculated the 5-year prevalence proportion for each obstetric intervention in 1995-1999, 2000-2004, 2005-2009, and 2010-2014 stratified by women's sociodemographic and pregnancy-related characteristics.

To assess changes over time in the use of obstetric interventions among primiparous and multiparous women, we conducted a Poisson regression analysis and estimated the relative risks (i.e., prevalence ratio, RR) and corresponding 95% confidence intervals (CI) for induction of labor, epidural analgesia, emergency cesarean, and instrumental delivery by calendar-period (2000-2004, 2005-2009, 2010-2014) using 1995-1999 as a reference period, stratified by parity. We stratified by parity as labor patterns vary considerably by parity.[25] We estimated crude measures, then adjusted for women's age (continuous), citizenship, marital and employment status, singleton pregnancy, and birthplace. As crude

TABLE 1 Ascertainment of obstetric interventions, hypertensive disorders, and diabetes according to recorded variables, diagnostic and surgical codes in the Icelandic Medical Birth Register (IMBR)

Study outcome	IMBR variable	ICD-10 code	NCSP code	Code description
Induction of labor				
	Onset of labor			Elective cesarean delivery, spontaneous labor, induced labor
		O83.8		Induction of labor
			MASC00	Induction by rupture of amniotic membrane
			MAXC02	Prostaglandin induction of labor
			MAXC09	Other induction of labor
Epidural analgesia				
			ZXXX30	Acute epidural analgesia for delivery
			WAA307	Epidural analgesia
Instrumental delivery				
			MASE00	Outlet vacuum delivery
			MASE03	Midcavity or high vacuum delivery
			MASE20	Failed vacuum delivery
			MASF00	Outlet forceps cephalic delivery
			MASF10	Mid forceps cephalic delivery
			MASF20	Failed forceps cephalic delivery
			MASF96	Other forceps cephalic delivery
			MASG03	Breech delivery with forceps to aftercoming head
			MASG13	Breech extraction delivery with forceps to aftercoming head
Cesarean delivery				
		O82.1		Delivery by emergency cesarean delivery
		O82.0		Delivery by elective delivery
			MCSA10	Lower uterine segment cesarean delivery
			MCSA00	Lower uterine segment cesarean delivery
Hypertensive disorders				
		O10		Preexisting hypertension complicating pregnancy, childbirth, and the puerperium
		O11		Preeclampsia superimposed on chronic hypertension
		O13		Gestational (pregnancy-induced) hypertension
		O14		Preeclampsia
		O15.0		Eclampsia in pregnancy
		O15.1		Eclampsia in labor
		O16		Unspecified maternal hypertension
		I10		Essential (primary) hypertension
Diabetes				
		O24.0		Preexisting type 1 diabetes mellitus
		O24.1		Preexisting type 2 diabetes mellitus
		O24.4		Diabetes mellitus arising in pregnancy
		O24.9		Diabetes mellitus in pregnancy, unspecified
		E10-E14		Diabetes mellitus

ICD-10, International Statistical Classification of Diseases and Related Health Problems, 10th revision; NCSP, Nordic Medico-Statistical Committee Classification of Surgical Procedures.

TABLE 2 Sociodemographic and pregnancy-related characteristics for women intending a vaginal birth in Iceland, 1995-2014 (N = 81 389)

	1995-1999	2000-2004	2005-2009	2010-2014
	n (%)	n (%)	n (%)	n (%)
Total[a]	19 611 (100)	19 290 (100)	21 472 (100)	21 016 (100)
Age				
≤20	1878 (9.6)	1500 (7.8)	1341 (6.2)	1018 (4.8)
21-29	9856 (50.3)	9782 (50.7)	10 720 (49.9)	10 068 (47.9)
30-39	7460 (38.1)	7492 (38.9)	8795 (41.0)	9242 (44.0)
≥40	398 (2.0)	510 (2.6)	614 (2.9)	689 (3.3)
Icelandic citizen	19 147 (97.7)	18 502 (95.9)	19 362 (90.1)	18 450 (87.7)
Urban residency	11 158 (60.3)	11 523 (63.3)	14 138 (66.7)	13 934 (66.5)
Married/cohabiting	17 241 (87.9)	16 237 (84.2)	18 198 (84.8)	17 014 (81.0)
Employment status				
Employed	13 725 (70.0)	14 080 (73.0)	16 008 (74.6)	15 061 (71.7)
Student	2317 (11.8)	2594 (13.4)	3516 (16.4)	3748 (17.8)
Homemaker/on disability/ unemployed	3569 (18.2)	2617 (13.6)	1945 (9.1)	2198 (10.5)
Birth place, capital area	13 428 (68.5)	13 625 (70.6)	15 247 (71.0)	15 373 (73.1)
Primipara	7672 (39.1)	8042 (41.7)	8969 (41.8)	8630 (41.1)
Gestational age				
<37 wk	994 (5.1)	995 (5.2)	1247 (5.8)	1108 (5.3)
37-41 wk	16 733 (86.6)	17 045 (88.7)	19 155 (89.5)	19 313 (92.3)
≥42 wk	1586 (8.2)	1187 (6.2)	993 (4.6)	513 (2.5)
Singleton pregnancy	19 090 (97.3)	18 831 (97.6)	21 040 (97.9)	20 682 (98.4)
Diabetes diagnosis	96 (0.5)	444 (2.3)	666 (3.1)	1019 (4.8)
Hypertensive disorder	1051 (5.4)	1168 (6.1)	1610 (7.5)	1623 (7.7)

[a]Numbers may not add to total as a result of missing data.

and adjusted models revealed similar results, we only report the adjusted models. We furthermore assessed change over time (reported as percentage points) for the adjusted model with Poisson regression for continuous years and evaluated the *P* value for trend; *P* values under .05 were deemed statistically significant.

To detect whether trends in use of obstetric interventions varied by women's underlying diagnosis of diabetes or hypertensive disorders, we divided the analysis by diagnosis, reporting adjusted relative risks for the total population.

RStudio statistical software (version 0.98.953) was used to analyze all data. Ethical approval for the study was obtained from the National Bioethics Committee (VSNb2012040011/03.07) and the Icelandic Data Protection Authority (2014081095TS/–, 2012050619AT/–).

3 | RESULTS

During the study period, there were 81 389 intended vaginal births in Iceland and 5544 planned elective cesareans (6.4%). Sociodemographic and pregnancy-related characteristics for women intending a vaginal birth are presented in Table 2. Compared with earlier years (1995-1999), women intending vaginal birth in later years (2010-2014) were older, more likely to be of foreign citizenship, and less likely to be married or homemaker/on disability/unemployed (Table 2). Furthermore, we observed an increasing incidence of hypertensive disorders and diabetes across time in the population; from 5.4% to 7.7% for hypertensive disorders and from 0.5% to 4.8% for diabetes, respectively, in 1995-1999 and 2010-2014. The proportion of births occurring in the Reykjavík capital area increased from 68.5% in 1995-1999 to 73.1% in 2010-2014.

Trends in obstetric interventions stratified by parity are shown in Figure 1. Throughout the study period, obstetric interventions were more common among primiparous than multiparous women. They were also more common among women with hypertensive disorders or diabetes than those without such diagnoses, with the exception of instrumental delivery, which appeared to have similar prevalence throughout the study period for women with or without a diagnosis (see Table S1 published online only).

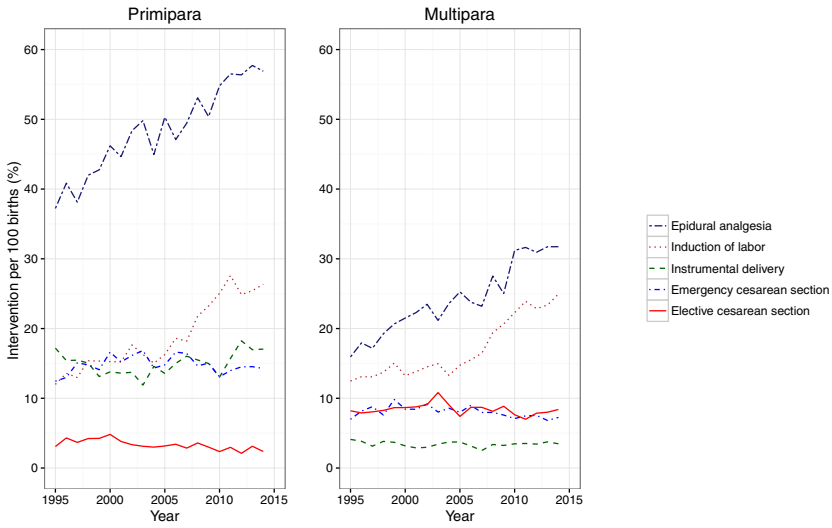

FIGURE 1 Incidence of common obstetric interventions among primiparous (n = 33 313) and multiparous (n = 48 076) women in Iceland in 1995-2014. Incidence of elective cesarean delivery per 100 (%) births in the population. Incidence of induction of labor, epidural analgesia, emergency cesarean, and instrumental delivery per 100 (%) intended vaginal births in the population

3.1 | Induction of labor

We observed an increasing incidence of labor induction in the population; rising from 12.0% in 1995 to 26.3% in 2014 among primiparous women and from 12.5% in 1995 to 24.9% in 2014 among multiparous women (Figure 1). Overall, induction of labor was more common among women of Icelandic citizenship than other citizenship, and among older compared with younger women (See Table S1 published online only).

During the study period, the annual increase in incidence of labor induction among primiparous and multiparous women in Iceland was 4.4 and 4.0 percentage points, respectively ($P < .001$). Comparing 2010-2014 with 1995-1999, both crude and adjusted models indicated an increase in labor induction among primiparous (RRa 1.78 [95% CI 1.67-1.91]; Table 3) and multiparous women (1.83 [1.73-1.93]; Table 4). A similar trend, but of smaller absolute magnitude, was observed among women with a hypertensive disorder (1.50 [1.36-1.66]; Table 3) and (1.59 [1.42-1.79]; Table 4). However, no significant trend was observed among women with diabetes.

3.2 | Epidural analgesia

The incidence of epidural analgesia in the population increased over the study period; rising from 37.2% in 1995 to 56.9% in 2014 among primiparous women and 15.9% to 31.7% among multiparous women (Figure 1). Overall, epidural analgesia was less common among women of Icelandic than non-Icelandic citizenship and less common among married women than those single, widowed or divorced. Throughout the study period, the prevalence of epidural analgesia was higher among younger women and those pregnant with multiples (see Table S1 published online only).

The annual increase in epidural analgesia in Iceland during the study period was 2.1 percentage points ($P < .001$) among primiparous women and 3.5 percentage points ($P < .001$) among multiparous women. Comparing 2010-2014 with 1995-1999, both crude and adjusted models revealed a significant trend for increases in epidural analgesia among primiparous (1.40 [1.36-1.45]; Table 3) and multiparous women (1.74 [1.66-1.83]; Table 4). While a similar trend was observed among women with a hypertensive disorder (Tables 3 and 4), no significant trend was observed among women diagnosed with diabetes.

3.3 | Cesarean section

The incidence of emergency cesarean remained relatively stable across the study period and was 14.3% among primiparous women and 7.3% among multiparous women in 2014 (Figure 1). Emergency cesarean delivery was elevated among older women, non-Icelandic citizens and women pregnant with multiples (see Table S1 published online only).

Comparing 2010-2014 with 1995-1999, we detected a decrease in emergency cesarean among primiparous women

TABLE 3 Adjusted relative risk for induction of labor, epidural analgesia, emergency cesarean delivery, and instrumental delivery for intended vaginal births among primiparous women (n = 33 313) by women's diagnosis of diabetes and hypertensive disorder, Iceland, 1995-2014

	n	1995-1999	2000-2004 Adj RR (95% CI)	2005-2009 Adj RR (95% CI)	2010-2014 Adj RR (95% CI)	*P* value
Induction of labor						
All	33 313	Reference	1.12 (1.04-1.21)	1.39 (1.30-1.49)	1.78 (1.67-1.91)	<.001
Without diagnosis	29 590	Reference	1.06 (0.96-1.16)	1.31 (1.20-1.43)	1.74 (1.60-1.90)	<.001
Diabetes	754	Reference	0.90 (0.69-1.18)	0.93 (0.72-1.99)	0.88 (0.69-1.14)	.643
Hypertensive disorder	3137	Reference	1.16 (1.03-1.29)	1.27 (1.15-1.41)	1.50 (1.36-1.66)	<.001
Epidural analgesia						
All	33 313	Reference	1.16 (1.12-1.19)	1.26 (1.21-1.30)	1.40 (1.36-1.45)	<.001
Without diagnosis	29 590	Reference	1.16 (1.12-1.21)	1.27 (1.23-1.32)	1.43 (1.38-1.48)	<.001
Diabetes	754	Reference	1.08 (0.86-1.36)	1.01 (0.81-1.27)	1.04 (0.83-1.29)	.945
Hypertensive disorder	3137	Reference	1.08 (0.97-1.15)	1.07 (0.98-1.15)	1.16 (1.08-1.26)	.046
Emergency cesarean						
All	33 313	Reference	1.11 (1.03-1.20)	1.06 (0.99-1.14)	0.94 (0.87-1.01)	.091
Without diagnosis	29 590	Reference	1.14 (1.04-1.24)	1.07 (0.98-1.16)	0.93 (0.85-1.02)	.083
Diabetes	754	Reference	0.79 (0.50-1.23)	0.80 (0.53-1.23)	0.70 (0.46-1.06)	.165
Hypertensive disorder	3137	Reference	0.95 (0.81-1.11)	0.88 (0.76-1.03)	0.79 (0.68-0.97)	.004
Instrumental delivery						
All	33 313	Reference	0.86 (0.80-0.93)	0.93 (0.86-1.00)	0.98 (0.91-1.05)	.723
Without diagnosis	29 590	Reference	0.84 (0.77-0.91)	0.91 (0.84-0.98)	0.95 (0.88-1.03)	.572
Diabetes	754	Reference	0.71 (0.31-1.59)	0.96 (0.45-2.03)	1.18 (0.57-2.43)	.081
Hypertensive disorder	3137	Reference	1.11 (0.87-1.43)	1.16 (0.91-1.47)	1.24 (0.99-1.57)	.036

Model adjusted for age, citizenship, marital and employment status, singleton pregnancy, and birthplace.
P value for annual trend was assessed with Poisson regression, adjusted for age, citizenship, marital and employment status, singleton pregnancy, and birthplace.

with hypertensive disorders (0.79 [0.68-0.92]; Table 3) and multiparous women without a diagnosis (0.83 [0.74-0.91]; Table 4). No other significant trends in emergency cesarean were observed among women with diabetes, a hypertensive disorder or without those diagnoses.

The incidence of elective cesarean remained stable during the study period and was 2.4% among primiparous women and 8.4% among multiparous women in 2014 (Figure 1).

3.4 | Instrumental delivery

Overall, we observed minimal changes in instrumental delivery incidence among primiparous and multiparous women. In 2014, the incidence among primiparous women was 17.1% and among multiparous women it was 3.5%, which was similar to the earlier years. Overall, among primiparous and multiparous women combined the incidence of instrumental delivery was 9.1% in 2014. Throughout the study period, the incidence of instrumental delivery was elevated among primiparous women, women of other citizenship than Icelandic and women with a hypertensive disorder (see Table S1 published online only).

4 | DISCUSSION

In this population-based study covering an entire nation over a 20-year period, we observed a considerable increase in labor induction and epidural analgesia but a relatively stable incidence of elective and emergency cesarean and instrumental delivery. The observed trends in obstetric interventions did not appear to be the result of simultaneous changes in sociodemographic characteristics of women giving birth such as a higher number of women of advanced maternal age, foreign citizenship, changing marital- and employment status, nor were they driven by increasing diagnoses of common pregnancy-related conditions. In fact, the rising trend in induction of labor and epidural analgesia was most notable among women without any diagnosis of hypertensive disorders or diabetes.

Obstetric interventions vary greatly across middle- and high-income countries. Increasing rates of induction of labor have been reported in middle- and high-income countries since the early 1990s; for example in the United States rising from 9.5% to 23.3%,[26] a trend very similar to what we observed in Iceland. This is based on extensive data from

TABLE 4 Adjusted relative risk for induction of labor, epidural analgesia, emergency cesarean, and instrumental delivery for intended vaginal births among multiparous women (n = 48 076) by women's diagnosis of diabetes and hypertensive disorder, Iceland, 1995-2014

			2000-2004	2005-2009	2010-2014	
	n	1995-1999	Adj RR (95% CI)	Adj RR (95% CI)	Adj RR (95% CI)	*P* value
Induction of labor						
All	48 076	Reference	1.04 (0.98-1.11)	1.34 (1.26-1.42)	1.83 (1.73-1.93)	<.001
Without diagnosis	44 507	Reference	0.97 (0.83-1.12)	1.23 (1.09-1.40)	1.59 (1.41-1.79)	<.001
Diabetes	1471	Reference	1.01 (0.77-1.32)	0.99 (0.76-1.29)	1.13 (0.87-1.47)	.344
Hypertensive disorder	2315	Reference	0.98 (0.91-1.05)	1.23 (1.15-1.32)	1.68 (1.58-1.80)	<.001
Epidural analgesia						
All	48 076	Reference	1.22 (1.16-1.29)	1.38 (1.31-1.45)	1.74 (1.66-1.83)	<.001
Without diagnosis	44 507	Reference	1.21 (1.15-1.28)	1.38 (1.30-1.45)	1.74 (1.65-1.83)	<.001
Diabetes	1471	Reference	0.97 (0.68-1.39)	0.98 (0.68-1.39)	1.14 (0.81-1.61)	.266
Hypertensive disorder	2315	Reference	1.18 (1.00-1.39)	1.15 (0.98-1.34)	1.40 (1.20-1.64)	.004
Emergency cesarean delivery						
All	48 076	Reference	1.00 (0.91-1.09)	1.03 (0.94-1.12)	0.93 (0.84-1.02)	.010
Without diagnosis	44 507	Reference	1.02 (0.93-1.10)	0.97 (0.89-1.06)	0.87 (0.79-0.95)	.001
Diabetes	1471	Reference	1.03 (0.82-1.29)	1.01 (0.82-1.25)	0.79 (0.62-1.00)	.039
Hypertensive disorder	2315	Reference	0.59 (0.36-0.97)	0.55 (0.34-0.89)	0.51 (0.32-0.83)	.071
Instrumental delivery						
All	48 076	Reference	0.83 (0.73-0.95)	0.81 (0.73-0.96)	0.86 (0.75-0.99)	.038
Without diagnosis	44 507	Reference	0.83 (0.72-0.96)	0.78 (0.67-0.90)	0.88 (0.76-1.01)	.042
Diabetes	1471	Reference	0.79 (1.73-3.66)	2.00 (0.48-8.36)	0.90 (0.20-3.88)	.782
Hypertensive disorder	2315	Reference	0.86 (0.49-1.52)	0.81 (0.48-1.37)	0.86 (0.49-1.50)	.414

Model adjusted for age, citizenship, employment and marital status, singleton pregnancy, and birthplace.
P value for annual trend was assessed with Poisson regression, adjusted for age, citizenship, marital and employment status, singleton pregnancy, and birthplace.

the Natality Data File from the National Vital Statistics System including all births in the United States. However, population-based annual data in the 2010 Euro-Peristat report describe a wide range in labor induction prevalence.[10] Such differences may be a reflection of varying underlying definitions of labor induction hampering direct comparison of rates across countries. Similarly, a wide variation in epidural analgesia use ranging from 11.3%-16.0% in the Netherlands and UK, to 58.7% in Canada and 82% in France[27] has been reported in various reports or studies. This indicates that compared to some middle- to high-income countries, the prevalence of labor induction and epidural analgesia is quite high in Iceland.

Conversely, the cesarean prevalence in Iceland has been low and fairly constant over the past 20 years while most Western countries have experienced a simultaneous rise in cesarean delivery, induction, and epidural analgesia over the years.[8,28] Similar results were presented in a recent comparison of cesarean section rates in the Nordic countries, where Iceland was the only country to lower its cesarean delivery rate during 2000-2011.[28] The decrease in cesarean delivery was mostly because of a decrease in cesarean delivery among primiparous women with a single, term cephalic pregnancy. A comparison of cesarean delivery rates presented in the Organisation for Economic Cooperation and Development report reveals a great variation in cesarean delivery prevalence between countries, with the lowest prevalence found in Northern Europe (16.1%-22.1%) and the highest in Turkey where over 50% of deliveries are cesarean.[5-8,11] In 2000, Iceland implemented a monitoring system for cesarean delivery, based on the Robson classification which may have influenced obstetric practice so that Iceland was the only country to lower its cesarean rate during the study period.[28] This is an example of the importance of monitoring and benchmarking obstetric interventions.

Direct comparison of instrumental delivery rates by parity was not possible as no studies were found that stratified rates by parity. However, in a population-based study among Nordic countries (2000-2011) the instrumental delivery rate was 6.5%-8.1% of all births,[28] an incidence of 10%-13% has been reported in the UK,[25] and in the United States the average instrumental delivery rate was reported at 6% in a population-based study between 2005 and 2013.[29] These rates are comparable to the overall rate in Iceland, especially considering that we calculated the instrumental delivery rate per intended vaginal births and not all births in the population. Instrumental

delivery rates vary considerably by parity in our population and it may suggest that stratifying results by parity is imperative for a more complete understanding of obstetric practice. It is furthermore important to study instrumental delivery and cesarean rates simultaneously, as low instrumental delivery rates may be explained by high cesarean rates and vice versa. It begs the question whether a low cesarean rate may come at the cost of a higher instrumental delivery rate, especially for primiparous women or women attempting a vaginal birth after a previous cesarean. These groups of women have high vaginal birth rates in Iceland and may be contributing significantly to the instrumental delivery rate.[28]

The stark difference in low cesarean prevalence and mid-to-high range prevalence of epidural analgesia and induction in Iceland highlights the importance of reporting on multiple obstetric interventions for a more complete picture of obstetric practice within a country. To our knowledge, our study is the first to describe and analyze nationwide trends of epidural analgesia, induction of labor, instrumental delivery, and cesarean trends.

Over the years multiple studies and meta-analyses have explored whether increased rates of labor induction have contributed to the steep increase in rates worldwide.[30-34] These studies have produced inconsistent results. While some have found a positive association between induction and delivery[30,31] others suggest that an induction of labor may possibly reduce the risk of cesarean delivery for some women.[32-34] An in-depth understanding of this controversy would have to include information on different methods of labor induction, and cervical maturity and cesarean delivery risk factors. Our study suggests that a dramatic increase in epidural and labor induction over a short period of time did not affect the cesarean delivery rates in Iceland.

Similar to other population-based studies,[35,36] we found an increase in diabetes and hypertensive disorders diagnoses in our study and, as expected, in our study women with diabetes or a hypertensive disorder were more likely to receive any of the 4 obstetric interventions compared with women without such conditions. However, the observed trends in obstetric interventions did not appear to be the result of simultaneous changes in sociodemographic characteristics of women giving birth such as a higher number of women of advanced maternal age, foreign citizenship, changing marital- and employment status, nor were they driven by increasing diagnoses of common pregnancy-related conditions. In fact, the rising trend in labor induction and epidural analgesia was most notable among women without any diagnosis of hypertensive disorders or diabetes.

A notable strength of our study is the use of data from a nationwide centralized Medical Birth Register with complete coverage of all live births and stillbirths in Iceland over the 20-year study period. The Nordic Registers are of high quality with compulsory notification and offer unique opportunities for clinical research with a collection of data spanning decades.[23] Nevertheless, limitations of our study mainly pertain to the reliability of the variables used in this study, as they have not been specifically validated in the Icelandic Medical Birth Register. However, the use of internationally standardized diagnostic and surgical codes ensures that statistics are comparable between countries. Other limitations include the lack of information on the indications for the obstetric interventions, which hamper conclusion of the appropriateness of their use. Also the study lacks data on important maternal factors, such as obesity and smoking, previously shown to affect the prevalence of common obstetric interventions.[37] However, a recent study of pregnant women in Iceland in 2001-2010 indicates that smoking during pregnancy decreased among Icelandic women, whereas an initial increase in obesity prevalence seemed to level off toward the end of the observation period.[38]

In conclusion, our data reveal a stark difference in trends between the 4 most common obstetric interventions in Iceland: a simultaneous rise in induction of labor and use of epidural analgesia, while maintaining a low and stable cesarean and instrumental delivery rate. These changes over time were not explained by an increase in diagnoses of diabetes or hypertension or sociodemographic factors such as age, citizenship, marital, or employment status. An exploration of whether and how these trends have affected maternal and perinatal mortality and morbidity in Iceland is warranted.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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Opting for natural birth: A survey of birth intentions among young Icelandic women

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ABSTRACT

Objective: To describe and analyse factors associated with natural birth intentions in a sample of pre-pregnant Icelandic women.
Methods: An internationally validated tool was used to survey pre-pregnant women about their attitudes towards birth. The online survey was sent to all students at the University of Iceland in November 2014. Log binomial regression was used to calculate crude and adjusted relative risks (RR_a), and corresponding 95% confidence intervals (CI), for intentions of natural birth (defined as vaginal birth without epidural analgesia) by high, moderate and low childbirth fear and by high, moderate and low confidence in birth knowledge. Models were adjusted for socio-demographic and psychological factors.
Results: 410 eligible women completed the cross-sectional survey. Women with low fear of birth were more likely to have natural birth intentions when compared to women with moderate ($RR_a = 2.83$; 95% CI; 1.48–5.41) and high ($RR_a = 4.86$; 95% CI; 1.37–17.27) fear. Women with high confidence in their birth knowledge were more likely to have natural birth intentions compared to women with moderate ($RR_a = 2.81$; 95% CI; 1.51–5.22) and low ($RR_a = 3.42$; 95% CI; 1.43–8.18) confidence in their birth knowledge.
Conclusion: Pre-pregnant women with low fear of birth and high confidence in their birth knowledge are more likely to have natural birth intentions. Addressing concerns about pain, safety, the perceived unpredictability of birth and worries about the physical impact of childbirth may strengthen natural birth intentions.

Introduction

With advances in medical technology, maternity care in industrialized countries has seen a rapid rise in the use of medical interventions during childbirth [1–4]. Childbirth fear is one of many factors contributing to this phenomenon. Pregnant women with high fear of birth are more likely to prefer a caesarean section [5,6] and deliver by caesarean section [6–8]. The most frequent fears reported in recent studies are concerns for the health and life of the baby and fear of labour pain [9,10]. Fear related to women's capabilities to give birth, worries about losing control and fear related to women's own health have also been documented [10]. Fear of birth is commonly met with the choice of epidural analgesia [11] however non-pharmacological methods of pain relief (such as water immersion, massage, ambulation, and changing positions) have been associated with higher maternal childbirth satisfaction [12] indicating that women should be encouraged to try non-pharmacological pain management techniques before resorting to epidural analgesia. Furthermore, while women with childbirth fear may fear labour pain, women with fear related to the child's safety would not necessarily benefit from pain management strategies. This is an important clinical issue, as fear of childbirth is often countered by ensuring the possibility of epidural analgesia. However, Alehagen et al. [13] found that women who expressed fear before delivery and who had epidural analgesia did not have lower levels of fear during delivery. While this study had a small sample size (n = 47), the results suggest that epidural analgesia alone is not an appropriate strategy to overcome fear of childbirth.

To date, only two papers have been published on childbirth fear in the Icelandic population [8,14] and both papers report on data from a cross-cultural study, comparing childbirth fear during pregnancy across six European countries. While the prevalence of severe childbirth fear varied among the different countries in the study,

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Icelandic women had the lowest mean fear scores while Swedish women had the highest score [14]. Furthermore, severe fear of birth was found to be a risk factor for elective caesarean delivery for women across all countries studied [8].

While childbirth fear is most commonly researched in the pregnant population, the phenomenon has been described in other subpopulations as well, for example among pre-pregnant Canadian and American students [15,16]. No studies on childbirth fear in the pre-pregnant Nordic population have been published to date. A comparison of childbirth fear scores among young adults who plan to become pregnant (using the same measure to assess childbirth fear used in our study) suggests that childbirth fear in Iceland falls in the middle range when compared to Australia, Canada, England, Germany and the United States of America [17]. Previous studies have almost exclusively focused on the link between fear and preferences for interventions [5–8,18], with some authors reporting on the association between childbirth self-efficacy and fear [19,20]. As a primary concept of social learning theory, self-efficacy provides a theoretical framework of behaviour to study maternal confidence in the ability to cope with labour [21]. Within salutogenesis, health promotion can be viewed as generating and maintaining healthy outcomes, instead of focusing on outcomes linked with illness or disability [22]. Working within this framework as well as with a population in a country with low caesarean section rates and good perinatal outcomes [1,4], we focused on the association between low, moderate and high levels of childbirth fear and young women's intention to have a natural birth, defined as vaginal birth without epidural analgesia. By using this definition of natural birth intentions, we report on a group of women with strong intentions to birth without using obstetric interventions and draw attention to parameters that can be emphasized within midwifery care when promoting natural birth. In addition to examining the association between childbirth fear and natural birth intentions, we also report the association between self-reported confidence in young women's knowledge of pregnancy and birth and natural birth intentions.

Material and methods

Study setting and sample

This Icelandic web-based cross-sectional study is part of an international study that examines attitudes towards birth among young men and women in eight OECD countries. As previous studies with the pre-pregnant population have revealed important gender differences in birth attitudes and fear of childbirth [15,17] we decided to focus our analysis on Icelandic women only. A recruitment email with a link to the online survey was sent to the whole student population of the University of Iceland (N = 9805) on November 1, 2014 and a reminder email was sent one week later [23]. The survey items were adapted from a Canadian instrument [15] and included the

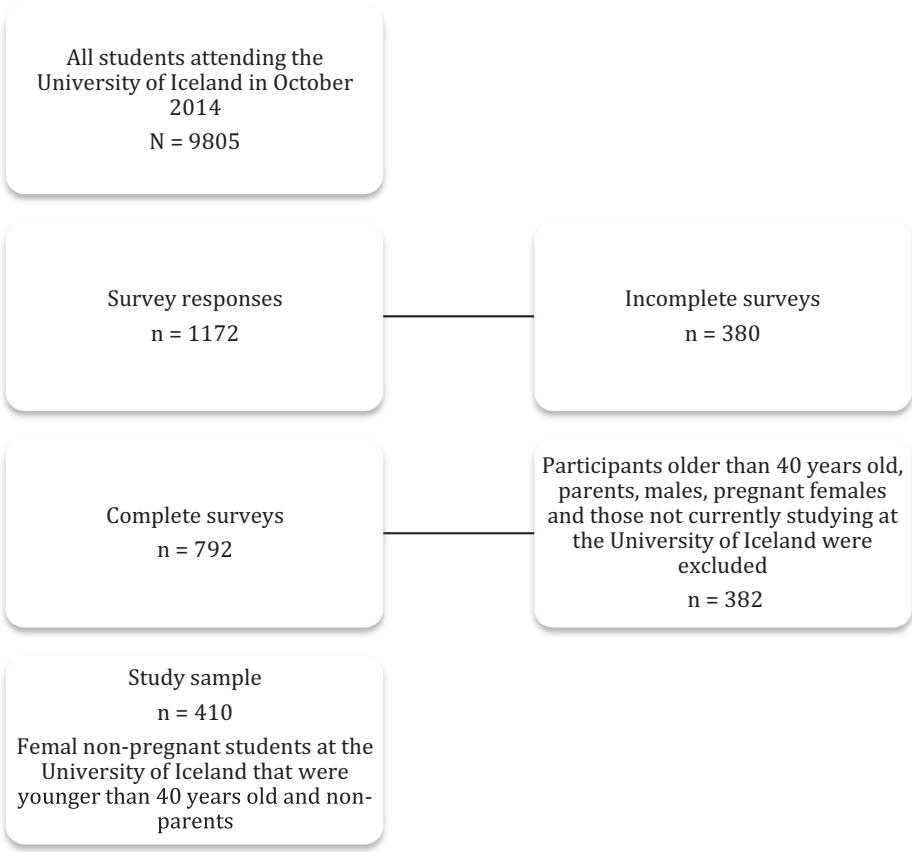

Fig. 1. Flowchart showing the number of students entering the study and the final study sample.

10 item *Childbirth Fear Prior to Pregnancy* (CFPP) scale [16] and questions about preferences for birth interventions and maternity care. The instrument was translated using forward-backward translation [17]. Of the 792 students who completed the survey, 410 met inclusion criteria (Fig. 1), i.e. women younger than 40 years old, who were not pregnant at the time of data collection, did not yet have any children but wished to have at least one child in the future. Ethics approval for the study was obtained from the Icelandic Data Protection Authority (S36964/2014) and Hannover Medical School (Nr. 2431-2014).

Exposure measures

Fear of birth was assessed using a validated 10-item scale [17] with six response options ranging from strongly disagree (one point) to strongly agree (six points). In previous studies the fear of childbirth scale was a six item measure [15], but it was expanded to 10 items in 2014 [16,17]. The development and validation of the 10-item scale is described in detail elsewhere [17]. The *Childbirth Fear Prior to Pregnancy* (CFPP) scale measures three general dimensions of fear: Fear of labour pain, fear of complications and fear of physical changes following pregnancy and birth. Internal reliability of the scale was good in the Icelandic sample (alpha = 0.89); unidimensionality of the scale was verified by examining item-to-total correlations and scree plots [17]. Scale scores were normally distributed. The CFPP scale was recoded into a categorical variable; *low fear* was defined as the lowest quartile of the scale (10–29 points), *high fear* as the highest quartile (42–60 points) and the remaining two quartiles as *moderate fear* (30–41 points). Using quartile levels to indicate high, moderate and low fear is common when utilizing childbirth fear scales without clinically relevant scores [24,25].

Confidence in participants' level of knowledge of pregnancy and birth was assessed on a six point Likert scale with the item "I feel confident about my level of knowledge around pregnancy and birth". The response options "strongly disagree" and "disagree" were recoded as *low confidence*, "somewhat disagree" and "somewhat agree" as *moderate confidence*, and "agree" and "strongly agree" were recoded as *high confidence*.

Outcome measure

The outcome variable "natural birth intentions" was created using responses to two survey questions: mode of birth preferences and epidural preferences. Preferred mode of birth was assessed with the question: "Assuming the pregnancy is low-risk and you could choose the type of birth for your baby, would you prefer a vaginal birth or cesarean delivery". Participants furthermore chose from a list of reasons why they would prefer vaginal birth or caesarean section. Participants were also asked if they would prefer to have epidural analgesia, to help them cope with labour pain. Epidural analgesia was defined as freezing/numbing from the waist down by injection of anaesthetic into the back. The options "yes" and "maybe" were recoded into one category, with "no" constituting its own category. The terminology around birth without interventions is complicated and there is no real consensus on what constitutes natural/physiologic/low interventionist birth. In this study we defined having natural birth intentions as preferring a vaginal birth without epidural analgesia.

Socio-demographic and psychological control variables

Age, a continuous variable, was recoded into higher and lower than the mean age. Anxiety, depression and stress; factors commonly shown to be associated with fear [26] and intervention preferences [27]; were assessed with the DASS-21 questionnaire [28]. Internal consistency reliabilities of the three subscales were good; 0.85 for depression, 0.82 for stress and 0.73 for anxiety [17]. Severe depression was defined as >20 points, severe anxiety >14 points, and severe stress >25 points [29].

The following categorical socio-demographic items were included in the analysis as control variables: marital status (single, in a relationship, cohabiting/married), education (high school diploma, 2nd–3rd year university student, undergraduate degree, graduate degree), and nationality (Icelandic, other). The socio-demographic and psychological profile of students is reported in Table 1. In the same table, we report the proportion of students who scored in the low to high ranges on measures of childbirth fear and confidence in birth knowledge across socio-demographic and psychological variables (Table 1).

Data analysis

We described categorical demographic characteristics and obstetric preferences of the study sample by reporting absolute and percentage frequencies and the mean and standard deviation (SD) for the continuous variable age. The association between level of

Table 1
Socio-demographic characteristics of the Icelandic female student sample stratified by low, moderate and high childbirth fear as well as low, moderate and high confidence in birth knowledge (n = 410).

	Total N = 410	Fear of birth			Confidence in knowledge		
		Low n = 101	Moderate n = 204	High n = 105	Low n = 117	Moderate n = 227	High n = 66
Mean age (SD)	23.0 (±3.4)	23.6 (±4.0)	22.9 (±3.3)	22.5 (±2.9)	23.0 (±3.6)	22.8 (±3.3)	23.6 (±3.4)
Relationship status, n (%)							
Single	152 (37.1)	44 (43.6)	75 (36.8)	33 (31.4)	44 (37.6)	85 (37.4)	23 (34.8)
Married/cohabiting	116 (28.3)	25 (24.8)	59 (28.9)	32 (30.5)	32 (27.4)	61 (26.9)	23 (34.9)
In a relationship	142 (34.6)	32 (31.7)	70 (34.3)	40 (38.1)	41 (35.0)	81 (35.7)	20 (30.3)
Nationality, n (%)							
Icelandic	402 (98.0)	98 (97.0)	204 (100)	100 (95.2)	117 (100.0)	221 (97.4)	64 (97.0)
Non-Icelandic	8 (2.0)	3 (3.0)	0 (0)	5 (4.8)	0 (0)	6 (2.6)	2 (3.0)
Education, n (%)							
High school diploma	230 (56.1)	50 (49.5)	116 (56.9)	64 (61.0)	68 (58.1)	133 (58.6)	29 (43.9)
2nd–3rd year university	99 (24.1)	27 (26.7)	47 (23.0)	25 (23.8)	25 (21.4)	54 (23.8)	20 (30.3)
Undergraduate degree	70 (17.1)	18 (17.8)	38 (18.6)	14 (13.3)	22 (18.8)	34 (15.0)	14 (21.2)
Graduate degree	8 (2.0)	5 (5.0)	1 (0.5)	2 (1.9)	2 (1.7)	3 (1.3)	3 (4.5)
Other	3 (0.2)	1 (1.0)	2 (1.0)	0 (0.0)	0 (0.0)	3 (1.3)	0 (0.0)
Severe depression, n (%)	24 (5.9)	0 (0.0)	14 (6.9)	10 (9.5)	5 (4.3)	17 (7.5)	2 (3.0)
Severe stress, n (%)	24 (5.9)	2 (2.0)	10 (4.9)	12 (11.4)	10 (8.5)	14 (6.2)	0 (0)
Severe anxiety, n (%)	30 (7.3)	3 (3.0)	17 (8.3)	10 (9.5)	9 (7.7)	18 (7.9)	3 (4.5)

childbirth fear and natural birth intentions was assessed by using log binomial regression to calculate the crude and adjusted relative risks (RR) and corresponding 95% confidence intervals (CI) [30]. Reporting relative risk as opposed to odds ratios is appropriate when reporting associations for common outcomes (>10%) and the log binomial model produces an unbiased estimate of the adjusted relative risk [30]. The models were adjusted for differences in the sociodemographic (age, relationship status and education level) and psychological profile (depression, stress and anxiety) of students. We were unable to adjust for nationality because of low response variance. A p-level of 0.05 was considered significant. The association between confidence in birth knowledge and natural birth intentions was assessed in the same manner. IBM SPSS 22 was used for data analysis.

Results

Sample characteristics and obstetric preferences

The cross-sectional survey was completed by 410 eligible women (Fig. 1). Participants were 18–38 years old and the vast majority (98.0%) identified as Icelandic (Table 1). Vaginal birth was preferred by most participants (89.9%) and epidural analgesia preferred or considered by 168 (41.0%) and 195 (47.6%) participants, respectively.

Childbirth fear and confidence in birth knowledge

The average fear of birth score was 35.76 (SD 9.53) with a range of 11–60 points. A total of 101 (24.6%) participants exhibited low fear, 204 (49.8%) moderate fear and 105 (25.6%) reported high fear of birth (Table 1). When examining responses to individual items on the CFPP scale, about 58.8% of women self-reported that they were fearful of birth. The majority of women (83.4%) agreed that they were worried about labour pain being too intense and about 70.0% of women believed that birth is unpredictable and risky. Complications during labour and birth were feared by 79.8%, and 70.9% expressed worries that harm might come to the baby. Approximately one in four (23.4%) believed that they would be out of control during labour and birth, 28.5% believed they would not be able to handle the pain of childbirth, and 30.0% believed that they would panic and not know what to do during labour and birth. More than half of the women (59.5%) said that they were afraid of what the labour and birth process would do to their bodies, and 57.6% of women were afraid that their bodies would never be the same again after birth. Confidence in childbirth knowledge was high for 66 participants (16.1%), moderate for 227 participants (55.4%) and low for 117 participants (28.5%).

Natural birth intentions

One in ten women reported natural birth intentions (i.e. preferred vaginal birth without epidural analgesia) (n = 44, 10.7%). Women with low fear of birth were more likely to have natural birth intentions when compared to women with moderate fear (RR_a = 2.83; 95% CI; 1.48–5.41; Table 2) and when compared to women with high fear of birth (RR_a = 4.86; 95% CI; 1.37–17.27). Women with high confidence in their birth knowledge were more likely to have natural birth intentions when compared to women with moderate confidence (RR_a = 2.81; 95% CI; 1.51–5.22; Table 3) and when compared to women with low confidence (RR_a = 3.42; 95% CI; 1.43–8.18).

The majority of women (81.0%) who preferred a vaginal birth did so because they felt that a vaginal birth was the normal/traditional way to give birth (Fig. 2). About one in every three women (29.3%) preferred a vaginal birth because they felt vaginal birth was safer for the mother or baby compared to operative delivery. The vast majority of women preferring a caesarean section indicated that the reasons were fear of labour pain (n = 35, 83.3%) and a desire to maintain vaginal integrity (n = 27, 64.3%). Epidural analgesia was preferred by women because it could help manage labour pain (n = 305, 74.4%) or because knowing an epidural was available could lessen fear of childbirth (n = 177, 43.2%).

Discussion

This is the first Nordic study to describe natural childbirth intentions in a pre-pregnant population. Our findings show that low fear of birth and high confidence in birth knowledge are factors strongly associated with natural birth intentions, even after controlling for socio-demographic and psychological factors. This is in line with results from previous studies based on Canadian and American populations [15,16,31], indicating that fear of birth and confidence in birth knowledge are associated with women's obstetric preferences prior to pregnancy.

Understanding why pre-pregnant women are afraid of childbirth can inform educational strategies before and during pregnancy. The majority of women in our sample were worried about birth being painful, unpredictable and risky. They feared complications

Table 2
Crude (RR) and adjusted relative risk (RR_a) and 95% confidence intervals (CI) for natural birth intentions.

	Fear of birth													
	Low n = 101		Moderate n = 204		High n = 105		Low vs. moderate				Low vs. high			
	%	n	%	n	%	n	RR	95% CI	RR_a*	95% CI	RR	95% CI	RR_a*	95% CI
Natural birth intentions	20.8	21	8.3	17	5.7	6	2.50	1.38–4.52	2.83	1.48–5.41	3.64	1.53–8.64	4.86	1.37–17.27

* Log binomial model adjusted for age, relationship status, education level, depression, stress and anxiety.

Table 3
Crude (RR) and adjusted relative risks (RR_a) and 95% confidence intervals (CI) for natural birth intentions.

	Confidence in birth knowledge													
	Low n = 117		Moderate n = 227		High n = 66		High vs. moderate				High vs. low			
	%	n	%	n	%	n	RR	95% CI	RR_a*	95% CI	RR	95% CI	RR_a*	95% CI
Natural birth intentions	7.7	9	8.8	20	22.7	15	2.58	1.40–4.75	2.81	1.51–5.22	2.96	1.37–6.38	3.42	1.43–8.18

* Log binomial model adjusted for age, relationship status, education level, depression, stress and anxiety.

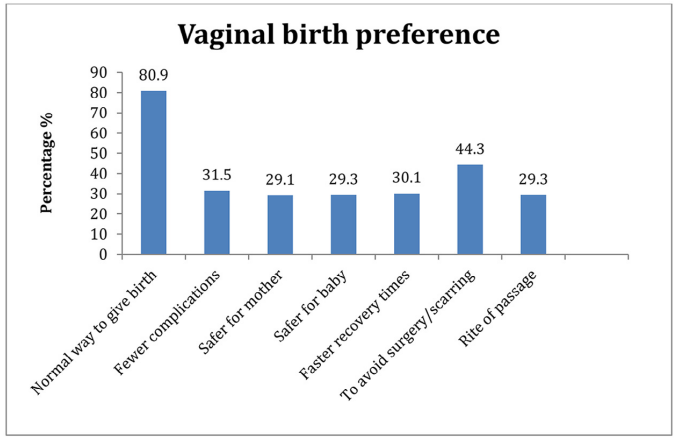

Fig. 2. Answers to the question "Please indicate why you prefer a vaginal birth" presented as percentage of women who ticked each possible option (n = 368).

during labour and birth as well as worried that harm may come to the baby. Growing up in a technocratic society that emphasizes the risky and dramatic nature of birth may affect young adults' views towards birth [15,32]. Many women in our sample were also worried about bodily damage, such as what the labour and birth process would do to their bodies, and that their bodies would never be the same again after birth. Therefore, educational strategies before as well as during pregnancy that address concerns about safety, the perceived unpredictability of birth and worries about the physical impact of childbirth may lower fear and strengthen natural birth intentions.

The midwifery model of care is supported by findings from an evidence-informed framework for high quality maternal and newborn care [33]. This is the most critical, wide-reaching examination of midwifery to date, and it includes a broad range of clinical, policy, and health system perspectives. The review includes recommendations that clearly distinguish between effective and ineffective practices to enhance and promote physiologic, natural childbirth and defines the core characteristics of midwifery as: "optimising normal biological, psychological, social and cultural processes of reproduction and early life" [33]. This process starts during the preconception period and highlights the importance of midwives as educators. As an example of a successful midwifery care project in the pre-conception period, a German midwifery led four hour curriculum where midwives educated school-aged children about pregnancy, birth and the midwifery model of care reduced childbirth fear among grade 3 and 4 students [34].

Our findings suggest that pre-pregnant women may underestimate the benefits of vaginal birth. These findings are in agreement with previous studies showing gaps in birth-related knowledge among pregnant women [35]. While the majority of pre-pregnant Icelandic women find that vaginal birth is the normal way to give birth, only one in three who prefer vaginal birth perceive it as safer for mother or baby. In contrast, women prefer caesarean section mostly because of fear and in order to maintain vaginal integrity. These findings suggest that positive neonatal and maternal outcomes associated with physiologic birth as well as evidenced-based information about physical changes after birth should be emphasized during antenatal care when motivating primiparous women to consider natural birth.

Similar to findings in American [16] and Canadian [15] pre-pregnant populations, the vast majority of pre-pregnant Icelandic participants (89.0%) prefer vaginal birth. However, few women in our sample (10.7%) prefer vaginal birth without epidural analgesia. While the caesarean section rate in Iceland (15.6%) is among the lowest in the western world and has been decreasing over the years [1,3,4] the epidural rate in Iceland, as in other western countries, has risen steadily and rapidly. In 2003, 31.0% of women utilized epidural analgesia [3]. Ten years later the rate had risen to 46.7% [4]. Low numbers of women with natural birth intentions may be a reflection of this rapid normalization of using epidural analgesia. Furthermore, low numbers of women with intentions to birth vaginally without using epidural analgesia may suggest that while the majority of women report wanting to have a vaginal birth, they have low confidence in their ability to birth without pharmacological pain relief. A recent Icelandic study on women's attitudes towards using epidural analgesia found that women who felt supported by their partners, and had positive attitudes towards expecting a child and towards the impending birth were most likely to want to avoid epidural analgesia [36].

Young women are increasingly accessing pregnancy and childbirth information through television and the Internet. However, when confidence was explored by source of information, young American women who reported confidence in their knowledge about pregnancy and birth were more likely to have gained their knowledge from a healthcare professional or from first-hand experience compared to experiences and stories of family and friends or movies [16]. Information from books or the Internet was not found to be significantly associated with confidence in birth knowledge [16]. These findings emphasize the importance of birth education prior to and during pregnancy by midwives in increasing confidence in birth knowledge, and by extension increasing preferences for natural birth.

Strengths and limitations of the study

Our sampling frame included all students at the University of Iceland. In terms of generalizability, the sampling frame of the study was strong as 70% of undergraduate and graduate students in Iceland study at the University of Iceland. This provides some generalizability to Icelandic university students and possibly university students in Nordic countries. Generalizations beyond that would require a more diverse sample in terms of education and age. The university does not collect information on whether or not students have children and thus our sampling frame did not accurately reflect our target population: female students only, who have no children and are not

pregnant at the time but intend on having children in the future. Assessing the true response rate was thus impossible. The study sample was a convenience sample, i.e. of female university students who had not previously given birth and were willing to answer the study survey. The generalizability of the results is therefore limited by the nature of the sample. Nonetheless, the results should provide valuable information as this was a relatively large sample on a subject that has not been explored before in the Nordic context. Furthermore, this unique group of participants offers interesting insights into maternity care preferences of future childbearing women even if the results are not generalizable to the overall population of those students. The cross-sectional survey design prevents us from describing cause and effect relationships, as information about fear, confidence and birth intentions were gathered simultaneously. Finally, "confidence" was only measured with one item, despite evidence that it is a complex and potentially multidimensional construct [37].

Conclusion

Our results indicate that the majority of female pre-pregnant university students prefer to birth vaginally, but few intend to birth vaginally without an epidural. Our results furthermore indicate that childbirth fear and confidence in birth knowledge are factors strongly associated with natural birth intentions. Women are more likely to have natural birth intentions if they report lower levels of childbirth fear and higher levels of confidence in birth knowledge. These two factors are modifiable through education and midwives are in a position to provide preconception counselling and education to young women who lack confidence and are afraid of birth. These strategies should be viewed as an integral part of efforts to reduce rates of elective interventions during childbirth.

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Paper III

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ORIGINAL ARTICLE

WILEY BIRTH ISSUES IN PERINATAL CARE

A systematic review of nonpharmacological prenatal interventions for pregnancy-specific anxiety and fear of childbirth

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Abstract

Background: Despite a sharp increase in the number of publications that report on treatment options for pregnancy-specific anxiety and fear of childbirth (PSA/FoB), no systematic review of nonpharmacological prenatal interventions for PSA/FoB has been published. Our team addressed this gap, as an important first step in developing guidelines and recommendations for the treatment of women with PSA/FoB.

Methods: Two databases (PubMed and Mendeley) were searched, using a combination of 42 search terms. After removing duplicates, two authors independently assessed 208 abstracts. Sixteen studies met eligibility criteria, ie, the article reported on an intervention, educational component, or treatment regime for PSA/FoB during pregnancy, and included a control group. Independent quality assessments resulted in the retention of seven studies.

Results: Six of seven included studies were randomized controlled trials (RCTs) and one a quasi-experimental study. Five studies received moderate quality ratings and two strong ratings. Five of seven studies reported significant changes in PSA/FoB, as a result of the intervention. Short individual psychotherapeutic interventions (1.5-5 hours) delivered by midwives or obstetricians were effective for women with elevated childbirth fear. Interventions that were effective for pregnant women with a range of different fear/anxiety levels were childbirth education at the hospital (2 hours), prenatal Hatha yoga (8 weeks), and an 8-week prenatal education course (16 hours).

Conclusions: Findings from this review can inform the development of treatment approaches to support pregnant women with PSA/FoB.

KEYWORDS
fear of birth, pregnancy-specific anxiety, systematic review

1 | INTRODUCTION

Until recently, perinatal anxiety and related disorders have been relatively neglected, compared with perinatal depression. This is despite evidence that women are three times more likely to be diagnosed with an anxiety or related disorder during and after pregnancy than depression.[1] Care providers routinely screen for postpartum depression, but not for pregnancy-specific anxiety (ie, fears, worries and anxiety related to aspects of one's pregnancy, and pending childbirth),

prenatal childbirth fear, or any of the anxiety and related disorders.[2] This focus on depression and postpartum mental health is short-sighted as prenatal fear of birth predisposes women to postpartum depression[3,4] and post-traumatic stress disorder.[5] Pregnancy-specific anxiety (PSA) is linked to a higher risk of preterm birth and low birthweight[6,7] and both childbirth fear and PSA are associated with a higher likelihood of cesarean birth.[8,9]

This systematic review examines interventions for pregnancy-specific anxiety. Fear of birth (FoB) is included in the review because PSA is a broad concept that encompasses FoB and other pregnancy-related anxieties. Women who suffer from PSA share similar concerns about pregnancy and childbirth as women affected by childbirth fear, such as fear/anxiety about the health of their baby and how they will cope with labor and birth.[8,10,11] At present, childbirth fear and PSA are not recognized mental health conditions. Women who present with PSA/FoB might receive a diagnosis of specific phobia, generalized anxiety disorder, or adjustment disorder. As such, clinically significant PSA/FoB falls under the umbrella of anxiety disorders.

Approximately 4% of pregnant women suffer from severe FoB (as diagnosed by a physician),[3] and 10-30% from moderate FoB[12-16]; the prevalence of high PSA has been estimated at 11%.[8] These estimates are based on scores above the 75th or 90th percentile and have not been validated against diagnostic criteria. Hence, it is unknown whether women with PSA/FoB experience impairments in daily functioning and how many would meet criteria for a diagnosis of specific phobia or other anxiety-related disorders.

There is a growing body of evidence that links FoB to labor and delivery outcomes. Fear of birth during pregnancy is associated with more intense pain perception during labor and more requests for epidural anesthesia,[17-19] lower pain intolerance,[20] longer labors,[21,22] and a higher likelihood of cesarean birth.[3,19,23-26] Elevated FoB has also been linked to preferences for cesarean birth among pregnant women[17,19,27,28] and women and men who plan to have children.[29,30]

Studies have shown increased FoB during pregnancy is more common among women with lower educational attainment,[28,31,32] younger women,[31,32] women who experience higher stress levels,[17] and more fatigue during pregnancy.[16] Increased FoB is also associated with low confidence in women's ability to cope with labor and birth,[28,31,33-35] lower self-rated health,[32] anxiety,[31,36-40] a history of depression,[33,37,40] less social support,[32,37] dissatisfaction with partner or support received from partner,[31,33] history of abuse,[15,40,41] previous negative birth experiences and/or traumatic births,[17,23,42-45] and previous operative or instrumental deliveries.[12,42,43,46] Although FoB has been shown to be more prevalent among nulliparous women,[12,16,18,35,38,39,47-49] a large Finnish cohort study with over 700 000 women found a higher incidence of severe childbirth fear among multiparas.[3]

Like FoB, PSA is linked to increased use of pain relief during labor, longer labor,[50] and a higher likelihood of delivery by cesarean birth[8] and is more common among women having their first baby, women with lower incomes, less social support, more stress, those experiencing domestic violence, lower self-esteem, and less commitment to the pregnancy.[6]

Several cohort studies, systematic reviews, and meta-analyses have documented that maternal psychological distress (including PSA) is linked to a wide range of adverse pregnancy and infant outcomes, such as premature delivery, low birthweight, neonatal morbidity, problems with mother-infant bonding, and infant cognitive, behavioral, emotional, and psychomotor deficits.[51-60] Specifically, PSA has been linked to spontaneous preterm birth.[61] Several potential physiological pathways have been identified that explain the link between stress and preterm birth, including behavioral, infectious, neuroinflammatory, and neuroendocrine mechanisms.[62] In contrast, FoB does not appear to affect neonatal outcomes.[17] In the largest cohort study to date (n = 788 317 singleton births) the incidence of low birthweight (<2500 g), small-for-gestational-age babies, preterm birth, and low APGAR scores at 1 minute were lower among Finnish women with high FoB.[3]

1.1 | Treatment of PSA/FoB

Reproductive health and illness are affected by economic, behavioral, psychological, biological, and genetic factors.[63] Behavioral and psychological factors are the most modifiable, and have been the focus of reproductive health interventions around the world.[12,64] In Finland and Sweden, maternity care providers are trained to assess and counsel women with PSA/FoB during pregnancy.[46,65] Outside the Scandinavian context, little is known about how PSA/FoB are identified and treated. A survey of 128 United Kingdom maternity units revealed that half did not offer any special services for women with childbirth fear and the other units reported many different approaches, including referrals to specialist obstetricians or midwives, and other psychological support services.[66] The situation is similar in other high-resource countries, ie, there are few guidelines on how to support women affected by PSA/FoB.

An important first step in developing guidelines and strategies to address PSA/FoB is to understand which interventions might be effective in reducing PSA/FoB during pregnancy.

The aim of the current systematic review was to summarize high quality studies of nonpharmacological prenatal interventions that might be linked to reductions in PSA/FoB during pregnancy.

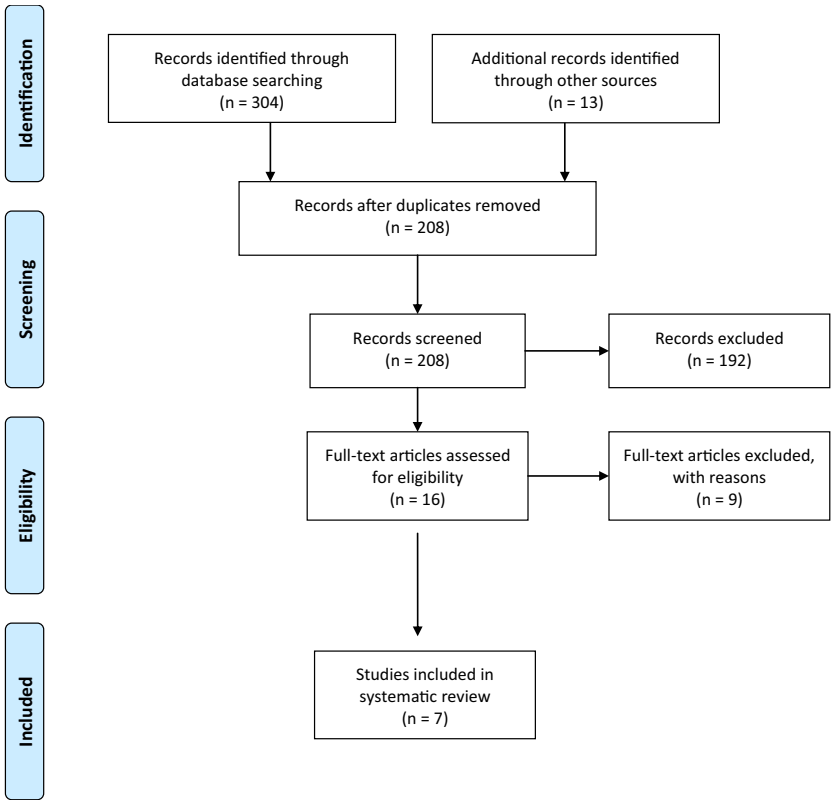

FIGURE 1 Prisma flow diagram

2 | METHODS

The inclusion criteria for the systematic review were that one of the outcomes must be PSA or FoB. PSA must be measured with a scale that specifically assesses anxiety about pregnancy/birth and not general trait or state anxiety. The article must report on an intervention, educational component, or treatment regime for PSA/FoB and include a control group. We included research published in any country and on any date. PSA/FoB must have been measured at least twice during pregnancy (ie, at baseline and postintervention).

We searched the PubMed and Mendeley databases on April 29, 2016, using 42 combinations of search terms. Mendeley is a reference manager and academic social network that is commonly used to manage systematic reviews. The bibliographies of all users are pooled and can be searched in Mendeley. The Mendeley database contains over 30 million citations, including unpublished papers and dissertations as well as articles that are not indexed. We entered childbirth fear, fear of birth, fear of childbirth, pregnancy anxiety, birth anxiety, childbirth anxiety AND intervention, treatment, RCT, childbirth education, antepartum education, antenatal education, and prenatal education. We then searched the bibliographies of relevant papers that were identified during the review and the grey literature. The Mendeley search revealed 176 records, after removal of duplicates. Through the PubMed search we identified an additional 14 records.

Two authors independently reviewed 190 articles. During this stage, 12 papers met the inclusion criteria.[9,12,67-76] An additional two papers were identified by searching bibliographies of related systematic reviews.[77,78] To keep the review as current as possible, we updated our literature search on March 15, 2017, using the same search terms, but this time restricting our search to articles listed on PubMed. We identified an additional 16 records that were independently reviewed by two co-authors, to determine eligibility. Through this process, we selected two more articles that met our inclusion criteria.[79,80] In total, 16 papers met eligibility criteria and moved on to the quality assessment stage.

Two co-authors (from a total of four) independently assessed study quality, with the Effective Public Health Practice Project Quality Assessment Tool[81] along six dimensions:

selection bias, study design, confounding, blinding, data collection, and withdrawal/attrition. Each article was rated on each dimension as weak, moderate, or strong, based on instructions from the quality assessment dictionary. Articles with no weak ratings on any of the dimensions were categorized as strong, articles with one weak rating were considered to be of moderate quality and articles with two or more weak ratings were deemed as weak. We only included studies with moderate or strong quality ratings in our review. The validity and reliability of the Effective Public Health Practice Project tool is well-documented.[82,83] Discrepancies between reviewers were resolved by first checking each assessment, to ensure discrepancies were not a result of errors in interpreting the instructions, and then by involving a third co-author, to review the assessments against the article. In a final stage, raters met to discuss remaining discrepancies and agreed on a final rating for the discrepant articles. During this stage, it was decided to waive one of the blinding criteria, ie, participants must be unaware of the research question. Studies reporting on interventions that pregnant women must agree to participate in are unlikely to meet this criterion. All excluded studies were reassessed and two additional randomized controlled trials (RCTs) included during this stage[12,77] for a total of seven included studies (see Fig. 1). We present a narrative summary of high quality studies, rather than a meta-analysis, because of heterogeneity of measurement tools, populations, and interventions.

3 | RESULTS

Six of seven included studies were RCTs (including one cluster RCT) (level IA evidence) and one a quasi-experimental study (level IIA evidence) (Table 1). Five studies received moderate quality ratings[12,71,77-79] and two a strong rating[9,76] (see Table 2). All were published in peer-reviewed journals, with the exception of the dissertation by Cole-Lewis.[76] Two studies were conducted in Finland, one in the United States, one in Turkey, one in Australia, one in Germany, and one in the United Kingdom (see Table 1). The RCTs conducted by Saisto et al. and Toohill et al.[9,12] randomized women with elevated childbirth fear to either the intervention or control group. In the German trial,[84] women were randomly allocated to treatment if they reported elevated pregnancy distress, trait-state anxiety, or elevated depression. None of the other studies required that women meet a minimum threshold for PSA/FoB, to participate in the study. In five studies, authors investigated changes in childbirth fear, in two studies the outcome was pregnancy-specific anxiety (see Table 1). Below we describe each study briefly.

In the study by Cole-Lewis,[76] 609 pregnant women participated at one of seven intervention sites and 619 participated at one of seven control sites in the New York Metropolitan Area between 2008 and 2010. All women were <24 weeks pregnant, between the ages of 14-21, and none were experiencing a high-risk pregnancy, or had been diagnosed with a psychological disorder. The intervention, Centering Pregnancy Plus, is a group prenatal care program specifically designed to decrease negative birth outcomes for women.[76] Typically, 8-12 women attend 10 structured prenatal group sessions, facilitated by a midwife or obstetrician. Each session is 2 hours long. The program integrates 1) assessments, 2) education and skill building, and 3) social support and includes components that might alleviate pregnancy anxiety, such as relaxation and comfort techniques and material that helps women know what to expect during labor and birth.[76] Participants in the control condition met the same number of times with their prenatal health care provider. Groups were evenly matched at baseline on most socio-demographic indicators; however more women in the intervention group were born outside the United States and spoke Spanish. Results indicated no change in pregnancy anxiety as a result of the Centering Pregnancy Plus intervention.

Saisto et al.[9] randomized 176 Finnish women with fear of birth in their 26th week of pregnancy to either intensive therapy for childbirth fear versus conventional therapy. Conventional therapy consisted of two appointments (45 minutes each) with an obstetrician and provision of written information about mode of delivery and pain relief options. The intensive therapy condition consisted of five appointments with the obstetrician, one with a midwife, visits to the labor ward, access to the obstetrician and midwife via telephone in between sessions, and provision of the same written information about mode of delivery and pain relief options. The obstetrician had completed a 185-hour course in cognitive therapy, another 40-hour course in childbirth psychology, and had treated women with childbirth fear for several years. The sessions with the obstetrician focused on medical check-ups, followed by cognitive therapy (ie, cognitive and behavioral exercises aimed at enhancing self-reflection and reducing childbirth fear). At postassessment, women in the intensive therapy group reported a nonsignificant reduction in pregnancy anxiety and a significant reduction in birth-related concerns. One item on the Pregnancy Anxiety Scale (fear of labor pain) decreased significantly among women in the intensive therapy group (ITG). In addition, women in the ITG who delivered vaginally experienced shorter labors and reported a more positive birth experience, compared with controls. Overall, 62% of women who preferred a cesarean birth during pregnancy ended up delivering vaginally; however, these rates did not differ by group assignment.

Haapio et al.[79] randomized 659 pregnant Finnish nulliparas to either extended childbirth education delivered by

TABLE 1 Summary of included studies

Author(s) & title	Location/date of data collection/study design	Inclusion/exclusion criteria	Outcome	Intervention	Results
Cole-Lewis Testing the effect of a group prenatal care intervention on pregnancy anxiety	USA 2008-2010 Cluster RCT	*Inclusion:* <24 weeks' gestation, 14-21 years of age, not considered a high-risk pregnancy, ability to speak English or Spanish. *Exclusion:* HIV infection, or clinically diagnosed psychological disorders.	Pregnancy anxiety (Revised Pregnancy Distress Questionnaire)	Centering Pregnancy + group prenatal care vs individual prenatal care	No significant difference in change in pregnancy anxiety between groups (B: −0.04, Standard error: 0.36, t = −0.10, $P = .918$)
Saisto et al. A randomized controlled trial of intervention in fear of childbirth	Finland 1996-1999 RCT	*Inclusion*: Five or more affirmative answers to the Pregnancy Anxiety Scale, or a request for cesarean. *Exclusion:* Contraindication to vaginal delivery at the time of randomization	Pregnancy Anxiety Scale—scale that measures birth-related concerns	Intensive vs conventional cognitive-behavioral therapy for childbirth fear	Birth-related concerns decreased in the intensive therapy group and increased in the control group (linear interaction $P = .022$) Pregnancy-related anxiety decreased in the intervention group, but the change was not statistically significant.
Sercekus et al. Effects of antenatal education on fear of childbirth, maternal self-efficacy and parental attachment	Turkey 2012-2014 Quasi-experimental study	*Inclusion*: 26-28 weeks' pregnant, minimum of primary school education, nulliparous, not at high risk in pregnancy, did not attend any other antenatal education program, gave birth at term, healthy newborn, no postnatal complications or postpartum psychiatric disorder	Childbirth fear (W-DEQ-A)	16 h of prenatal education for couples vs standard care	Antenatal education was linked to significant reductions in childbirth fear, compared with standard care ($P < .001$)
Haapio et al. Effects of extended childbirth education by midwives on the childbirth fear of first-time mothers: an RCT	Finland Date of data collection not stated RCT	*Inclusion:* <14 weeks' gestation, 18-40, nulliparous, Finnish speaking, with normal ultrasound	Objects of Childbirth fear scale	Extended childbirth education (+ 2 h) vs standard care	The intervention was linked to significantly reduced odds (OR 0.58 [95% CI 0.38-0.88]) of childbirth-related fears, compared with standard care
Newham et al. Effects of antenatal yoga on maternal anxiety and depression: a randomized controlled trial	United Kingdom 2010-2011 RCT	*Inclusion:* Healthy women, 18 years or older, 2nd or early 3rd trimester, uncomplicated, singleton, first pregnancy *Exclusion:* Medical illness, taking prescription medication, already practicing antenatal yoga	Childbirth fear (Modified version W-DEQ-A; items 28-33 omitted)	8-week antenatal yoga course compared with controls	Reductions in childbirth fear scores in the intervention group were greater compared with the control group (14 points vs 6 points), women in the intervention group had significantly larger reductions in childbirth fear scores (B = −9.59, $P = 0.014$; d = −057).

(Continued)

TABLE 1 (Continued)

Author(s) & title	Location/date of data collection/study design	Inclusion/exclusion criteria	Outcome	Intervention	Results
Toohill et al. A randomized controlled trial of a psycho-education intervention by midwives in reducing childbirth fear in pregnant women	Australia 2012-2013 RCT	*Inclusion*: 2nd trimester, three specific antenatal clinics, can communicate in English, aged 16 or older, and with high W-DEQ scores *Exclusion*: Require an interpreter, <16 or >24 weeks' gestation, anticipating/experiencing a perinatal death or stillbirth	Childbirth fear (W-DEQ-A)	Telephone psycho-education delivered by midwives vs usual prenatal care	Women in the intervention group reported significantly lower childbirth fear scores, compared with controls ($P < .001$, effect size = 0.59)
Bittner et al. Early intervention in pregnant women with elevated anxiety and depressive symptoms	Germany Date of data collection not stated RCT	*Inclusion*: 18 years or older, 13-14 weeks' gestation, medically verified pregnancy, screening results of at least 1 questionnaire above study cutoff (PDQ >14 and/or STAI >36 and/or BDI-V > 20), participated at time 1, 2, and 3 *Exclusion*: No current severe mental health diagnosis, miscarriage or abortion	Fear of Childbirth Scale	8 weeks of psycho-education/cognitive-behavioral therapy delivered by a clinical psychologist vs standard prenatal care	No significant reductions in childbirth fear ($P = 0.60$) were observed, as a result of the cognitive-behavioral therapy intervention

midwives (intervention) or standard prenatal education (voluntary childbirth education class at health clinic and a short excursion to the maternity ward). The intervention was comprised of standard prenatal care plus a leaflet with basic information about pregnancy and birth and a 2-hour childbirth education class at the maternity ward. Women attend the session before 34 weeks' gestation. The session took place inside of the delivery rooms, and included several exercises to learn about pain relief options, positions for pushing, etc. Women in the intervention group had significantly reduced odds (OR 0.58 [95% CI 0.38-0.88]) of childbirth-related fears, compared with the control group and also reported that fear interfered less with their everyday activities (OR 0.64 [95% CI 0.44-0.94]). The significant association between treatment allocation and childbirth-related fears persisted, after controlling for socio-demographics and other potential confounders.

Newham et al.[78] tested the effectiveness of antenatal yoga on childbirth fear (as an indicator of pregnancy anxiety) among low-risk primiparas from the United Kingdom (n = 59). Women in the intervention group were randomized to 8 weeks of prenatal Hatha yoga compared with standard care. Sessions had different themes, to emphasize how yoga might be applied to promote maternal well-being. For example, sessions 1-3 were focused on alleviating common aches and pains through yoga postures; sessions 6 and 7 included teachings about postures for improving hip flexibility and breathing techniques during labor; session 8 emphasized pelvic floor exercises. Women in the control group received prenatal care as usual. There were some differences between groups at baseline, eg, women in the yoga group were more likely to be white and were less likely to consume coffee during pregnancy. The mood profiles of women from both groups were similar at baseline. After the intervention period, reductions in childbirth fear scores in the intervention group were greater compared with the control group (14 points vs 6 points), with a small effect size ($r = -0.26$). The significant association between group assignment and reductions in childbirth fear persisted, after controlling for other variables that might have influenced the outcome (eg, maternal age, gestational age at baseline, mood scores at baseline, etc.). The effect size was $d = -0.57$.

Sercekus et al.[71] recruited 35 pregnant Turkish couples to participate in eight 2-hour antenatal education sessions, covering topics such as physiological and psychological changes during pregnancy and how to cope with these changes, feelings toward birth and a discussion about how to manage FoB, the mechanism of labor and birth, breathing and relaxation techniques, laboring positions, breastfeeding, newborn care, etc. Couples in the experimental group participated in childbirth education, in addition to receiving routine prenatal care. Women/couples in the control group received routine prenatal care only. Participation in childbirth education classes

TABLE 2 Quality assessment results

Author(s)	Selection bias	Study design	Confounders	Blinding	Data collection method	Withdrawals and dropouts	Overall rating, after blinding criterion was waived
Bittner et al.	Moderate	Strong	Strong	Weak	Strong	Weak	Moderate
Cole-Lewis	Strong	Strong	Strong	Moderate	Strong	Strong	Strong
Guardino et al.	Weak	Strong	Weak	Moderate	Moderate	Strong	Weak
Isbir et al.	Weak	Moderate	Weak	Moderate	Weak	Strong	Weak
Guszkowska	Weak	Moderate	Weak	Moderate	Strong	Weak	Weak
Haapio et al.	Moderate	Strong	Strong	Weak	Weak	Moderate	Moderate
Kizilirmak et al.	Weak	Moderate	Strong	Weak	Strong	Weak	Weak
Khorsandi et al.	Weak	Moderate	Weak	Moderate	Strong	Weak	Weak
Karabulut et al.	Weak	Moderate	Weak	Moderate	Strong	Weak	Weak
Martin et al.	Weak	Moderate	Weak	Moderate	Weak	Weak	Weak
Navaee et al.	Moderate	Moderate	Moderate	Weak	Strong	Weak	Weak
Newham et al.	Weak	Strong	Strong	Moderate	Strong	Strong	Moderate
Saisto et al.	Moderate	Strong	Strong	Moderate	Strong	Moderate	Strong
Sercekus et al.	Moderate	Moderate	Weak	Moderate	Strong	Moderate	Moderate
Taheri et al.	Moderate	Moderate	Weak	Weak	Weak	Moderate	Weak
Toohill et al.	Moderate	Moderate	Weak	Weak	Strong	Moderate	Moderate

was linked to decreases in childbirth fear among women, ie, the mean Wijma Delivery and Expectancy Questionnaire (W-DEQ-A) scores in the experimental group decreased from 60.7 points at baseline to 37.9 posttreatment. The difference in W-DEQ-A scores between the experimental and control group was significant posttreatment (37.9 vs 59.9, $P < .001$).

In the RCT by Toohill et al.,[12] 339 Australian pregnant women with high childbirth fear were randomly assigned to receive two telephone psycho-education counselling sessions (at 24 and 34 weeks) or standard care. Women in both groups received an information booklet about giving birth in Queensland. The telephone intervention was led by midwives and consisted of listening and responding to women's feeling about childbirth, providing accurate information about labor and birth, and teaching women strategies to cope with elements of childbirth they identified as distressing. Women in the intervention group reported significantly lower childbirth fear scores, compared with controls ($P < .001$, effect size = 0.59); 47.5% of women in the treatment group versus 25.8% of women in the control group experienced a reduction of 20 points or more on the W-DEQ-A, indicating clinically relevant improvements in childbirth fear. The difference was statistically significant ($P = .002$).

Bittner and colleagues[77] randomized 160 women from Germany to an 8-week course of psychoeducation/cognitive behavioral therapy delivered by a clinical psychologist in addition to standard prenatal care. Women were eligible to participate in the trial if they reported elevated prenatal distress, state-trait anxiety, or elevated depression during standardized clinical interviews. Women with severe depression, anxiety, or other mental health diagnosis were excluded from the trial and referred for therapeutic support. Women in the intervention group met with 4-6 other pregnant women over an 8-week period, to learn about cognitive behavioral therapy, progressive muscle relaxation, how to cope with stress, problem-solving techniques, prevention and treatment of pregnancy anxiety, and depression during pregnancy, and what to expect in the postpartum period. Women in the control group only received standard prenatal care; there were no significant differences in sociodemographic characteristics between women in the treatment and control groups at baseline. No significant reductions in childbirth fear were observed, as a result of the cognitive-behavioral therapy intervention.

4 | DISCUSSION

Seven of sixteen studies (44%) were of sufficient quality to be included in the systematic review. All studies except the cluster RCT by Cole-Lewis[76] and the cognitive-behavioral therapy intervention described by Bittner and colleagues[77] reported significant changes in childbirth fear, or PSA, as a result of the intervention. The interventions that were effective for women with elevated childbirth fear were individual intensive therapy (for childbirth fear delivered by an obstetrician with extensive training in cognitive-behavioral therapy >5 h of treatment)[9] and individual telephone counselling with midwives with some training in psychotherapy (approx. 1.5–2 h treatment).[12] A group cognitive-behavioral therapy intervention delivered by clinical psychologists was not effective in reducing childbirth fear,[77] although the intervention was much longer (12 h, plus homework assignments). These findings suggest that short, individual psychotherapeutic interventions for childbirth fear and PSA delivered by maternity care providers with training in cognitive-behavioral therapy/psychotherapy are effective for women with elevated PSA/FoB. Interventions that were effective for pregnant women with a range of different PSA/FoB levels were childbirth education at the hospital (2 h),[79] prenatal Hatha yoga (8 weeks),[78] and an 8-week prenatal education course (16 h).[71]

While the Centering Pregnancy Program did not reduce pregnancy-specific anxiety in the study included in this review,[76] other interventions studies with control groups have shown that Centering Pregnancy can have a positive overall effect on psychological well-being, especially among women with greater stress or lower personal coping resources.[84,85] This indicates that while Centering Pregnancy may strengthen overall psychosocial well-being, Centering Pregnancy alone may not be an effective strategy to reduce PSA among young mothers.

Cognitive-behavioral therapy is one of the most effective treatments for anxiety and specific phobias (eg, childbirth fear).[86-89] Our review showed that women who suffer from fear of birth experienced reductions in fear, after working with an obstetrician trained in cognitive-behavioral therapy. A recent study from Sweden reported on the feasibility of an Internet-based cognitive-behavioral therapy program (8 weeks) for nulliparas with severe childbirth fear. The 28 women who received therapy experienced a statistically significant decrease in childbirth fear ($P < .0005$) with a large effect size (d = 0.95).[90] Follow-up interviews with 15 of the women indicated that the cognitive-behavioral therapy intervention increased self-confidence and was linked to more active coping strategies.[91] The study was not included in the review because it did not include a control group, but the intervention described in the study is currently being tested, using a randomized controlled design (ClinicalTrials.gov ID: NCT02266186).

Our systematic review revealed divergent findings about the efficacy of cognitive-behavioral therapy in reducing PSA/FoB. Neither cognitive-behavioral therapy intervention that was described in our review[9,77] included exposure to the feared stimulus. Traditional cognitive-behavioral therapy places strong emphasis on exposure (imaginal and in vivo)

because it has been shown to be the most effective intervention for specific phobias[88] and future cognitive-behavioral therapy interventions for PSA/FoB ought to include this important component. There appears to be a particular advantage to in vivo exposure compared with other forms of exposure treatment such as imaginal exposure.[88] In vivo exposure might include watching a video about childbirth or observing a birth first hand; multiparas with PSA/FoB might benefit from imaginal exposure to memories of the previous birth as well as cognitive restructuring of maladaptive beliefs, resulting from the previous birth.

4.1 | Implications for future research

We recommend that studies testing interventions for PSA/FoB should be restricted to healthy women as women experiencing medically complicated pregnancies have higher odds of perinatal anxiety.[92] Parity is also an important factor which has been shown to modify childbirth fears and findings should be stratified by parity.

A key feature of all future studies should be the use of well-validated measures of FoB. These can be diagnostic tools (eg, semi-structured, diagnostic interviews), or self-report inventories with well-established cutoff scores. At present, the W-DEQ-A dominates the assessment of FoB during pregnancy. Although the W-DEQ-A has well-established psychometric strengths,[93] it also suffers from several problematic qualities as well. First, the W-DEQ-A is not limited to an assessment of fear, but rather assesses a wide range of women's perceptions of labor and delivery. In factor analytic studies of the W-DEQ-A, fear has been found to emerge as one of four factors, strongly suggesting that the W-DEQ is not only a measure of fear.[39,94] Furthermore, several aspects of FoB are not addressed in this metric (eg, pain, perceptions of social embarrassment, pressure to receive/avoid pain medication, mother's safety, changes to the body and sexual function, fear of medical interventions). Women who are fearful of childbirth, for reasons not assessed via the W-DEQ-A, may be missed when screened with the W-DEQ and other measures of childbirth fear that only assess general fear (see, eg, the two-item visual analog Fear of Birth Scale).[13]

The recently developed Childbirth Fear Questionnaire,[95] a 40-item measure that assesses both fear of vaginal and fear of cesarean birth, encompasses the full range of women's childbirth fears, and measures the degree of interference in daily life as a result of FoB—improving its accuracy as a screening tool.

4.2 | Limitations

Our systematic review likely underrepresented studies with negative findings and overestimated observed effects, as a result of publication bias,[96] although the use of Mendeley as a search tool likely increased our chances of locating studies with negative findings. In addition, many other promising intervention studies did not meet the inclusion criteria for our review, eg, those testing mindfulness-based childbirth education (combining training in mindfulness meditation with skills-based childbirth education).[97] During the quality assessment stage, three studies from Turkey and two studies from Iran were excluded because of overall weak ratings. It is unclear whether language barriers, unfamiliarity with reporting standards, and/or lack of institutional support and funding to conduct RCTs might play a part in the number of studies from these countries that were excluded because of methodological weaknesses.

4.3 | Conclusion

Findings from this review can inform the development of treatment approaches to support pregnant women with PSA/FoB. Short interventions delivered by maternity care providers that explore the root of childbirth-specific fears and anxieties (including previous traumatic pregnancies and births), and help women develop strategies to cope with their fears and anxieties were effective as were antenatal yoga and prenatal education, including exposure to the delivery room, progressive muscle relaxation, and other techniques to cope with stress, fear, and anxiety during pregnancy.

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