Pregnancy and childbirth among women previously exposed to sexual violence

Agnes Gísladóttir

Thesis for the degree of Philosophiae Doctor

Supervisor:
Unnur Anna Valdimarsdóttir

Doctoral committee:
Berglind Guðmundsdóttir, Bernard L. Harlow,

Ragnheiður I. Bjarnadóttir, Sven Cnattingius

September 2017

UNIVERSITY OF ICELAND
SCHOOL OF HEALTH SCIENCES
FACULTY OF MEDICINE

Meðganga og fæðing hjá konum sem hafa orðið fyrir kynferðisofbeldi

Agnes Gísladóttir

Ritgerð til doktorsgráðu

Leiðbeinandi:
Unnur Anna Valdimarsdóttir

Doktorsnefnd:
Berglind Guðmundsdóttir, Bernard L. Harlow,

Ragnheiður I. Bjarnadóttir, Sven Cnattingius

September 2017

UNIVERSITY OF ICELAND
SCHOOL OF HEALTH SCIENCES
FACULTY OF MEDICINE

ISBN 978-9935-9365-1-6

Printing by Háskólaprent.

Reykjavik, Iceland 2017

Ágrip

Bakgrunnur og markmið: Alþjóða heilbrigðismálastofnunin lítur á kynferðisofbeldi sem lýðheilsuvá á heimsvísu, þar sem það er bæði algengt og getur haft alvarlegar afleiðingar fyrir brotaþola. Stórar og vel gerðar rannsóknir á kynferðisofbeldi og hugsanlegum áhrifum í kringum barnsburð kvenna síðar á lífsleiðinni eru takmarkaðar og niðurstöðum ber ekki saman. Með því að nota gögn sem safnað var á þeim tíma sem bæði útsetning og útkoma áttu sér stað var markmið þessarar rannsóknar að skoða hugsanlegt samband á milli kynferðisofbeldis á unglings- eða fullorðinsárum og áhættunnar á óæskilegum þáttum á meðgöngu, í fæðingu eða hjá nýburanum. **Aðferð:** Notast var við gagnagrunna í öllum þremur rannsóknunum; upplýsingar um konur sem leituðu til Neyðarmóttöku vegna kynferðisofbeldis voru samkeyrðar við rafræna fæðingaskrá. Í **rannsókn I** var meðganga 586 kvenna sem leituðu til Neyðarmóttöku á árunum 1993-2008 borin saman við meðgöngu 1.641 konu sem hafði ekki leitað þangað. Notast var við gögn úr fæðingaskrá og mæðraskrám. Í **rannsókn II** voru skoðaðar fæðingar mæðra sem höfðu leitað til Neyðarmóttöku á árunum 1993-2011 og að meðaltali sex árum síðar eignast 1.068 einbura (útsettur hópur). Til samanburðar voru 9.126 einburafæðingar óútsettra kvenna (höfðu ekki leitað til Neyðarmóttöku). Þær voru valdar af handahófi en parað var á aldri móður, hvort konan hafði áður eignast barn og ársþriðjungi fæðingar innan sama árs. Í **rannsókn III** voru borin saman einkenni lifandi fæddra einbura, 1.067 voru í útsettum hópi og 9.104 voru í óútsettum

hópi. Notast var við Poisson aðhvarfsgreiningu til að meta áhættuhlutfall (RR) með 95% öryggisbili. **Niðurstöður:** Í samanburði við óútsettar konur voru útsettar konur yngri, síður á vinnumarkaði, síður í sambúð og reyktu oftar (41.4% vs. 13.5%; aRR 2.59, 95% CI 2.19-3.07) (**rannsókn I**). Útsettar konur voru í aukinni áhættu á að fá greiningarnar móðurnauð í hríðum og fæðingu (RR 1.68, 95% CI 1.01-2.79) og lengt fyrsta stig fæðingar (RR 1.40, 95% CI 1.03-1.88), og að beita þyrfti áhöldum eða bráðakeisaraskurði (RR 1.16, 95% CI 1.00-1.34), samanborið við óútsettar konur. Á heildina litið fannst enginn munur á valkeisaraskurðum **(rannsókn II)**. Samanborið við nýbura óútsettra mæðra voru nýburar útsettra mæðra léttari (3.573,6 g vs. 3.675,6 g, $p<0.01$), í aukinni áhættu á að fæðast fyrir tímann (RR 1.49, 95% CI 1.13-1.97, einkum á 32.-37. viku (RR 1.64, 95% CI 1.24-2.19)), og vera fluttir á vökudeild (RR 1.35, 95% CI 1.05-1.73). Áhættustuðlar fyrir fyrirburafæðingu lækkuðu dálítið þegar leiðrétt var fyrir núverandi sambúðar- og atvinnustöðu **(rannsókn III)**. Áhættustuðlar í rannsóknum II og III voru almennt hærri fyrir konur sem urðu fyrir kynferðisofbeldi á unglingsárum en þær sem voru eldri. **Umræða:** Meðganga og fæðingar kvenna sem hafa orðið fyrir kynferðisofbeldi virðast oftast ganga vel. Niðurstöðurnar benda þó til þess að konur sem hafa orðið fyrir kynferðisofbeldi séu í aukinni áhættu á að reykja á meðgöngu, langdregnu fyrsta stigi fæðingar, fæðingu með áhöldum eða bráðakeisaraskurði og fyrirburafæðingu.

Lykilorð: Kynferðisofbeldi, heilsa mæðra, meðganga, fæðing, nýburi

Abstract

Background and aims: Sexual violence is common and, due to the possible impact on the exposed individual, a major public health concern according to the World Health Organization. However, knowledge from large and well conducted studies on the associations between sexual violence and women's childbirth outcomes later in life is as yet somewhat scarce and inconclusive. Using prospectively collected data, the aim of this thesis was to examine the potential associations between sexual violence exposure in adolescence or adulthood, and the risks of adverse pregnancy, obstetric, or neonatal outcomes in later pregnancies. **Material and methods:** All three studies were register-based, where information on women who attended a Rape Trauma Service (RTS) were linked with the Icelandic Medical Birth Registry (IMBR). In **Study I**, 915 pregnancy characteristics of mothers who attended the RTS during 1993–2008 (exposed) were compared to a randomly selected cohort of 1,641 pregnancies of women who had not attended the RTS (non-exposed), using data from the IMBR and maternity records. In **Study II**, we contrasted obstetric characteristics among 1,068 singleton births of women who attended the RTS 1993-2011, on average six years after the exposure, to 9,126 randomly selected births of non-exposed women, matched by maternal age, parity, and season/year of delivery. In **Study III** we compared characteristics of live-born singletons of exposed mothers (n=1,067) to those of non-exposed mothers (n=9,104). Poisson regression models were typically used to estimate relative risks (RR) with 95% confidence intervals. **Results:** Compared to non-exposed women, women previously exposed to sexual violence

were younger, more often not employed, not cohabiting, and more often smokers during pregnancy (41.4% vs. 13.5%; aRR 2.59, 95% CI 2.19–3.07). Exposed primiparas were at increased risk of obesity (RR 1.56, 95% CI 1.15–2.12) **(Study I)**. Exposed mothers presented with increased risks of maternal distress during labor and delivery (RR 1.68, 95% CI 1.01–2.79), prolonged first stage of labor (RR 1.40, 95% CI 1.03–1.88), and emergency instrumental delivery (RR 1.16, 95% CI 1.00–1.34), compared to non-exposed mothers. No overall differences were found regarding elective cesarean sections **(Study II)**. Compared to infants of non-exposed mothers, infants of exposed mothers were lighter (3,573.6 g vs. 3,675.6 g, $p<0.01$), had an increased risk of being born preterm (≤36 completed gestational weeks) (RR 1.49, 95% CI 1.13–1.97, mainly moderately preterm (32-36 gestational weeks) (RR 1.64, 95% CI 1.24–2.19)), and transferral to the Neonatal Intensive Care Unit (RR 1.35, 95% CI 1.05–1.73). Adjusting for concurrent cohabiting and occupational status slightly attenuated the relative risk of preterm birth **(Study III)**. Overall, the risk elevations in **Studies II and III** were larger for women assaulted in adolescence than those assaulted later. **Conclusion:** Obstetric outcomes of women with a history of sexual violence are, in most cases, relatively favorable. Yet, our data suggest that assaulted women may still be at increased risks of sustained smoking during pregnancy, obesity, prolonged first stage of labor, emergency instrumental delivery, and preterm birth.

Keywords:

Sexual violence, maternal health, pregnancy, obstetrics, neonatal outcomes

Acknowledgements

This journey is coming to an end. I started the Master of Public Health Sciences program in the fall of 2007. I didn't plan to stay at the Center of Public Health Sciences for almost 10 years. It is just such a good place. Dear friends in Stapi (and at Sturlugata during the last few months): Your friendship is invaluable. It means a lot to be surrounded by good friends all day long. It is important both during the fun times and the less fun times, both of which have been part of this journey. I feel so fortunate to have met you and made friends with so many of you.

My supervisor, Unnur Anna Valdimarsdóttir, a role-model in many ways. Positive, passionate, warm, and optimistic. A text machine. I am grateful for your supervision, and especially for the invitation to spend one winter in Boston. What an enjoyable time. I am also very appreciative of the guidance of other members of my doctoral committee, Sven Cnattingius, Bernard L. Harlow, Berglind Guðmundsdóttir and Ragnheiður I. Bjarnadóttir. Sven Cnattingius is thanked especially for lending his endless expertise in the field. Other collaborators, Thor Aspelund and Miguel-Angel Luque-Fernandez, are also thanked with gratitude, as well as Þórður Þórkelsson for important input in the third study. Eyrún Jónsdóttir, supervising nurse at the Rape Trauma Service, is thanked with appreciation for all assistance, and for being welcoming and supportive. I sincerely hope this thesis will stress the importance of continued specialized services, and provide survivors of sexual violence with improved services around the time of childbearing.

Agnes Björg Tryggvadóttir, Auður Sjöfn Þórisdóttir, and Þyri Ásta Hafsteinsdóttir are also thanked for their important help with the data gathering. Birna Björg Másdóttir and Ingibjörg Richter, data administrators at Landspitali, are thanked for good collaboration and their work on the record linkage.

I am very thankful for the financial support by the Icelandic Research Fund for Graduate Students (RANNIS), Landspitali-University Hospital Research Fund, and Soroptimist International of Europe Scholarship Fund.

Last but most importantly, I want to sincerely thank my friends and family. It is invaluable to have such a precious circle of friends and family. My mother, Elín Alma Arthursdóttir has been my greatest supporter throughout the years. My rock. This would not have been completed without your support and encouragement. My other rock came about in the latter half of this work, Þórður Ingi Guðmundsson. Sharing everything and looking forward to coming home to a supportive atmosphere is invaluable. You put a smile on my face and peace in my heart. I am extremely grateful for our little family and our one-year-old, Arthúr Ingi, whose smiles and cuddles are the meaning of life. Lastly, I want to acknowledge all support and interest from my late uncle, Helgi Már Arthursson (1951 - 2013).

In loving memory of my dearest grandmother

Anna María Helgadóttir

(1927-2013)

Contents

Ágrip ..... **iii**
Abstract ..... **v**
Acknowledgements ..... **vii**
Contents ..... **ix**
List of abbreviations ..... **xii**
List of figures ..... **xiii**
List of tables ..... **xiv**
List of original papers ..... **xv**
Declaration of contribution ..... **xvi**
1 Introduction **1**
1.1 Prevalence 2
1.2 Risk factors 4
1.3 Potential consequences 5
1.3.1 Mental health 5
1.3.2 Social, behavioral and other risk factors 6
1.3.3 General health effects and physical health consequences 7
1.3.4 Reproductive health 8
1.3.4.1 Maternal health during pregnancy 9
1.3.4.2 Delivery 11
1.3.4.3 Neonatal outcomes 15
1.3.5 Potential pathways towards adverse birth outcomes after previous exposure to sexual violence 17
1.3.6 Methodological aspects of previous studies 17
2 Aims **19**
3 Materials and methods **21**
3.1 Setting 21
3.2 Data sources 22
3.2.1 The Rape Trauma Service 22

3.2.2 The Icelandic Medical Birth Registry 24
3.2.3 Maternity records 25
3.2.4 Approvals 25
3.3 Design and methods 26
3.3.1 Study I – setting and population 27
3.3.1.1 Study I – data from the Rape Trauma Service .. 28
3.3.1.2 Study I - data from maternity records 29
3.3.1.3 Study I - variables obtained from the IMBR 30
3.3.1.4 Study I – statistical analysis 31
3.3.2 Studies II and III – setting and population 32
3.3.2.1 Studies II and III - data from the RTS 33
3.3.2.2 Studies II and III - data from the IMBR and Maternal Records 33
3.3.2.3 Studies II and III – statistical analysis 35

4 Results 39
4.1 Results from Study I - pregnancy 39
4.1.1 Women's background 39
4.1.2 Behavioral risk factors 39
4.1.3 Maternal health 40
4.2 Results from Study II – delivery 41
4.2.1 Background 41
4.2.2 Labor characteristics 41
4.2.3 Delivery interventions 42
4.3 Results from Study III – neonatal outcomes 42
4.3.1 Background and infant characteristics 42
4.3.2 Gestational length 43
4.3.3 Infant size 44
4.3.4 Health and viability 44

5 Discussion 47
5.1 Summary of main findings 47
5.2 Strength and limitations 47
5.2.1 Methodological approach 47
5.2.1.1 The data sources and risk of bias 50

5.2.1.2 Selection of the non-exposed cohort 51
5.2.1.3 Statistical power 52
5.3 General discussion 52
5.3.1 Main findings compared with current and previous studies 52
5.3.1.1 Age at attendance 56
5.3.2 Potential pathways 56
5.3.2.1 Maternal risk factors 57
5.3.2.2 Biological risk factors 58
5.3.3 Public Health Implications 59
5.4 Implications for research 62
5.5 Ethical considerations 63
6 Conclusions 65
References 67
Paper I 83
Paper II 95
Paper III 111
Appendix 149

List of abbreviations

aRR – Adjusted relative risk

BMI – Body mass index

CI – Confidence interval

CSA – Child sexual abuse

HPA-axis – Hypothalamic-pituitary-adrenal (HPA) axis

IMBR – The Icelandic Medical Birth Registry

LBW – Low birth weight

MoBa – The Norwegian Mother and child cohort study

NS – Non-significant

OR – Odds ratio

PTB – Preterm birth

PTSD – Posttraumatic stress disorder

RR – Relative risk

RTS – Rape Trauma Service

SGA – Small for gestational age

WHO - The World Health Organization

List of figures

Figure 1. Potential pathways between the exposure and the outcomes..... 18

Figure 2. The record linkage 27

Figure 3. Summary of main findings..... 47

List of tables

Table 1. Overview of some of the previous studies on delivery interventions 14

Table 2. Methodological differences between the three studies 37

Table 3. Comparison of maternal health diagnosis between the two datasets. 41

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-III):

I. Gisladottir A, Harlow BL, Gudmundsdottir B, Bjarnadottir RI, Jonsdottir E, Aspelund T, Cnattingius S, Valdimarsdottir, U. *Risk factors and health during pregnancy among women previously exposed to sexual violence*. Acta Obstet Gynecol Scand. 2014;93(4):351-8. doi:10.1111/aogs.12331

II. Gisladottir A, Luque-Fernandez MA, Harlow BL, Gudmundsdottir B, Jonsdottir E, Bjarnadottir RI, et al. *Obstetric Outcomes of Mothers Previously Exposed to Sexual Violence*. *PLoS One*. 2016; 11:e0150726.

http://dx.doi.org/10.1371/journal.pone.0150726

III. Gisladottir A, Cnattingius S, Luque-Fernandez MA, Thorkelsson Th, Hauksdottir A, Gudmundsdottir B, Bjarnadottir RI, Aspelund T, Harlow BL, Valdimarsdottir, U. *Neonatal outcomes in infants of women with past exposure to sexual violence: A follow-up study.* Manuscript submitted.

Declaration of contribution

I, Agnes Gísladóttir, the doctoral student of this project, wrote this thesis, with guidance from my supervisor and the doctoral committee. With my supervisor, Unnur Anna Valdimarsdóttir, I planned the studies and applied for appropriate approvals from national ethical and research authorities. Also, I manually collected data on both the exposure and on some of the outcomes in the first study. I ran the statistical analyses under the supervision of my supervisor, doctoral committee, and the collaborating statistician. I drafted the manuscript of the three papers that form the foundation of this thesis, and revised the papers in close collaboration with my co-authors.

1 Introduction

"Violence against women and girls is a global phenomenon that historically has been hidden, ignored, and accepted."

"All violence, including that against men and children, is a serious human rights and public health concern." p.1 (1).

In 1996, The World Health Assembly declared violence a major public health concern worldwide, and that research on violence was a priority for public health research (2, 3).

One of the most commonly experienced traumatic events among women is sexual violence (4). In the World Health Organization's (WHO's) World report on violence and health (5), sexual violence is defined as:

> *any sexual act, attempt to obtain a sexual act, unwanted sexual comments or advances, or acts to traffic, or otherwise directed, against a person's sexuality using coercion, by any person regardless of their relationship to the victim, in any setting, including but not limited to home and work. (p.149).*

A defining point is that the sexual act is without consent, and with coercion of the perpetrator. Coercion may present as physical force, psychological intimidation or threat, and also the victim's incapability

of giving consent because of alcohol consumption, drug intoxication, sleep, or mental disability affecting understanding the situation (5). The Nordic research network, NorVold, developed a questionnaire for abuse studies where the term "*against your will"* is used to define exposure to sexual violence. The network categorizes sexual abuse as: *Mild* (touch of other body parts than genitals in a sexual way or sexual humiliation), *moderate* (touch of genitals or body used for perpetrator's sexual satisfaction) and *severe* (penetration or attempted penetration, where penis, other body parts, or an object is penetrated into the vagina, rectum or mouth). The age of 18 years distinguishes between exposure to sexual violence as a child or an adult (6). Use of violence (including locking up or drugging), force, or compulsion, or victim's mental disability or incapability of opposing or understanding the act, defines sexual violence in Icelandic law. The corresponding penalty frame is 1 to 16 years (7). Even though definitions and perceptions have changed considerably, it is notable that even the oldest preserved Icelandic law includes an act of punishment for rape (forced sexual intercourse by a man against a woman) (8). It is important to acknowledge that males (boys and men) may certainly be exposed to sexual violence. Yet, since this thesis focuses on pregnancy and birth outcomes of women previously exposed to sexual violence, the literature review here is solely about females (girls and women).

1.1 Prevalence

In addition to various definitions and methods to estimate the prevalence of sexual violence, different perceptions and readiness to disclose exposure may differ between cultures. Therefore, comparison

between countries may be inaccurate. In a recent report by WHO, the global prevalence of sexual violence against women by non-partners was estimated as 7.2%, but as high as 12.6% in high-income countries. Globally, 30% of ever-partnered women reported exposure to intimate partner violence, sexual or physical, with a somewhat lower prevalence reported in high-income countries (9). In a systematic review including 55 studies from 2002 to 2009, the worldwide prevalence of child sexual abuse ranged from 8% to 31% for girls. The pooled prevalence of forced intercourse was 9% (10). In the first study using the Norvold Abuse Questionnaire, the lifetime prevalence of sexual abuse among Swedish women was 16.9%, of whom 8.0% had experienced severe (penetrative) sexual violence (6).

Analyses of the prevalence of sexual violence in Iceland have included the following results. In the International Crime Victims Survey from 2004-2005, 1.4% of 999 Icelandic female participants reported exposure to sexual assault in the preceding year. The average one-year prevalence rate was 0.6% for all 30 participating countries, ranging from 0.0 to 1.4% (11). Of Icelandic female respondents, 9.0% claimed to have experienced sexual offences during the past five years, of which approximately half were considered sexual assaults (rape, attempted rape, or indecent assaults). The majority of these women were aged 16-25 years (12). In 2004, a large study was conducted among students aged 16-19 years, in all upper secondary schools in Iceland (n= 9,113, response rate 80%). Of the female respondents, 8.2% had been persuaded, pressed or forced to have sexual intercourse before the age of 18 (13). In a study of students aged 13-15 years (n=206), rape was reported by 5.8% and sexual abuse by 5.8% of the

girls (14). From 1998 through 2007, an increase in attendance rates to the Rape Trauma Service (described in the methods section) was observed in a study conducted by myself and coworkers. The attendance rates for penetrative sexual violence doubled among women aged 18-25 years. However, it cannot be concluded whether the increase was due to different help seeking behavior or increased prevalence of sexual violence (15). Further, a telephone survey was conducted in 2008 on behalf of the Ministry of Social Affairs as a part of a Governmental Plan of Action on Violence against Women. Randomly selected women aged 18-80 years (n=3,000) were asked if they had been assaulted by a male after the age of 16. The response rate was 73% and one of every four women reported some form of exposure to sexual violence; 13% reported exposure to rape/rape attempt (16). Lastly, the Directorate of Health conducted a study on the Health and Wellbeing of 6,783 Icelanders in 2012, where 18% of female respondents reported lifetime exposure to sexual violence (17).

To conclude, even though estimates of the prevalence of exposure to sexual violence vary, it is evident that it is a widespread trauma and an important public health concern. Recently, WHO has called for further studies on the topic, including longitudinal studies on the possible health consequences of sexual violence (1).

1.2 Risk factors

Individuals in all societies and all social classes are at risk of being exposed to sexual violence. It may occur under various circumstances, and the perpetrators may be people known or unknown to the victim, including partners, strangers, friends, and authority figures (18).

Victims are at no circumstances to blame for being exposed to sexual violence. Yet, some factors have been suggested as increasing the risk of being exposed. Young females are particularly at risk (1), and a high proportion of women are assaulted in relation to consumption of alcohol or drugs (15). Also, a history of sexual violence increases the likelihood of being exposed again (19).

1.3 Potential consequences

In the following sections, some potential health consequences of sexual violence exposure are summarized. While various cross-sectional studies on the consequences of child sexual abuse exist, prospective studies are largely lacking (1). Studies on health consequences of rape (1) as well as studies on sexual violence perpetrated by non-intimate partners (9) are also limited.

1.3.1 Mental health

In 1974, an article was published in The American Journal of Psychiatry by Burgess and Holstrom, that described the symptoms of women who had been raped. These symptoms were reported as similar to those of soldiers returning from war. The term *Rape Trauma Syndrome* was used for the first time (20). Since then, knowledge of the possible effects of exposure to traumatic events has increased greatly. Posttraumatic stress disorder (PTSD) is an anxiety disorder with four symptom clusters (21):

1. Intrusion, e.g. flashbacks
2. Avoidance of memories or external reminders
3. Negative changes in mood and cognition, e.g. impaired memory of the traumatic event

4. Alterations in arousal and reactivity, e.g. angry outbursts or self-destructive behavior.

To fulfill the criteria of PTSD diagnosis, these symptoms have to persist for over one month and cause distress or impaired functioning (21). More than one of every 10 incidents of PTSD in Europe are reported to result from rape (attributable risk = 12.3%) (22). Comorbidity with other mental disorders, e.g. depression or anxiety disorders, is also common among women who have PTSD (23). Further, depression (24) and anxiety (9, 25-27) have been associated with sexual violence. Associations have also been found with eating disorders (26), sleep disorders (27), suicidal ideation (24), and suicide attempts (24, 27). At least one suicide attempt was reported by 16-24% of sexual violence survivors seeking help at an Icelandic counselling and information center for survivors of sexual violence (Stígamót) in 2011 to 2015 (28).

1.3.2 Social, behavioral and other risk factors

Women with a history of sexual violence are compared to never-exposed women at increased risk of low socioeconomic status. At the time of childbirth, women with previous exposure to sexual violence in childhood or adulthood are for example less often employed than non-exposed women, fewer have higher education, and a higher proportion are single (29-32). Potential pathways towards lower socioeconomic status include that sexual violence may lead to sick leaves, and interfere with job performance, and thus result in unemployment (33). Associations have also been found between exposure to sexual violence and misuse of alcohol (9), illicit drugs (26, 34), and smoking (35, 36). Twin studies provide an interesting approach, where

comparison of the exposed versus the non-exposed twin inherently controls (to some extent) for familial background and genetic factors. An Australian twin study found those sexually abused in childhood were at increased risk of smoking and illicit drug use compared to their non-exposed co-twin (35). An increased risk of food addiction has been reported (37) and obesity has also been reported in prospective studies among exposed women (38, 39). Only prospective studies can uncover the true health consequences of sexual violence; however, there is as yet a scarcity of studies based on such study designs. Methodological challenges of studies in this field are discussed in more detail at the end of the introduction section.

1.3.3 General health effects and physical health consequences

Associations have been reported between past exposure to sexual violence and an increased risk of various negative health consequences (40-44). *General* health effects of sexual violence include increased risks of poor self-reported health (45), frequent sick leaves (46), and even mortality (44). Negative *physical* health effects include increased risk of somatic symptoms (41), pain (47), type II diabetes (39, 44), hypertension (48), cardiovascular disease (49), pelvic pain (41, 46), and vulvodynia (50). A recent study from Denmark used data from a sexual violence center and followed 2,501 attendees in population-based health registers for 10 years, 5 years before and 5 years after their attendance. Attendees were reported to be at increased risk of chronic somatic illnesses, including diabetes, epilepsy, heart and lung diseases, and chronic liver disease, compared to 10,004 women who had not attended the center. Remarkably, many of the associations

were not only present after the assault, but also before. Even though the incidence decreased slightly when excluding women with a previous history of sexual violence, the attendees still had a significantly higher incidence of somatic diagnoses than women in the comparison group. The authors suggested that the population might be vulnerable and that those who seek help for sexual violence at the center may have a different socioeconomic or health profile compared to women who had been assaulted but did not attend the center (44).

1.3.4 Reproductive health

The risk of adverse health consequences among women exposed to sexual violence includes reproductive morbidities. Assaulted women are more likely than non-exposed women to suffer from pelvic pain (41, 46, 51) or pelvic dysfunction (52), undergo exploratory laparoscopic surgery (44), have adult-onset vulvodynia, chronic vulvar pain disorder (50), and get cervical cancer (53). It has also been reported that a gynecologic examination may provoke anxiety in adult women sexually abused in childhood (54).

Girls or young women exposed to sexual violence are reported to be at increased risk of adolescent pregnancies (55, 56), repeated induced abortions (57) or unintended pregnancies (58). An increased risk of risky sexual behavior (34), sexually transmitted diseases (44) as well as a suboptimal sex life (45) have further been reported by assaulted women. Seven women with a history of sexual abuse participated in a qualitative study in Akureyri, Iceland. They had all experienced gynecological problems in adulthood, including severe pelvic pain, ovarian cysts, infections, repeated miscarriages, ectopic pregnancies or

complications following childbirth (59). Similarly, in a longitudinal study from New Zealand, young women exposed to child sexual abuse were at increased risk of negative reproductive outcomes such as sexually transmitted infections, unhappy pregnancies and abortions when aged 18-21 years, yet the elevation of risk diminished with time from the assault (60). Studies on childbearing patterns among assaulted women are currently lacking.

1.3.4.1 *Maternal health during pregnancy*

In light of the multiple reports indicating severe health outcomes associated with sexual violence, it is reasonable to assume that exposed women may be affected around the time of pregnancy and childbirth. The literature addressing the association between sexual violence and pregnancy outcomes was, until very recently, quite scarce (61), but has grown rapidly during the last decade. The Norwegian Mother and Child Cohort Study (MoBa) includes 110,000 pregnancies (abuse studies include up to 80,000 pregnancies). Exposure was assessed with a questionnaire during pregnancy, but outcomes were obtained from the national Medical Birth Registry. The results showed that women exposed to sexual violence were more likely than non-exposed women to report common complaints (such as nausea, vomiting, headache, edema, heartburn and backache) (29, 62) and to be hospitalized (63) during pregnancy. Reasons for hospitalizations included bleeding, threatening preterm birth, and hyperemesis.

Another large study, the Nurses' Health Study II, included 45,000 nurses in the US with 100,000 pregnancies. Both exposure and outcomes were obtained with retrospective self-reports. The results

showed 30% increased risk of gestational diabetes for women exposed to forced sex in childhood or adolescence, which remained similar when adjusted for various covariates, including body size at age five (64). The prevalence of diabetes in the MoBa study was also higher among women exposed to severe sexual violence compared to non-exposed (1.7% vs. 1.2%, $p<0.001$). However, no differences were noted with respect to pre-eclampsia (30). Likewise, findings from a small study from Germany indicate that child sexual abuse survivors did not have pre-eclampsia, gestational hypertension or HELLP more frequently than non-exposed women (65). Further, in their study on women attending a sexual assault center in Copenhagen, Larsen et al. (44) found an increased risk of maternal disorders, but the results were not presented in more detail.

While studies on maternal diseases in pregnancy among assaulted women are few, other trauma exposures have indeed been associated with maternal diseases during pregnancy. An Icelandic study found an increased risk of gestational hypertension in the year following the economic crisis in 2008, possibly explained by high aggregate unemployment rates (66). The same researchers had previously reported an increased prevalence of gestational diabetes and pregnancy induced hypertension post-crisis compared to pre-crisis (67). The risk of these outcomes is positively associated with Body Mass Index (weight in kilograms divided by height in meters squared, BMI) (68). Obesity (BMI $\geq$30) has also been found to be more prevalent among pregnant women previously exposed to severe sexual violence, 13.5%, compared to 8.9% among non-exposed women ($p<0.001$) (30). The same applies to another known risk factor for adverse birth outcomes,

smoking (68). In the MoBa study, 22.1% of those exposed to severe sexual violence were smokers vs. 7.0% among non-exposed women ($p<0.001$) (30). Other studies have likewise reported more maternal smoking among exposed compared to non-exposed women (69-71). Differences in background and socioeconomic status have also been reported among pregnant women; exposed women tend to be younger than non-exposed women when giving birth, and are more often unemployed and single (30). Lastly, sexual violence exposure has been linked with perinatal depressive symptoms (72-74) and fear of childbirth during pregnancy (75) or during labor (76).

1.3.4.2 *Delivery*

Women who have been raped in adolescence/adulthood (77) or exposed to child sexual abuse (78) have, in qualitative studies, been described as re-experiencing the assault during labor and delivery. In a small study from Germany, Leeners et al. (31) found that 40% of 85 child sexual abuse survivors had disturbing memories of the abuse during delivery; for some of them it was the first time they remembered since they were children. Dissociation was experienced by some women in their study, yet often considered positive. Longer deliveries have been described in small studies (31, 71), whereas neither researchers in Denmark (79) nor MoBa (30) found any association between sexual violence and labor dystocia. The study by Nerum et al. (71) included exposed women who sought mental support during pregnancy, whose prior birth experience was studied retrospectively. This method may have induced selection bias, since women with a bad birth experience are more likely to seek mental

support during a subsequent pregnancy. In fact, many of the existing studies on adverse birth outcomes in relation to history of sexual violence suffer methodological challenges (discussed in more detail below).

MoBa findings indicate that exposed women were less likely than those non-exposed to look forward to having their infant, and more likely to worry about their infant's health. Further, those exposed to severe sexual violence (i.e. rape) were more likely than non-exposed women to opt for cesarean section (75). Indeed, Henriksen et al. (30) showed that mothers exposed to severe sexual violence had an increased risk of elective cesarean sections. Crude models showed that women exposed to moderate or severe sexual violence also had an increased risk of emergency cesarean sections, which only remained significant in adjusted models for women exposed to moderately severe sexual violence. The adjusted models included various covariates, making it hard to distinguish which of the variables had the most effect, or what the results would be if only adjusted for variables such as age and parity. However, Schei et al. (80) used different variables in their adjusted models on delivery interventions in the other large study on the topic, the Bidens study (a multi-country study including Iceland). For instance, smoking was included in adjusted models by Henriksen et al., while Schei et al. considered smoking as a possible result of the exposure and did therefore not include smoking in their adjusted models. In adjusted models, Schei et al. (80) found an increased risk of elective cesarean sections only for primiparas assaulted in adulthood, whereas an increased risk of emergency cesareans was only found among primiparas assaulted in adulthood

who also reported current suffering from the sexual violence. They also reported an increased risk of cesarean sections without medical indications. For operative vaginal deliveries, Schei et al. only found an increased risk among primiparas exposed to severe sexual violence in adulthood. On the other hand, Henriksen et al. (30) did not find an increased risk of vaginal instrumental deliveries in the MoBa study.

Smaller studies have also revealed conflicting results. Studies from the Netherlands (69) and Germany (31) showed non-significant indications of more instrumental vaginal deliveries among exposed women, whereas in Norway, Nerum et al. (71) found a greater risk of vaginal instrumental deliveries among women raped as adults, but not among those exposed to sexual abuse in childhood (32). Finally, in the only register-based study I am aware of, including 2,500 women who had sought services at a sexual violence center in Denmark, Larsen et al. (44) found no differences between exposed and 10,000 non-exposed women regarding complications in delivery. They hypothesized that the awareness, screening, and specialized care of exposed women within the obstetric field in Denmark explained their findings.

In sum, the literature on delivery complications and interventions among sexually assaulted women has revealed inconsistent results. Further studies are needed to establish whether women with previous exposure to sexual violence are at an increased risk of adversities during deliveries later in their lives.

Table 1. Overview of some of the previous studies on delivery interventions

	Popu-lation	**Vaginal instrumental**	**Elective CS**	**Emergency CS**	**Any CS**	**Method**	**Exposure**	**Outcome**
MoBa Henriksen et al., 2014a	75,000	No differences	↑ risk	↑ risk		Cohort study	Questionnaire, retrospective self-report	Register
Bidens Schei et al., 2014	7,000	↑ risk among primiparas exposed as adults	↑ risk among primiparas exposed as adults	No overall associations (↑ risk for subgroups)		Multi - country cohort study	Questionnaire, retrospective self-report	Hospital records
Larsen et al., 2016	12,500	Not reported separately	Not reported separately	Not reported separately	Not reported separately	Cohort	Attendance at a sexual violence center	Health registers
Nerum et al., 2010, 2012	200 400	↑ risk (for adult rape, not child sexual abuse (CSA))			↑ risk (for adult rape, not CSA)	Cohort/ Case control in a clinical cohort	Retrospective, women asked when seeking consultation at a mental health team for their second birth	Labor records (first birth analyzed retro-spectively)
Van Der Hulst et al., 2006	600	Non significant (NS) indications			No association	Cohort	Questionnaire, retrospective self-report	Maternity records
Leeners et al., 2016	250	NS indications			No association	Cohort	Interview/questionnaire, recruitment from support centers	Maternity records

1.3.4.3 *Neonatal outcomes*

Relatively few studies have been conducted on the potential effects of mother's previous exposure to sexual violence on subsequent newborn outcomes. One of the outcomes which has been studied is preterm birth (PTB), i.e. birth before 37 completed weeks of gestation. PTB is the main cause of neonatal mortality worldwide (81), yet, the mechanisms leading to spontaneous PTB are not fully understood (82). Nonetheless, some risk factors have been identified, including maternal psychological stress (83, 84), exposure to stressful life events (85, 86) or PTSD (87). Birthweight has also been studied in relation to mother's history of sexual violence, mainly low birth weight (LBW), and small for gestational age (SGA). LBW is defined as weight below 2500 g, irrespective of gestational age. On the contrary, SGA is based on growth curves, and takes gestational age and sex into account.

In a recent review article on exposure to sexual abuse in childhood and subsequent risk of PTB, six studies were identified. Half of them found statistically significant associations, or three to five-fold odds of PTB, among child sexual abuse survivors compared to those non-exposed. The remaining studies did not find any associations (88). Further, a recent study based on the Nurses' Health Study showed an odds ratio of 1.2 for PTB among women who reported forced sex in childhood or adolescence compared to those non-exposed. The main model was adjusted for age, socioeconomic position in childhood, and race, but the results remained unchanged when they additionally adjusted for various covariates, including prenatal alcohol and cigarette use, marital status at baseline, physical abuse during pregnancy, and

BMI at the age of 18. Analyses stratified by age at the time of exposure (≤10 or 11-17 years) showed comparable results (89). In the MoBa study, women with self-reported exposure to severe sexual violence were at a 30% increased risk of PTB (crude odds ratio). Yet, when the model was adjusted for age, parity, education, smoking, BMI and mental distress, the results were not statistically significant (OR 1.15, 95% CI 0.97-1.37) (90). As reviewed in previous sections, some of these factors could be associated with the sexual violence and have acted as mediators. As a result, other researchers have chosen not to adjust for covariates such as smoking (80). Similarly, a Canadian study found a twofold risk of PTB in women exposed to physical or sexual violence within the two years preceding birth, a risk which was not statistically significant in adjusted models (91). However, women's exposure to domestic (physical) violence, shortly before or during pregnancy, has been associated with increased risk of PTB in a meta-analysis of 14 studies, both in adjusted and unadjusted analyses (92).

As with PTB, findings from the MoBa study showed that the risk increase for LBW and SGA was only significant in crude models, but not when adjusted (90). The same applied to SGA in the study by Urquia et al. (91). Conversely, Shah and Shah (92) did not find an increased risk of SGA in their meta-analysis, whereas women exposed to recent domestic violence were at an increased risk of LBW, both in unadjusted and adjusted models.

Lastly, infants born to women exposed to sexual violence have been reported to be more frequently transferred to the neonatal intensive care unit (32).

To conclude, newborns of exposed mothers may be at increased risk of adversities. A review of the existing literature shows clearly that large, well designed studies are needed to advance current knowledge on the association between women's exposure to sexual violence and potential subsequent adverse neonatal outcomes.

1.3.5 Potential pathways towards adverse birth outcomes after previous exposure to sexual violence

Various mechanisms by which sexual violence may have negative consequences have been hypothesized, including biological, behavioral and emotional. These are described in a thorough review by Walsh, et al. (34) and in a report from WHO (9). Potential pathways include changes in the structure and function of the brain, dysregulation of the hypothalamic-pituitary-adrenal axis (HPA-axis), substance use and other mental morbidities after sexual assaults. However, further studies are needed to better understand and intervene in these complex pathways (34), including longitudinal studies, use of biomarkers and better confounding adjustments (9). In their recent study on PTB, Selk et al. (89) found increased odds for women exposed to severe sexual violence, but not those exposed to less severe abuse. Further, their results were adjusted for prenatal alcohol consumption, a previously hypothesized mechanism (93).

1.3.6 Methodological aspects of previous studies

As discussed in the previous sections, the relatively scarce literature reveals inconsistent findings, possibly reflecting the diverse methodological challenges of many studies, including use of different statistical analyses. To the best of my knowledge, there are no previous

studies on this topic with medically registered information on both the exposure and the outcome, except for the study by Larsen et al. (44). However, that study presented their findings on obstetric outcomes in no more detail than "complications of labor and delivery". Most researchers have obtained information on the exposure with *retrospective self-reports* (30, 62, 63, 69, 76, 80, 89, 90, 94, 95), and some studies have had *low response rates* (30, 63, 90, 94, 95). Others have recruited exposed women from support services, which may induce a selection bias and limit the generalizability of the findings (32, 71).

Using prospectively collected information on assaulted women entering the Rape Trauma Service in Reykjavik, Iceland, and record linkage to subsequent pregnancy and birth outcomes in the population-based Medical Birth Registry represents a unique opportunity for a vigorous study, complementing some of these methodological shortcomings of previous studies.

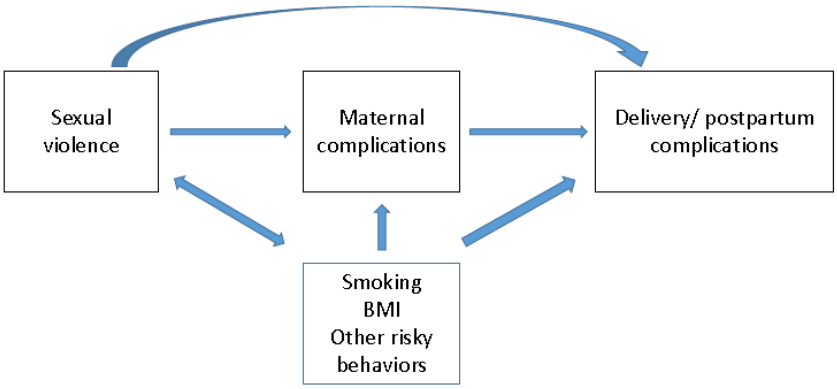

Figure 1. Potential pathways between the exposure and the outcomes

2 Aims

With this background, the overarching aim of this thesis was to explore possible associations between women's exposure to sexual violence in adolescence or adulthood and adverse pregnancy and birth outcomes later in their lives, using medically registered data on both exposure and outcomes.

The research consisted of three parts, presented in three separate scientific papers. The specific aims of each paper were as follows:

I. **Risk factors and health during pregnancy among women previously exposed to sexual violence.** The main aim of this study was to investigate the association between women's exposure to sexual violence and maternal health and lifestyle during subsequent pregnancies, e.g. maternal smoking, illicit drug use, obesity, and diseases during pregnancy. We also aimed to study whether the severity of the violence, age at the time of exposure to sexual violence, or time from exposure to delivery affected these associations.

II. **Obstetric outcomes of mothers previously exposed to sexual violence.** Our aims were to investigate the associations between women's history of sexual violence (in adolescence or adulthood) and adverse obstetric outcomes. We also aimed to analyze whether the associations were affected by age at the time of exposure to sexual violence and the time elapsed between the assault and delivery.

III. **Neonatal outcomes in infants of women with past exposure to sexual violence: A follow-up study.** We aimed to investigate the potential associations between mother's experienced sexual violence in adolescence or adulthood and risks of neonatal adversities. We furthermore aimed to identify whether risk profiles were different for those assaulted as teenagers than those assaulted in adulthood, and also whether time between exposure and delivery affected the risk estimates.

3 Materials and methods

The three studies on pregnancy, delivery, and neonatal outcomes (studies I, II and III, respectively) used similar methods. In studies II and III, the material was extended to include a larger number of non-exposed women and years of follow-up. Yet, all studies use prospectively collected data from the Rape Trauma Service in Reykjvik and the nationwide Icelandic Medical Birth Registry. The data sources are described in the following section.

3.1 Setting

Iceland is a country in the North Atlantic Ocean, and one of the Nordic countries along with Sweden, Norway, Denmark, and Finland. In 2013, Iceland had a population of approximately 320,000 inhabitants, with nearly 2/3 living in the capital, Reykjavik, or its surrounding cities (96). The annual number of births ranged from 4,000 to 4,900 in the years 2001 – 2010 (97). Life expectancy in Iceland is high (98), maternal mortality extremely low (99), and the neonatal mortality rates are among the lowest worldwide (100). At birth or immigration, inhabitants are assigned a unique national personal identification number (ID-number). Every contact with the public health care system is registered, along with underlying diagnoses, with his/her ID number, making record linkage between various data sources possible. The national healthcare system, which is largely financed by taxes, will not be described in detail here. However, the part of the healthcare system relevant for this study, maternal and obstetric healthcare, is fully paid for by the state treasury and free of charge for the mother to be. For

normal pregnancies, the suggested number of visits to midwives in primary healthcare is 10 for primiparas and 7 for multiparas, starting preferably around week 10 of gestation. Fetal ultrasound scans are performed around week 20 (101).

3.2 Data sources

3.2.1 The Rape Trauma Service

The Women's Movement, a political party, laid the ground for improved services for sexually assaulted individuals, and one important milestone in this development was the establishment of a Rape Trauma Service (RTS) in the early 1990's (102). The RTS is located in Reykjavik, at the Emergency Department of Landspitali – the National University Hospital of Iceland. Landspitali is the only tertiary referral hospital in the country. Approximately 2/3 of the population live in Reykjavik or its surrounding municipalities. Adding those who live within a 2-hour drive from Reykjavik, the proportion of Icelandic inhabitants who could rather easily seek services in Reykjavik increases substantially. The services at the RTS are free of charge and include an interview and assessment by a nurse, and a gynecological and forensic examination. Legal services, follow-up meetings, and since 2006 up to ten appointments with an expert psychologist are also offered. The services are available without referral at all hours for sexually assaulted adolescents or adults.

Information on the assault is registered in "RTS records", medical records which are on paper and stored separately from other medical records of the hospital. Using a checklist based on available information from the RTS records and following procedures used in a

previous study (103), all records from 1993 through 2010 have been coded and registered in an electronic database. Registered information includes date of attendance and assault, age, relation to perpetrator/s, site of assault, and severity categorized according to the NorVold classification (6). The vast majority of the records from 1993 through 2007 were coded by two raters, myself and another graduate student. In addition, an RTS managing nurse coded some records and other RTS staff members handled the coding of a few records to protect sensitive information on victims known by the main raters. Records from 2008–2010 were coded by another graduate student and the RTS managing nurse. To test inter-rater reliability, five percent of the records from 1998–2007 were randomly selected and re-coded. The kappa coefficient for individual items varied from 0.77 to 0.94. The error rate for data entry was < 0.15%. In addition, ID number, victim's age, and dates of assaults for those who attended in 2011 were registered for studies II and III.

The database is without ID numbers, but a key linking attendance numbers and ID numbers is kept separately for research purposes. To provide a better idea of the attendees, our previous work (excluding males) showed that from 1st January 1998 through 31st December 2007 a total of 1048 females attended the RTS (n=1153 attendances). The mean age was 24.2 years and most reported a recent exposure to penetrative sexual violence. Most perpetrators were strangers or peripherally known (41.3%), although 37.0% were friends, acquaintances or coworkers. A few were assaulted by family members (2.8%) or partners (4.0%) (15).

3.2.2 The Icelandic Medical Birth Registry

The Directorate of Health is a government agency, operated under the authority of the Ministry of Welfare. Its responsibilities, according to law, include the collection and processing of data on health, and the promotion of research (104). One of the registers held by the agency is the Icelandic Medical Birth Registry (IMBR), which is electronic and includes information on every birth in the country from gestational week 22. The IMBR includes various information on each pregnancy. These include place and time of birth, birth weight, length, head circumference, gestational age in weeks and days (according to ultrasound and/or first day of last menstrual cycle), mother's age, cohabiting status (living with partner or not), occupation of both parents (in text form), residence (postal code), and place of birth. For all diagnoses of mothers and infants, International Classification of Diseases (ICD) codes are registered, all updated according to the tenth version (ICD-10). NOMESCO (Nordic Medico-Statistical Committee) Classification of Surgical Procedures (NCSP) codes are also used.

Landspitali, the largest obstetric unit in the country (>70% of all births (105)) is the operational holder of the register. Data is sent from healthcare professionals at each place of birth to Landspitali, where it is verified by a specialized secretary. No formal validation of the IMBR has been conducted. However, in a recent study on hypertensive disorders, sensitivity analysis showed that women who had these diagnoses indeed had markedly higher blood pressure measurements in antenatal check-ups, as registered in maternity records, compared with women without such diagnoses (106).

3.2.3 Maternity records

At entry to antenatal care, each woman gets a maternity record in paper format, which is filled out by her midwife (and/or other healthcare professionals) during all visits. The record is kept by the woman during pregnancy and brought to every antenatal visit and the birthplace, where it is stored after delivery. Information listed in maternity records is therefore registered by healthcare professionals for both *a)* antenatal checkups, including regular measures of weight and blood pressure, and *b)* during and after delivery. Some of this information is sent to the IMBR after delivery. Other information, such as smoking, use of illicit drugs, height and weight, is not transferred from maternity records to the IMBR. These variables were therefore only available in paper format.

3.2.4 Approvals

Study I was approved by The National Bioethics Committee (VSNb2010050009/03.7) and The Data Protection Authority (2010060504AT/–). Approvals were also obtained from The Directorate of Health, and from Landspitali and all other birthplaces where maternity records were read.

Separate approvals were obtained for studies II and III. The National Bioethics Committee (VSNb2010050009/03.7) and The Data Protection Authority (2013040591HGK/--), approved of the study, in addition to acceptance from Landspitali and The Directorate of Health. Approvals are shown in the appendix.

3.3 Design and methods

All data, both at attendance due to the sexual assault as well as for pregnancy and birth, was systematically recorded independently of the present study by attending healthcare professionals. A key aspect of the research design in these studies was record linkages of these independent data sources, using personal identification numbers (ID numbers). A data administrator at the Technology center at Landspitali was in charge of all record linkages for the three studies. By linking ID numbers of women who attended the RTS, their subsequent births could be identified in the IMBR, which also made data collection from maternity records possible. After record linkage, I received a dataset with encrypted study IDs. Thus, no women were contacted for the study, and data were analyzed anonymously. This procedure was approved by the National Bioethics Committee and the National Data Protection Authority.

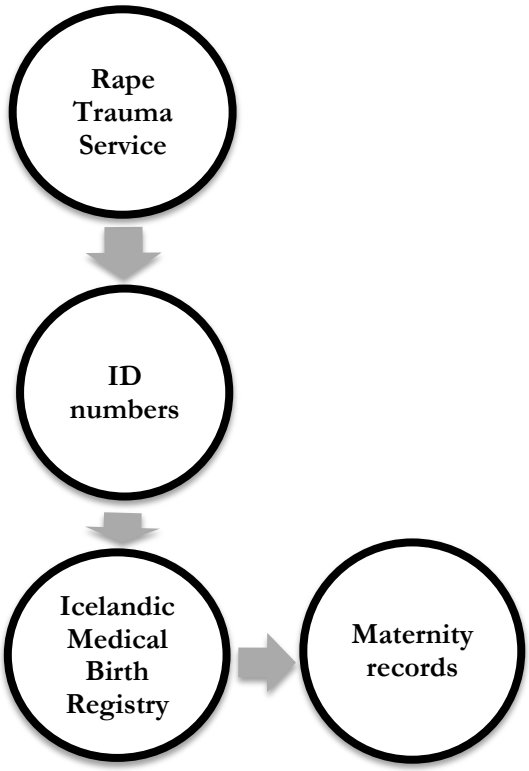

Figure 2. The record linkage

3.3.1 Study I – setting and population

The exposed group was identified by linking ID numbers of all 1,421 women who had attended the RTS from 1993 through 2008 with the IMBR. By the end of follow-up in April 2011, 594 women were identified in the IMBR, for a total of 925 subsequent births (exposed cohort). For comparison, we randomly selected women who had not attended the RTS (with a ratio 2 for every exposed woman) as the non-exposed cohort. Two criteria for selection were used:

1) Time: The women had to have delivered in the same month of the same year as the exposed women.

2) Birthplace: The random selection of non-exposed women was

stratified by birthplace (corresponding to birthplaces of exposed women). For deliveries occurring at Landspitali, the matching was restricted to deliveries at Landspitali, and deliveries from other birthplaces were matched with deliveries outside of Landspitali.

When randomly selecting women for the non-exposed cohort, some mothers were randomly selected more than once, resulting in a cohort of n=1,771 (instead of 1,850 with 2:1 ratio). Afterwards, the study population was restricted to Icelandic women, due to differences in the proportion of women with foreign citizenship between the exposed and the non-exposed cohorts. The final study population included 2,556 pregnancies; 915 pregnancies of 586 exposed mothers and 1,641 of non-exposed mothers. The vast majority of these women delivered in the year 2000 or later (median year 2006).

3.3.1.1 *Study I – data from the Rape Trauma Service*

Although a variety of information was available (described above), the main variables for the purpose of this study were age at assault, timing (calendar time) of assault and severity of the violence, as categorized by NorVold (6). We stratified some analyses according to age at the time of exposure and time that had elapsed from exposure to delivery. For women who had attended the RTS more than once (due to repeated assaults), age categorization refers to age at *first* attendance. However, date of the *most recent* assault was used when calculating the number of months between the date of assault, as reported by the woman at the time of RTS registration, and the date of delivery. When the date of assault was not registered, the date of attendance was used.

3.3.1.2 *Study I - data from maternity records*

The principal aim of the first study was to understand whether history of sexual assault was associated with adverse maternal health indicators during pregnancy. We therefore compared the prevalence of selected risk factors during pregnancy between the exposed and non-exposed cohorts. However, risk factors such as smoking, illicit drug use, and body mass index are not registered in the IMBR. Thus, this information was manually collected from maternity records. I received a list of ID numbers and date of delivery for women in both the exposed and non-exposed cohorts from the Landspitali database administrator. Blinded with respect to the exposure status of each woman, I travelled around the country and collected this data (with the assistance of a trained research assistant in Reykjavik, who also collected data from maternity records of women personally known to me). Except for one large birthplace that denied access to these data, maternity records from five of the largest birthplaces were studied (n=2,773).

Height and weight are measured and registered by midwives in antenatal care. We used height and weight measured at the first visit to calculate BMI, and adjusted for pregnancy length at the first weight measurement. By subtracting the first weight measurement from the last, we calculated pregnancy weight gain. We followed the Institute of Medicine's (IOM) recommendations for US women (107) when assessing maternal weight gain, which have previously been used in Iceland (108). Adequate weight gain is considered 12.5-18 kg for underweight (BMI <18.50), 11.5-16 kg for normal weight (BMI 18.50-24.99), 7-11.5 kg for overweight (BMI 25.00-29.99), and 5-9 kg for

obese women (BMI ≥30.00) (according to pre-pregnancy BMI). The weight gain analyses were restricted to singleton pregnancies where weight measurement had been conducted before day 140 of the pregnancy (mean gestational age at first and last measurements was 90.4 and 269.9 days, respectively).

At the first antenatal visit, midwives register smoking status, according to the women's self-reports. Their answers are in text form. We categorized smoking as: Nonsmokers (never smokers or smokers who quit before or soon after onset of pregnancy), and smokers (a) <10 cigarettes per day, b) ≥10 cigarettes per day, and c) undefined frequency). Illicit drug use is also registered in maternity records, mostly based on self-reports but, for some women, drug tests.

3.3.1.3 *Study I - variables obtained from the IMBR*

Age, cohabitation, occupation, residence (postal code), *parity* and *number of prenatal* visits are registered in the IMBR. Occupation is a text variable, for both parents. We received information on occupation in text form and categorized it as: a) employed, b) unemployed, fulltime at home or on disability pension, and c) student. Those who were listed as both employed and a student or at home were considered employed. Those registered as both a student and on disability pension were categorized as students.

For antenatal diagnosis, *gestational diabetes* was defined as ICD-10 codes O24.4 or 24.9, *gestational hypertension* as O13, and *pre-eclampsia* as O11, 14, or 15.

3.3.1.4 *Study I – statistical analysis*

We studied the prevalence of maternal risk factors between the exposed and non-exposed cohorts, using Poisson log-linear models with robust error variance. The results are presented as relative risks (RR) with 95% confidence intervals (CI), calculated as the ratio of the proportion of exposed vs. non-exposed women with index outcome or characteristic in each line. We analyzed separately:

a) All exposed women's pregnancies.

b) Restricted the exposed cohort to each exposed woman's first subsequent pregnancy after the exposure (3/4 were primiparas).

We adjusted our multivariable models for age, parity and year of delivery. When analyzing weight related outcomes, we also adjusted for length of gestation at the time of weight measurement. Also, we conducted separate analyses on primiparous women. Lastly, we conducted analyses on maternal smoking and illicit drug use and restricted the exposed population to women who were exposed to penetrative sexual violence. We also stratified the analyses by the woman's age when she attended the RTS and time from assault to delivery, before the age of 20 or older. This cut-off in age was chosen since it reflects the general age at which most Icelandic students complete a four-year elective upper secondary education. Time was divided into three categories. These analyses were restricted to first subsequent pregnancy after exposure.

We used IBM SPSS Statistics versions 20.0 (109) and 22.0 (110) to analyze the data.

3.3.2 Studies II and III – setting and population

As in Study I, a data administrator at Landspitali conducted the record linkage between data sources. With longer follow-up at both the RTS and the IMBR, the exposed cohort now included 666 women with Icelandic citizenship. They had attended the RTS from 1993 through 2011 and had at some point later in time had a singleton pregnancy, through December 31, 2012. The total number of deliveries of these women was 1,068. For every pregnancy and birth of an exposed woman, we randomly selected 10 non-exposed women who had not attended the RTS through 2011. Unlike study I, the non-exposed cohort was matched by age at birth, parity and period of the year, but not by birthplace:

- *Maternal age.* For exposed women aged 20-39 years, women at the exact same age were selected. For exposed women aged a) ≤19 years or b) ≥40 years, the matched non-exposed women were in the same age group.
- *Parity.* Primiparas were matched with primiparas and multiparas with multiparas.
- *Calendar season of delivery.* Matching was done by season of delivery, within the same year. Each calendar year was divided into three groups, January-April, May-August, or September-December.

The data administrator used a computerized program to randomly select women for the non-exposed comparison cohort; we aimed to select 10 births by Icelandic mothers for each exposed mother's birth. However, in some cases fewer than 10 women fulfilled the matching

criteria, and the same non-exposed birth was only used once.

The final study population included 9,126 deliveries of non-exposed women and 1,068 of exposed women in Study II. However, in Study III, we restricted the group to live-born singleton infants, resulting in a study population of 9,104 infants of non-exposed mothers and 1,067 infants of exposed mothers.

3.3.2.1 *Studies II and III - data from the RTS*

The only variables we used in studies II and III as exposure characteristics were age and date of attendance.

3.3.2.2 *Studies II and III - data from the IMBR and Maternal Records*

The available background information differed somewhat from study I, due to an altered approval from the Data Protection Authority. In these studies, we did not receive postal code information for the women. Occupation was further pre-categorized by the data administrator at Landspitali before we received the dataset. Students or not working (unemployed, on disability benefit or a fulltime homemaker) were categorized accordingly; all remaining mothers were considered employed. Those with missing information would therefore have been considered employed. The proportion of missing information was small (as shown in Table 1, Study I).

3.3.2.2.1 Delivery outcomes – study II

The following ICD-10 codes were used to define these outcomes: *Labor dystocia* (primary (O62.0), secondary (O62.1) and unspecified (O62.2) dystocia, prolonged first (O63.0) and second (O63.1) latent phase, or unspecified prolonged labor (O63.9)), *maternal distress*

during labor and delivery (O75.0), *antepartum bleeding* (O44–46, including placental abruption O45), *elective caesarean section* (O82.0), and *emergency caesarean section* (O82.1).

The following NCSP codes were used to define obstetric interventions: *Induced labor* (MAXC00, 02, 09), *instrumental vaginal delivery (either forceps or vacuum extraction)* (MASE00, 03, 96; MASF00, 10, 96, MASG03, 13, or ICD-10 O81.0, O81.1, O81.2, O81.3, O81.4, O81.5), and *emergency instrumental delivery* (defined as either vaginal instrumental delivery or emergency cesarean delivery).

3.3.2.2.2 Neonatal outcomes – study III

Ultrasound is routinely conducted around week 20 of gestation (101), and this assessment was used to estimate gestational age. When not available, last menstrual period was used (n=11). *Preterm birth* was defined as birth before 37 completed weeks of gestation (<259 days) and births between 32 and 36 weeks (224 and 258 days) were considered *moderately PTBs*. Elective cesarean sections (ICD-10 code O82.0) and induced labor (NCSP codes MAXC00, 02 or 09) were considered *medically indicated births*. Those who were not assigned these codes were considered to have *spontaneous* births. The calculation of *SGA* relied on the Swedish reference curve for normal fetal growth (111). We used the formula to calculate the fetal growth rate index and identified separately a cut-off value of fetal growth rate index below the 10^{th} percentile for our non-exposed cohort. This cut-off value was used to define SGA in our study population. "Observation of infant" is a variable registered in the IMBR, where

Transferral to the Neonatal Intensive Care Unit is one option. Other outcomes include *epidural analgesia* (NCSP code ZXX30). The following ICD-10 codes were used to examine neonatal health outcomes: *Singleton, born in hospital* (a primary diagnosis, healthy infants with no other diagnosis) (Z38.0), *pneumonia or respiratory distress* (J15, J18, P23, P36, P22, P25), *neonatal jaundice* (P59.0, P59.9), *cephalhaematoma due to birth injury* (P12.0), and *other neonatal hypoglycemia* (P70.4).

3.3.2.3 *Studies II and III – statistical analysis*

Differences in background characteristics between the groups are shown in Table 1 in each study. In Study III, a chi-square significance test for categorical variables, at a significance level of $\alpha=0.05$, was used. For other tables, we used Poisson log-linear models to assess differences in the prevalence of obstetric outcomes between exposed and non-exposed groups. Since the non-exposed cohort was selected by matching, the crude models were inherently adjusted for age, parity, season and year of delivery. We also presented adjusted models, where we additionally adjusted for concurrent socioeconomic status (occupation and cohabiting status at the time of delivery).

Further, we examined the effects of age at exposure and time between assault and delivery in stratified analyses:

A) Mother's age at attendance to the RTS, *teenagers* (12-19 years of age, median 17 years), or *adults* (≥20 years, median 23 years). This cut-off in age was chosen since it reflects the general age at which most Icelandic students complete a four-year elective upper secondary education.

B) Time, calculated as number of completed months between day of assault and day of delivery. Time was dichotomized into ≤5 or >5 years, and this stratification reflects the median time from assault to delivery (5.1 years).

For women who attended the RTS more than once, age was according to first visit, whereas time was calculated from the most recent attendance. Time stratified analyses were adjusted for maternal age, parity (primiparous or multiparous), and year of delivery.

3.3.2.3.1 Additional analyses in Study II

The IMBR does not include electronic information about smoking and BMI. Utilizing data from Study I (n = 792 exposed and n = 1,416 non-exposed women), we had the possibility to estimate the role of these factors on delivery outcomes. Study I consists of a sub-sample of exposed women from Study II, but the non-exposed women differed between the two studies, since they are both fewer and were selected with different matching criteria. We showed two models, with and without adjustments. The first model was adjusted for age, parity, year and month of delivery (the matching variables from Study II). The second model was aimed at analyzing the effects of maternal smoking and BMI and was therefore adjusted for these factors.

3.3.2.3.2 Other statistical analyses in Study III

In Table 2, linear regression models were used to compare the means for continuous outcomes. Additional models were presented, adjusting for gestational age and concurrent socioeconomic status.

Table 2. Methodological differences between the three studies

	Method characteristics			Data sources		
Study	**Exposed vs. non-exposed**	**Matching**	**Population**	**RTS**	**IMBR**	**Maternity records**
I	≈1:2	Month and year of delivery, Reykjavik/ other	All pregnancies	1993-2008	To April 2011	Yes
II	≈1:10	Age, parity, season and year of delivery	Singleton deliveries	1993-2011	Through December 31, 2012	For sub-analysis
III	≈1:10	Age, parity, season and year of delivery	Liveborn singletons	1993-2011	Through December 31, 2012	Not used

4 Results

4.1 Results from Study I - pregnancy

4.1.1 Women's background

During their *first* subsequent pregnancy after the exposure, exposed women were younger than the non-exposed (mean age 24.4 years vs. 29.3 years, median age 23.0 and 29.0 years, respectively). Further, they were more likely to be unemployed, on disability pension or fulltime at home (7.8% vs. 4.3%; aRR 2.42, 95% CI 1.49-3.94) and not cohabiting (45.6% vs. 14.2%; aRR 2.15, 95% CI 1.75-2.65), when compared to non-exposed women (Table 1, paper 1). Similar differences were seen when comparing these background characteristics between *all* subsequent pregnancies of exposed women (mean age 25.3 years, median 25.0) and the non-exposed cohort.

4.1.2 Behavioral risk factors

Compared with non-exposed women, exposed women were more often smokers during their first subsequent pregnancy (45.4% vs. 13.5%; aRR 2.68, 95% CI 2.25-3.20) (Table 2, paper I). When analyzing the risk of smoking 10 or more cigarettes per day at some point during pregnancy, the overall risk, adjusted for age, parity and year of delivery, was 3.55 (95% CI 2.46-5.12). When stratified by age, the relative risk for those who were assaulted as teenagers was 2.17 (95% CI 1.33-3.54) but 4.04 (95% CI 2.81-5.83) for women assaulted as adults (Table 3, paper I). The exposed women further had an increased risk of having a registered use of illicit drugs at least once during

pregnancy (3.4% vs. 0.4%; aRR 6.27, 95% CI 2.13- 18.43) (Table 2, paper I). The risk of using illicit drugs seemed to diminish with longer duration from assault to delivery (Table 3, paper I). Associations between exposure and increased risks of obesity and weight gain below the recommendations were marginally significant (Table 3, paper I). Additional analyses showed that exposed primiparas were more likely than non-exposed primiparas to be obese (15.5% vs. 12.3%; aRR 1.56, 95% CI 1.15-2.12). Furthermore, adjusting for women's occupational status had minimal or no influence on these associations.

4.1.3 Maternal health

The overall risk of adverse maternal health outcomes (pregnancy induced hypertension, pre-eclampsia, and gestational diabetes), was not statistically significantly different between exposed and non-exposed women (Table 2, paper I). However, analyses stratified on age categories of assault showed that women who were assaulted as adults were at elevated risk of gestational diabetes (RR 1.99, 95% CI 1.01-3.95). Similarly, delivering within three years of being assaulted was also associated with gestational diabetes (RR 2.60, 95% CI 1.14-5.90). After adjusting for BMI, the risk estimates were not statistically significant (RR 1.23, 95% CI 0.65-2.30 and RR 1.88, 95% CI 0.65-5.40, respectively). Due to differences in study size and methods between study I vs. studies II and III, we here present additional analyses on the association between assault and maternal diseases during pregnancy in the larger dataset (Table 2). The results revealed that exposed women had reduced risk of being diagnosed with pre-eclampsia but a 55% increased risk of gestational diabetes (RR 1.55, 95% CI 1.04-2.31), unadjusted for BMI.

Table 3. Comparison of maternal health diagnosis between the two datasets.

	Study I			Study III		
	Non - exposed	Exposed		Non - exposed	Exposed	
Diagnosis	**n (%)** **1641**	**n (%)** **915**	**RR (95% CI)[a]**	**n (%)** **9104**	**n (%)** **1067**	**RR (95% CI)[b]**
Gestational hypertension	46 (2.8)	29 (3.2)	1.18 (0.73 – 1.90)	225 (2.5)	36 (3.4)	1.37 (0.96 – 1.95)
Pre-eclampsia	62 (3.8)	27 (3.0)	0.70 (0.44 – 1.11)	329 (3.6)	26 (2.4)	0. 67 (0.45 – 1.00)
Gestational diabetes	39 (2.4)	25 (2.7)	1.37 (0.76 – 2.48)	204 (2.2)	37 (3.5)	1.55 (1.04 – 2.31)

[a]Adjusted for age, parity and year of delivery. Data matched by month of delivery and Reykjavik vs. non-Reykjavik delivery

[b] Data matched by age, parity, and season of delivery within the same year

4.2 Results from Study II – delivery

4.2.1 Background

Fewer exposed women than non-exposed were employed (54.4% vs. 67.6%) and cohabiting (59.1% vs. 77.3%), but a higher proportion delivered in Landspitali, the tertiary specialized hospital (77.5% vs. 67.1%).

4.2.2 Labor characteristics

Compared to non-exposed women, exposed women had an increased risk of prolonged first stage of labor (RR 1.40, 95% CI 1.03-1.88), being diagnosed with maternal distress during labor and delivery (RR 1.68, 95% CI 1.01-2.79), and antepartum bleeding (RR 1.95, 95% CI 1.23- 3.07) (Table II, paper II). These outcomes were further studied by stratification of age when attending the RTS. With the exception of

antepartum bleeding, these risk elevations among exposed women seemed largely limited to women assaulted before the age of 20 (Table III, paper II). Analyses of our sub-sample showed that the relative risks were similar with or without adjustments for smoking and BMI (Table II, paper III).

4.2.3 Delivery interventions

Compared to non-exposed women, exposed women had an increased risk of an emergency instrumental delivery (RR 1.16, 95% CI 1.00-1.34) (Table IV, paper II). As with labor characteristics, stratification by age at assault showed that the increased risk was mainly among those who attended the RTS <20 years of age; for emergency instrumental delivery (RR 1.21, 95% CI 1.02-1.44) and instrumental vaginal delivery (RR 1.29, 95% CI 1.00-1.66). Conversely, the younger age group had a decreased risk of having an elective cesarean section (RR 0.56, 95% CI 0.34-0.93), whereas no differences were found when comparing those assaulted in adulthood to the non-exposed women (Table V, paper II). Again, the relative risks were similar in the main model and when additionally adjusting for smoking and BMI in our sub-sample (Table IV, paper II).

4.3 Results from Study III – neonatal outcomes

4.3.1 Background and infant characteristics

The matching variables, age, parity and season of delivery, were comparable between the exposed and non-exposed cohorts ($p>0.9$), nor was infant's sex different between the groups. Compared to non-exposed mothers, exposed mothers were more often not working (24.3% vs. 10.3%, $p<0.01$) and not cohabiting with a partner (39.3%

vs. 21.2%, p<0.01). The exposed mothers delivered more often at Landspitali (77.5% vs. 67.0%, p<0.01) and a higher proportion had an epidural administered during labor (30.2% vs. 26.5%, p<0.01). Mode of delivery did not differ between the groups when categorized as non-instrumental (vaginal) delivery and instrumental (vaginal or cesarean) delivery (p=0.27). The proportion of mothers who had an antenatal diagnosis differed between the groups; gestational diabetes was diagnosed more frequently among exposed mothers (3.5% vs. 2.2%, p=0.01), whereas pre-eclampsia was diagnosed less frequently (2.4% vs. 3.6%, p<0.05) (please also refer to our additional analyses in Table 2 above). The results for gestational hypertension were not statistically significant (3.4% of exposed vs. 2.5% of non-exposed mothers, p=0.08)

4.3.2 Gestational length

Infants of exposed mothers were born on average one day earlier than neonates in the non-exposed cohort (279.7 days vs. 278.7 days, p<0.01). When adjusted for mother's concurrent socioeconomic status, the results were not statistically significant (p=0.08) (Table II, paper III).

Analysis of gestational length in categories showed that infants of the exposed mothers were less often born at term (37 to 42 weeks) (88.8% vs. 91.5%) and had increased risk of being born preterm (RR 1.49, 95% CI 1.13-1.97) compared to infants of non-exposed mothers. These were mainly moderately PTBs (RR 1.64, 95% CI 1.24-2.19). Again, adjusting for mother's concurrent occupation and cohabiting status lowered the risk estimates of PTB (Table III, paper III), but the findings remained statistically significant for moderately PTB (RR 1.42, 95% CI 1.06-1.91). Furthermore, stratified analyses showed that

the risk elevation was mainly apparent among infants of mothers who were assaulted before the age of 20 (RR 1.61, 95% CI 1.14-2.26) rather than later (RR 1.32, 95% CI 0.86-2.03), compared to non-exposed women (Table IV, paper III).

4.3.3 Infant size

Compared to the non-exposed cohort, infants in the exposed cohort were on average lighter (3573.6 g vs. 3675.6 g), shorter (50.9 cm vs. 51.5 cm), and had a smaller head circumference (35.4 cm vs. 35.7 cm) ($p<0.01$ for all outcomes, both crude and when adjusted for *a)* gestational age and *b)* mother's concurrent socioeconomic status) (Table II, paper III)). Furthermore, they were at a marginally increased risk of being small for their gestational age (RR 1.18, 95% CI 0.98-1.42).

4.3.4 Health and viability

Compared with infants of women in the non-exposed cohort, infants of exposed mothers had a marginally significantly greater risk of having an Apgar score <7 at 5 minutes after delivery (RR 1.36, 95% CI 0.96-1.94), which is an indication of a neonate more likely to need resuscitation. They were also at an increased risk of being transferred to the Neonatal Intensive Care Unit (RR 1.35, 95% CI 1.05-1.73). The risk estimates were similar when adjusted for mother's concurrent socioeconomic status (Table III, paper II). Stratified analyses revealed that the risk was largest among infants of those who attended the RTS before the age of 20 and delivered not later than five years later, compared to infants of non-exposed women.

As to neonatal diagnoses, neonates in the exposed cohort were at an increased risk of hypoglycaemia (RR 2.16, 95% CI 1.33-3.50) and marginal risk of neonatal jaundice (RR 1.31, 95% CI 0.98-1.76). Additionally, they were less likely to receive the diagnosis “Singleton, born in hospital” (RR 0.91, 95% CI 0.87-0.95), which is an indication of a healthy neonate (Table V, paper III).

5 Discussion

5.1 Summary of main findings

The majority of mothers previously exposed to sexual violence had uncomplicated birth and neonatal outcomes. However, our data point to increased risks of some adversities at the time of pregnancy and delivery, when comparing exposed mothers to non-exposed mothers. Most of the risk increase was moderate. Figure 3 sums up findings from all three papers.

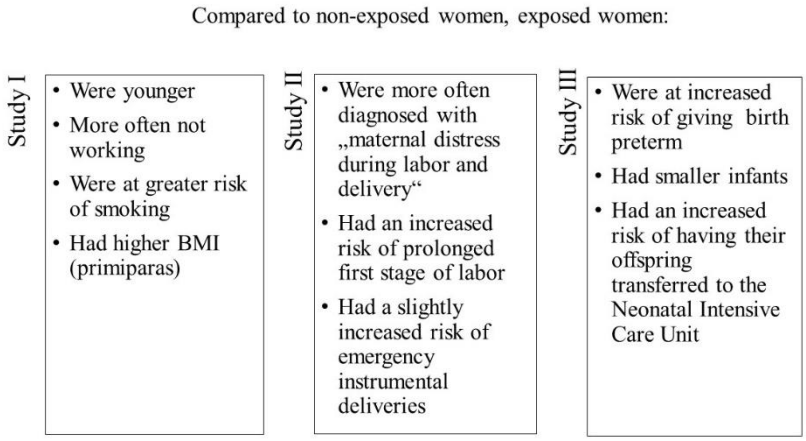

Figure 3. Summary of main findings

5.2 Strength and limitations

5.2.1 Methodological approach

The studies were population based, with a complete follow-up of pregnancies, birth, and neonatal outcomes for women who had sought medical services after being exposed to sexual violence. Information on both the exposure and the outcomes was systematically registered

by healthcare professionals at the time of contact with healthcare services, independently of the study. In contrast to most previous studies, our study is free from recall bias since women were not asked about their exposure history. With the exception of a recent study by Larsen et al. (44), I am unaware of studies that have utilized an approach similar to ours. Since Larsen et al. only reported "maternal disorders related to pregnancy" and "complications of labor and delivery" in categories, I am unaware of studies that have utilized similar data and published detailed findings on obstetric outcomes within this field. However, some methodological aspects of our approach should be discussed:

The complete follow-up of all pregnancies (beyond 22 weeks of gestation) and births among assaulted women seeking services at the RTS reduced problems related to selection. *Selection bias* refers to the participation in a study, whether individuals can choose to participate or not, and that the choice of participants can also be made by the investigators (112). In the MoBa study for example, the participation rate was around 40% and the investigators have reported an under-representation of young mothers, single mothers, and mothers who smoke, indicating that the participants' lifestyles may have been healthier than the non-participants' (113). Consequently, results on, for example, the prevalence of sexual violence and smoking may be underestimated. However, MoBa researchers concluded that estimates of associations between exposure and outcome would not be affected by self-selection of the participants (113).

However, even though we did not select our participants, we cannot rule out that some sort of selection was associated with seeking services from the RTS, and those women differed from exposed women in the population who did not seek such services. Located at the emergency department, the RTS may serve cases of the most violent incidents of sexual violence, whereas those exposed to chronic abuse and those assaulted by known perpetrators may be less likely to seek services (15). Larsen et al. (44), who found an increased risk of morbidity both before and after attendance at a center similar to the RTS, suggested that socioeconomic status or health profile might differ between exposed women who attend and those who do not attend the center. We found substantial differences between exposed and non-exposed cohorts regarding socioeconomic status (occupational status and cohabitation status) at the time of birth (all papers). Yet, since we only have information on socioeconomic status at the time of birth, not at the time of attendance, we cannot tell whether socioeconomic status changed, or did not develop as it would have done among young women, as a consequence of the violence - or reflects status before the assault. The services at the RTS and maternal health care/delivery units are free of charge and accessible for all women in the population (with the exception of restricted access due to location). However, it is possible that women of the highest social status in the population seek help elsewhere, for example from their private gynecologists. Also, since all exposed women in our study population sought medical help, they may have worked through their trauma exposure differently than those who have been exposed but have not sought any help. It is also possible that different choices regarding childbearing induce selection

bias in our study. We do not have information on wether exposed women are more, less, or equally likely as non-exposed women to continue with pregnancy. It can by hypothesized that some women may have chosen not to become pregnant, had an abortion, or avoided sexual contact with men following the exposure.

5.2.1.1 *The data sources and risk of bias*

All three studies relied solely on one source of exposure documentation, attendance at the RTS. Since only a minority of women exposed to sexual violence attended the RTS, there is a risk of *information bias, misclassification*. Some women with prior history of exposure to sexual violence were in this study considered non-exposed, since they did not attend the RTS. If there is an association between the exposure and outcomes, this misclassification would bring the relative risks closer to the null. It is also a limitation that we do not have information on other trauma exposures.

Another possibility of misclassification is the outcome registration. The IMBR has not been validated, and cannot be assumed to be 100% accurate. However, to be of concern in these studies, misclassification of the outcomes would have to be *differential*, that is, different between the exposed and non-exposed cohorts. We cannot rule out that for some diagnosis or outcomes; registration, or the tendency to diagnose women with some outcomes, may be differential across exposure status. For example, women of lower social status may be more likely to be screened for illicit drug use than those of high social status. It can also be hypothesized that this could occur for a diagnosis such as “maternal distress during labor and delivery”; a diagnosis that

may be used when a woman does not collaborate well or expresses feelings of being exhausted. This could lead to overestimation of risks for the exposed cohort. On the other hand, as we were blinded with regard to exposure status when retrieving information from the maternity records (including illicit drug use and smoking), potential errors in data collection should have been *non-differential*, that is, equal for both cohorts. Lastly, it is a limitation that risk factors such as smoking and BMI are not registered electronically in the IMBR. These factors may act as confounders or mediators of the association between sexual violence and adverse birth outcomes. However, we had a chance to estimate the influence of these factors on delivery outcomes, and the results remained more or less unchanged. Also, these factors are strongly associated with socioeconomic status, which when accounted for did not change the RRs of adverse neonatal outcomes considerably.

5.2.1.2 *Selection of the non-exposed cohort*

Residence may affect the risks of adverse maternal and obstetric outcomes (114). Since both the specialized services for sexual violence and obstetrics are in Reykjavik, it can be expected that exposed women were more likely to deliver in Reykjavik. Since the selection of the non-exposed cohort was matched by place of delivery in the first study, women with complicated pregnancies (perhaps living in rural areas but referred for special care) may have been overrepresented in the non-exposed cohort. We therefore refrained from this matching criterion when randomly selecting non-exposed women for the two subsequent studies.

5.2.1.3 *Statistical power*

A power calculation was conducted early in the study phase. Having two women in the non-exposed cohort was considered to give sufficient power when the estimated RRs were above 1.5 and the prevalence of the outcomes was at least 10%. However, for less frequent outcomes and lower estimated RRs, ten women would be needed in the non-exposed cohort for sufficient statistical power. For prevalent outcomes such as smoking or cesarean section, the statistical power was clearly sufficient in Studies I and II, whereas we had limited power for outcomes such as maternal diseases during pregnancy. When comparing the two datasets on these outcomes, Table 3 shows some differences in statistical power with extended ratio of included non-exposed women to the study, while the overall pattern in results remains the same.

5.3 General discussion

5.3.1 Main findings compared with current and previous studies

The literature on the possible adverse effects of exposure to sexual violence and subsequent adverse birth outcomes has revealed mixed findings. The three studies presented in this thesis add significantly to the fragmented knowledge base within this important area.

Nearly half of the exposed women in our population were smokers, compared to 22% of MoBa participants exposed to severe sexual violence (30). This difference may also have been due to selection forces elicited in participation rates in MoBa, as discussed earlier. Also, that study only included term deliveries, which may have led to underestimation of smoking, since smoking is associated with PTB

(68). Nevertheless, in their study on nurses and the risk of PTB in relation to sexual violence exposure in childhood or adolescence, Selk et al. (89) reported a lower prevalence of smoking among exposed women. Still, the prevalence was somewhat higher among those exposed to forced sex (18%) than non-exposed women (11%). I do not have explanations as to why the prevalence of smoking was larger in our study than other studies and we can only speculate about possible explanations. Perhaps, our exposed group, women who sought medical services for sexual violence, is different from other study populations which may have influenced the rate of smoking during pregnancy. Also, smoking rates among those in our study population who were assaulted as adults seemed greater than for those exposed earlier. Exposed primiparas in our study were at an increased risk of obesity. As with smoking, we do not have information on BMI at the time of exposure, though it was in line with previous findings, which have indeed reported an increased risk of obesity following exposure to sexual violence (38, 115) and for women with PTSD (116).

Exposed women had increased risks of the ICD-10 diagnoses of prolonged first stage of delivery and maternal distress during labor and delivery. I am not aware of previous studies analyzing these associations, though they could reflect other measures which have been reported. Fear of childbirth has been associated with slower labor (117, 118), and this could also possibly reflect impaired confidence in healthcare professionals among exposed women (119). A disturbing perception of progress examinations and feeling like their body refuses to give birth have further been described in a qualitative study from Norway (77).

Studies have been inconclusive regarding delivery interventions. As described in the background section, two of the largest and most recent studies on delivery interventions, MoBa (30) and Bidens (80), showed somewhat inconsistent findings, and our findings also differed from their findings. In contrast with these studies, which used logistic regression models to obtain odds ratios (OR), we used Poisson regression to estimate relative risks. Poisson regression models are more conservative, which may have added to some discrepancies. Apart from other methodological differences (described in section 1.3.4.2.), we do not have explanations for why our findings contrast with some previous findings and not others. We found no difference regarding the risk of elective cesarean sections, except for a decreased risk among those assaulted in adolescence. Conversely, the risk of elective cesarean sections was greater in the MoBa study (30) and for subgroups in the Bidens study, which showed a greater risk for primiparas assaulted in adulthood (80). However, they also showed an increased risk of instrumental deliveries, that is, either cesareans or operative vaginal deliveries. The results for primiparas were borderline significant (adjusted odds ratio (AOR) 1.16, 95% CI 0.99-1.36), which was identical to our results for exposed women overall (RR 1.16, 95% CI 1.00-1.34).

One of the most noticeable findings in this thesis was the increased risk of PTB. In a recent review, Wosu et al. (88) found mixed results on the risk of child sexual abuse survivors giving birth preterm. They concluded that longitudinal and rigorously designed studies were needed on the topic, and that studies should distinguish between subgroups of PTB. We showed that the risk of PTB is mainly

explained by an increased risk of *moderately* PTB. Even though it is not as severe as *very* preterm birth, which we did not have statistical power to draw conclusions about, moderately PTB is associated with both morbidity and mortality (120, 121). Findings on PTB overall in the MoBa study were only significant in crude models (OR 1.28, 95% CI 1.08-1.51 for those exposed to severe sexual violence) (90). They did not show models that solely adjusted for covariates such as age and parity, only the fully adjusted model, including smoking and education (OR 1.15, 95% CI 0.97-1.37). However, as in our study, information on women's socioeconomic status at the time of exposure was not available in the MoBa study. It is therefore unknown whether socioeconomic status is a confounder or a mediator in the possible association between sexual violence and PTB. Also, the prevalence of PTB in our exposed cohort was 5.9%, the same as for women exposed to severe sexual violence in the MoBa study. However, the prevalence among our non-exposed cohort was 4.0%, in contrast to 4.7% in the MoBa study. Moreover, Noll et al. (93) found an increased risk of PTB among women with a history of child sexual abuse compared to those non-exposed. They concluded that the association was mediated through prenatal alcohol consumption among exposed mothers. However, in a recent paper from the Nurses' Health Study II on childhood maltreatment and the risk of PTB, Selk et al. present their findings adjusted for various covariates, including alcohol consumption and smoking. The risk of PTB was around 20% both before and after multivariate adjustments, both for those assaulted in childhood and those assaulted in adolescence (89).

5.3.1.1 *Age at attendance*

For all three studies, we aimed to analyze whether age at the time of attendance at the RTS, or time between assault and birth, had effects on the results. Overall, the increased risk of adversities was mainly evident in the younger age group, indicating that age at exposure may be critical for subsequent birth outcomes. Large studies on adversities in childhood have found dose-response associations with various negative health outcomes, that is, the risk of adversities increases as the number of experienced adverse childhood events increases (122). Others have found consistent positive associations between childhood exposure to violence and cardiovascular disease, whereas studies on adult exposure revealed mixed findings (123). Also, the risk of PTSD is somewhat greater for women exposed to sexual violence in childhood than for those exposed in adulthood (124), and re-victimization increases the association with psychiatric disorders (26). Pathways by which women assaulted as teenagers are at greater risk for later negative health outcomes than those assaulted later are not clear, but exposure during a more sensitive age period and risk of re-victimization may contribute to the differences. In a recent publication from the Nurses' Health Study, women exposed to forced sex in childhood were at approximately 20% increased risk of PTB, and the results were similar when stratified by age (<10 or 11-17 years) (89). It would have been interesting if they had also reported their findings for those exposed after the age of 17.

5.3.2 Potential pathways

There is no simple answer to what may cause an association between sexual violence and adverse birth outcomes. Some mechanisms have been hypothesized and will be discussed in the following sections.

5.3.2.1 *Maternal risk factors*

Two of the most important preventable risk factors for adverse pregnancy and birth outcomes are maternal smoking and obesity (68). These risk factors were studied in Study I. Over 4 of every 10 women in our exposed cohort were registered as smokers during pregnancy, and 15% reported smoking 10 or more cigarettes per day (Paper I). That equals a relative risk of 3.55 for victimized women smoking heavily, compared to non-exposed women. Since smoking and a high BMI are associated with both adverse obstetrical outcomes and exposure to sexual violence, they may act as mediators between the exposure and the outcome. To estimate if this was the case, we ran the models for labor characteristics and delivery interventions (Study II) in our smaller data set (from Study I). No major differences were found in models adjusted for age, parity, month, and year of delivery, and models additionally adjusted for smoking and BMI (Paper 2). Also, the risk of smoking seemed greater among women who attended the RTS in adulthood than those who were younger (even though confidence intervals overlapped), while the increased risks of adverse delivery outcomes and neonatal adversities was mainly seen for mothers/neonates of mothers who attended the RTS before the age of 20 years (Papers 2 and 3). Therefore, it is unlikely that smoking and obesity were the main contributors to the associations we found.

Furthermore, our findings showed that exposed women were less frequently working or cohabiting. We did not adjust for concurrent socioeconomic status in our main models in all papers, as this factor could indeed have been in the causal pathway, but showed the adjustments in additional analyses, to see if the risk estimates changed.

Some findings were analogous with or without adjustments, such as labor characteristics and delivery interventions, a low Apgar score and transferrals to the Neonatal Intensive Care Unit. Other associations (such as SGA) were attenuated, suggesting that they may have been mediated by socioeconomic factors. In addition, the risk estimate lowered somewhat for PTB, yet remained statistically significant for moderately PTB. Indeed, low socioeconomic status and being single (82, 125) are associated with PTB, and may act as a piece in the puzzle in the mechanism between the exposure and the outcome. However, since information on these demographic characteristics at the time of exposure is not available, it cannot be concluded whether socioeconomic status is a confounder or a mediator in this association.

5.3.2.2 *Biological risk factors*

This study did not analyze by which mechanisms sexual violence could be associated with adverse obstetric outcomes. Hypothesized mechanisms according to previous studies include biologic dysregulation of stress-response systems that may occur among sexually assaulted women (34, 126). Elevated cortisol awakening response during late pregnancy has been associated with child sexual abuse (127), and elevated cortisol has been associated with having shorter infants and lower birthweight (128). Elevated cortisol levels could therefore be one relevant pathway for our findings, as well as altered function of the HPA axis and the corticotrophin-releasing hormone (88, 126) which have been associated with PTB. Yet other researchers have reported that alcohol use increased the risk of PTB for exposed women, not the function of the HPA axis (93). Further studies are needed on the complex potential pathways between exposure to sexual violence and subsequent adverse health outcomes (34).

5.3.3 Public Health Implications

As reviewed in the first chapter of this thesis, sexual violence against women is common and considered a threat to human rights and public health (1). Therefore, sexual violence prevention should be a priority.

> *„Before [I attended the course on gender studies], I thought a girl who was raped would feel bad for maybe 2-3 months, then she would be ok. I didn‘t know her life could be devastated. If more boys would attend a course like this, their minds might open up and rapes decrease.“P.36 (translation by myself) (129)*

This quote from a 2011 newspaper interview with a teenage boy summarizes the need for preventive efforts. Spending money on violence prevention is cost effective (1), and school-based interventions have been effective in lowering the risk of either perpetrating or experiencing sexual dating violence (130). Following a validation of the Lanzarote Convention in Iceland in 2011, three ministries have collaborated in the project “Raising awareness on sexual, emotional and physical violence against children”. The project focuses on prevention and educational material on violence against children (such as a puppet theater and short films/educational videos) (131). Following a call to action article in Lancet 2014, the authors wrote an „Is anyone listening?“ comment in Lancet in 2017 (132). The authors state that positive effects exist regarding prevention, probably the most effective way to reduce violence on a large scale, and that more funding has been put into research to improve interventions. At the same time, women‘s rights and further progress of women’s status may be threatened. They conclude that increased actions are needed,

preferably by young people with various political ideas.

It is also important to recognize whether something helpful can be done to increase the possibilities of a normal pregnancy and delivery, and to reduce the likelihood of adverse birth outcomes among sexual violence survivors. In light of the findings on the considerably larger risk of heavy smoking among exposed women during pregnancy, it is of importance to recognize that obstetric risks can be lowered not only by cessation, but also diminished smoking, since a dose-response relationship has been found with adverse outcomes (68). Interventions aimed at smoking cessation during pregnancy may be beneficial in lowering the risk of adverse neonatal outcomes, including admissions to the Neonatal Intensive Care Unit (133). To the best of my knowledge, no previous studies have analyzed which approaches are most efficient in reducing smoking among women previously exposed to sexual violence/other trauma. Worse mental health may contribute to their persistent smoking, since pregnant women who are not capable of quitting smoking are more likely to suffer from anxiety, depression (134) or PTSD (135) than those who quit, and these problems are all associated with exposure to sexual violence. Therefore, exposed women may need additional attention in antenatal care, and referral for psychological treatment may be needed. Improvements in mental health services must also be made in Iceland. During the past decades, mental health services have not been a priority in the Icelandic healthcare system, neither as a part of general healthcare nor subsidized by the Icelandic Health Insurance for adults (136). Pregnancy is a unique opportunity to approach the exposed women, and promote healthier lifestyle. Women are in frequent contact with

primary healthcare, and could be especially motivated at this time point. It provides an opportunity to ask about violence and identify women at risk (137) and refer them to services they may need. Indeed, in clinical guidelines for prenatal care of normal pregnancies, midwives are encouraged to pay attention to signs of violence and provide an opportunity for pregnant women to discuss these matters (101). We do not have information on whether or how this is done.

Importantly, interventions such as psychoeducative group therapy dealing with fear of childbirth have proven effective in reducing the negative effects of fear (138). Furthermore, women who receive continuous one-to-one support during labor are more likely to have shorter labor and spontaneous vaginal delivery than those who do not receive such support, and their infants are less likely to have a low Apgar score at 5 minutes (139). Also, acknowledging that routine clinical procedures (such as examination of cervical dilation) can have negative effects and re-activate rape experiences, may be important for healthcare professionals. Working in co-operation with each woman may be beneficial. Wosu et al. (88) concluded that increased attention and antenatal care for women with a history of child sexual abuse may be important in order to avoid PTB.

The findings also underscore the importance of services for sexually assaulted individuals in the population. The four elements on the right to health are: availability, accessibility, acceptability, and good quality (140, 141). The RTS is always open to all sexually assaulted adolescents and adults in the population (other services are available for children). It is *available*. The RTS is well known and all

individuals can seek services without referral. The services are without charge and located in Reykjavik, where 2/3 of the population live. The police sometimes escort individuals to the RTS and sometimes victims from other parts of the country fly to get there. Still, due to the location, it may not be *easily accessible* for every individual in Iceland. The services are provided by specially trained health professionals within the University Hospital, many of whom have long experience in working in this field. The services are *acceptable* and of *good quality*. Continued services of the RTS are important for public health in Iceland.

5.4 Implications for research

Twenty years have passed since the World Health Assembly declared sexual violence a leading public health problem (3). One of the recommendations from WHO to act against violence is support of studies on the consequences of sexual violence (1). The findings from this thesis underscore that exposure to sexual violence is associated with various adverse pregnancy and birth outcomes. Still, the associations were modest, and most women had uncomplicated birth outcomes. Yet, this thesis adds to a growing literature on possible adversities for individuals exposed to sexual violence, and the findings may be the basis for future studies. It is important to study how sexual violence survivors can be supported at this important time point in their lives. Qualitative studies could give insight into women's perceptions; if they thought something slowed the progress of labor, or if they found some actions of either healthcare professionals or their accompanying person to be supportive or unhelpful. Qualitative studies

could lay the ground for various future studies, such as intervention studies on pregnancy and labor support, including smoking cessation programs. Randomized intervention studies could also examine whether health promotion during pregnancy is beneficial; is a group of women who do yoga or take walks with a group of women and a midwife at decreased risk of adversities than a group who receives standard care? It is also of great importance that analyses, especially regarding outcomes such as maternal distress and PTB are replicated in different populations with good statistical power. However, it is not only important to prevent adversities for women who have already been exposed to sexual violence. Most importantly, sexual violence should not exist. To target prevention, it may be of importance to study demographics of perpetrators, their beliefs and behavior, and how they can be stopped from perpetrating sexual violence.

5.5 Ethical considerations

In 1964, the World Medical Association developed an ethical statement on medical research involving human subjects: The Helsinki declaration. The declaration has been revised since then, latest in 2013 (142).

> *Medical progress is based on research that ultimately must include studies involving human subjects. (P. 2191, paragraph 5)*

It is further stated that the main purpose of research "*...is to understand the causes, development and effects of diseases and improve preventive, diagnostic and therapeutic interventions*..." (paragraph 6). We followed these guidelines in our work, even though we did not

contact the subjects of our study to obtain informed consent. This method was considered to best serve their interests. To provide the highest attainable standard of health, scientific knowledge is essential. It can therefore be argued that it is unethical not to use the data. Improved knowledge can improve health care services, which can benefit exposed women in their future pregnancies or future mothers that have experienced the severe crime, sexual violence.

6 Conclusions

Mother's past exposure to sexual violence, in adolescence or in adulthood, may be associated with an increased risk of adversities at the time of pregnancy and childbirth later in their lives. On average 6 years after being exposed to sexual violence, exposed women had an increased risk of smoking and being obese (primiparas), delivery complications (such as maternal distress during labor and delivery, prolonged first stage of labor, and emergency instrumental deliveries), and some neonatal hazards (including preterm births and admissions to the Neonatal Intensive Care Unit) as compared to non-exposed women. Exposure to sexual violence during the teenage years was the strongest risk factor for these adverse outcomes. Yet, the risk estimates of delivery complications were modest and most exposed women gave birth without complications.

We aimed to study whether age at the time of sexual violence exposure and time between the assault and the delivery affected the potential associations. We found that, overall, women exposed in adolescence seemed at greater risk than those who were assaulted later. Our data did not lend support to linear effects of time between assault and delivery.

Further research is needed to address how these survivors can be supported during pregnancy and delivery. Intervention studies would add to the available literature, and could result in clinical methods of great importance. Also, other Nordic countries should be able to replicate our method in larger populations. Medical birth registries in

the other countries have electronic information on risk factors such as smoking and BMI, which could then be taken into account in the analysis. However, information on these factors is being added to the IMBR here in Iceland. Registering background factors at the RTS (at the time of exposure) and replicating this study here in Iceland in a few years would also be of interest.

Despite the fact that most women gave uncomplicated births, this thesis confirms that sexual violence is a health and human rights concern requiring serious attention (143), both in terms of the women who were exposed to sexual violence and the babies they give birth to.

References

1. García-Moreno C, Zimmerman C, Morris-Gehring A, Heise L, Amin A, Abrahams N, et al. Addressing violence against women: a call to action. *The Lancet*. 2015;385(9978):1685-95. Available from doi: 10.1016/S0140-6736(14)61830-4
2. Krug EG, Mercy JA, Dahlberg LL, Zwi AB. The world report on violence and health. *The Lancet*. 2002;360(9339):1083-8.
3. World Health Assembly, 49. *Prevention of violence: a public health priority*. Geneva: World Health Organization; 1996.
4. Amstadter AB, Aggen SH, Knudsen GP, Reichborn-Kjennerud T, Kendler KS. Potentially traumatic event exposure, posttraumatic stress disorder, and Axis I and II comorbidity in a population-based study of Norwegian young adults. *Soc Psychiatry Psychiatr Epidemiol*. 2013;48(2):215-23. Available from: doi: 10.1007/s00127-012-0537-2
5. Jewkes R, Sen P, Garcia-Moreno C. Chapter 6. Sexual violence. In Krug EG, Mercy JA, Dahlberg LL, Zwi AB, editors. *World report on violence and health*. Geneva: World Health Organization; 2002. Available from: http://apps.who.int/iris/bitstream/10665/42495/1/9241545615_eng.pdf
6. Swahnberg IMK, Wijma B. The NorVold Abuse Questionnaire (NorAQ): Validation of new measures of emotional, physical, and sexual abuse, and abuse in the health care system among women. *Eur J Public Health*. 2003;13(4):361-6.
7. *The General Penal Code no. 19/1940*, Article 194, cf. Article 3, of Act no. 61/2007. Available from: https://www.althingi.is/altext/stjt/2007.061.html
8. Bragadóttir R. *Kynferðisbrot* [Sexual crimes]. Matthíasson VM, editor. Reykjavík: Lagastofnun Háskóla Íslands [The Law Institute]; 2006.
9. Garcia-Moreno C, Pallitto C, Devries K, Stockl H, Watts C, Abrahams N. *Global and regional estimates of violence against women: prevalence and health effects of intimate partner violence and non-partner sexual violence*: World Health Organization; 2013.
10. Barth J, Bermetz L, Heim E, Trelle S, Tonia T. The current prevalence of child sexual abuse worldwide: a systematic review and meta-analysis. *Int J Public Health*. 2013;58(3):469-83. Available from: doi: 10.1007/s00038-012-0426-1

11. van Dijk JJM, van Kesteren JN, Smit P. *Criminal Victimisation in International Perspective. Key findings from the 2004-2005 ICVS and EU ICS*. The Hague: Boom Legal Publishers; 2008. Available from: https://publikationen.uni-tuebingen.de/xmlui/handle/10900/65201

12. Þórisdóttir R, Gunnlaugsson H, Magnúsdóttir V. *Brotaþolar, lögreglan og öryggi borgaranna*. [Victims, the Police and Public safety.] (in Icelandic). Reykjavik: Ríkislögreglustjórinn og Háskólaútgáfan [National Commissioner of the Icelandic Police and the University's Publisher]; 2005. Available from: http://www.logreglan.is/wp-content/uploads/2014/12/Brota%C3%BEolar-l%C3%B6greglan-og-%C3%B6ryggi-borgaranna-%C3%BAtg.-2005.pdf

13. Sigfusdottir I, Asgeirsdottir B, Gudjonsson G, Sigurdsson J. A Model of Sexual Abuse's Effects on Suicidal Behavior and Delinquency: The Role of Emotions as Mediating Factors. *J Youth Adolesc* 2008;37(6):699. Available from: doi 10.1007/s10964-007-9247-6

14. Bodvarsdottir I, Elklit A. Victimization and PTSD-like states in an Icelandic youth probability sample. *BMC Psychiatry*. 2007;7:51. Available from: doi: 10.1186/1471-244X-7-51

15. Gisladottir A, Gudmundsdottir B, Gudmundsdottir R, Jonsdottir E, Gudjonsdottir GR, Kristjansson M, et al. Increased attendance rates and altered characteristics of sexual violence. *Acta Obstet Gynecol Scand*. 2012;91(1):134-42. Available from: doi: 10.1111/j.1600-0412.2011.01283.x.

16. Elísabet Karlsdóttir, Ásdís A. Arnalds. Rannsókn á ofbeldi gegn konum. Reynsla kvenna á aldrinum 18-80 ára á Íslandi [Research on violence against women: The experiences of women aged 18-80 in Iceland]. Reykjavík: Rannsóknarstofnun í barna- og fjölskylduvernd [Center for children and family research]; 2010. Available from: https://www.stjornarradid.is/media/velferdarraduneyti-media/media/ritogskyrslur2011/26012011_Ofbeldi_a_konum.pdf

17. Guðlaugsson JÓ, Magnússon KT, Jónsson SH. *Heilsa og líðan Íslendinga 2012: Framkvæmdaskýrsla*. [Health and Wellbeing of Icelanders 2012: Project Report]. Reykjavík: Embætti landlæknis [Directorate of Health]; 2014. Available from: https://www.landlaeknir.is/servlet/file/store93/item22830/Framkvaemdaskyrsla_2012_loka.pdf

18. Dartnall E, Jewkes R. Sexual violence against women: The scope of the problem. *Best Pract Res Clin Obstet Gynaecol*. 2013;27(1):3-13. Available from: doi: 10.1016/j.bpobgyn.2012.08.002.

19. Jewkes R, Sen P, Garcia-Moreno. C. *World report on violence and health. Chapter 6. Sexual violence*. Geneva: World Health Organization; 2002. Available from: http://apps.who.int/iris/bitstream/10665/42495/1/9241545615_eng.pdf

20. Burgess AW, Holmstrom LL. Rape trauma syndrome. *Am J Psychiatry*. 1974;131(9):981-6.

21. American Psychiatric Association. Diagnostic and statistical manual of mental disorders (DSM-5®): *American Psychiatric Pub*; 2013.

22. Darves-Bornoz JM, Alonso J, de Girolamo G, Graaf Rd, Haro JM, Kovess-Masfety V, et al. Main traumatic events in Europe: PTSD in the European study of the epidemiology of mental disorders survey. *J Trauma Stress*. 2008;21(5):455-62. Available from: doi: 10.1002/jts.20357

23. Kessler RC, Sonnega A, Bromet E, Hughes M, Nelson CB. Posttraumatic stress disorder in the National Comorbidity Survey. *Arch Gen Psychiatry*. 1995;52(12):1048-60. Available from: doi: 10.1111/j.1943-278X.2011.00040.x

24. Bedi S, Nelson EC, Lynskey MT, Mc Cutcheon VV, Heath AC, Madden PA, et al. Risk for suicidal thoughts and behavior after childhood sexual abuse in women and men. *Suicide Life Threat Behav*. 2011;41(4):406-15. Available from: doi: 10.1111/j.1943-278X.2011.00040.x

25. Lindert J, von Ehrenstein O, Grashow R, Gal G, Braehler E, Weisskopf M. Sexual and physical abuse in childhood is associated with depression and anxiety over the life course: systematic review and meta-analysis. *Int J Public Health*. 2014;59(2):359-72. Available from: doi: 10.1007/s00038-013-0519-5

26. Jonas S, Bebbington P, McManus S, Meltzer H, Jenkins R, Kuipers E, et al. Sexual abuse and psychiatric disorder in England: results from the 2007 Adult Psychiatric Morbidity Survey. *Psychol Med*. 2011;41(04):709-19. Available from: doi: 10.1017/S003329171000111X

27. Chen LP, Murad MH, Paras ML, Colbenson KM, Sattler AL, Goranson EN, et al. Sexual Abuse and Lifetime Diagnosis of Psychiatric Disorders : Systematic Review and Meta - analysis. *Mayo Clinic Proceedings*. 2010;85(7):618. Available from. doi: 10.4065/mcp.2009.0583

28. Stígamót. *Ársskýrsla Stígamóta 2015 [Annual report 2015]*. Reykjavík, 2015. Available from: https://www.stigamot.is/static/files/arsskyrslur/stigamot-2015-netid.pdf

29. Lukasse M, Schei B, Vangen S, Øian P. Childhood Abuse and Common Complaints in Pregnancy. *Birth*. 2009;36(3):190-9. Available from: doi: 10.1111/j.1523-536X.2009.00323.x

30. Henriksen L, Schei B, Vangen S, Lukasse M. Sexual violence and mode of delivery: a population-based cohort study. *BJOG*. 2014;121(10):1237-44. Available from: doi: 10.1111/1471-0528.12923

31. Leeners B, Görres G, Block E, Hengartner MP. Birth experiences in adult women with a history of childhood sexual abuse. *J Psychosom Res*. 2016;83:27-32. Available from: doi: 10.1016/j.jpsychores.2016.02.006

32. Nerum H, Halvorsen L, Straume B, Sørlie T, Øian P. Different labour outcomes in primiparous women that have been subjected to childhood sexual abuse or rape in adulthood: a case–control study in a clinical cohort. *BJOG*. 2013;120(4):487-95. Available from: doi: 10.1111/1471-0528.12053

33. Loya RM. Rape as an Economic Crime: The Impact of Sexual Violence on Survivors' Employment and Economic Well-Being. *J Interpers Violence*. 2015;30(16):2793-813. Available from: doi: 10.1177/0886260514554291

34. Walsh K, Galea S, Koenen KC. Mechanisms Underlying Sexual Violence Exposure and Psychosocial Sequelae: A Theoretical and Empirical Review. *Clin Psychol-Sci Pr*. 2012;19(3):260-75. Available from: doi: 10.1111/cpsp.12004

35. Nelson EC. Childhood sexual abuse and risks for licit and illicit drug - related outcomes: a twin study. *Psychol Med*. 2006;36(10):1473. Available from: doi: 10.1017/S0033291706008397

36. Nichols HB, Harlow BL. Childhood abuse and risk of smoking onset. *J Epidemiol Community Health*. 2004;58(5):402-6.

37. Mason SM, Flint AJ, Field AE, Austin SB, Rich-Edwards JW. Abuse victimization in childhood or adolescence and risk of food addiction in adult women. *Obesity*. 2013;21(12):E775-E81. Available from: doi: 10.1002/oby.20500

38. Noll JG, Zeller MH, Trickett PK, Putnam FW. Obesity Risk for Female Victims of Childhood Sexual Abuse: A Prospective Study. *Pediatrics*. 2007a;120(1):e61-e7. Available from: doi: 10.1542/peds.2006-3058

39. Rich-Edwards JW, Spiegelman D, Hibert ENL, Jun HJ, Todd TJ, Kawachi I, et al. Abuse in Childhood and Adolescence As a Predictor of Type 2 Diabetes in Adult Women. *Am J Prev Med*. 2010;39(6):529-36. Available from: doi: 10.1016/j.amepre.2010.09.007

40. Scott KM, Koenen KC, Aguilar-Gaxiola S, Alonso J, Angermeyer MC, Benjet C, et al. Associations between Lifetime Traumatic Events and Subsequent Chronic Physical Conditions: A Cross-National, Cross-Sectional Study. *PLoS ONE*. 2013;8(11):e80573. Available from: doi: 10.1371/journal.pone.0080573

41. Paras ML. Sexual Abuse and Lifetime Diagnosis of Somatic Disorders: A Systematic Review and Meta - analysis. *JAMA*. 2009;302(5):550 - 61. Available from: doi: 10.1001/jama.2009.1091

42. Irish L, Kobayashi I, Delahanty DL. Long-term Physical Health Consequences of Childhood Sexual Abuse: A Meta-Analytic Review. *J Pediatr Psychol*. 2010;35(5):450-61. Available from: doi: 10.1093/jpepsy/jsp118

43. Wegman HL, Stetler C. A Meta-Analytic Review of the Effects of Childhood Abuse on Medical Outcomes in Adulthood. *Psychosom Med*. 2009;71(8):805-12. Available from: doi: 10.1097/PSY.0b013e3181bb2b46

44. Larsen ML, Hilden M, Skovlund CW, Lidegaard Ø. Somatic health of 2500 women examined at a sexual assault center over 10 years. *Acta Obstet Gynecol Scand*. 2016;95:872-8. Available from: doi: 10.1111/aogs.12903

45. Pikarinen U, Saisto T, Schei B, Swahnberg K, Halmesmäki E. Experiences of physical and sexual abuse and their implications for current health. *Obstet Gynecol*. 2007;109(5):1116-22. Available from: doi: 10.1097/01.AOG.0000259906.16474.86

46. Hilden M, Schei B, Swahnberg K, Halmesmaki E, Langhoff-Roos J, Offerdal K, et al. A history of sexual abuse and health: a Nordic multicentre study. *BJOG*. 2004;111(10):1121-7. Available from: doi: 10.1111/j.1471-0528.2004.00205.x

47. Ulirsch J, Ballina L, Soward A, Rossi C, Hauda W, Holbrook D, et al. Pain and somatic symptoms are sequelae of sexual assault: results of a prospective longitudinal study. *Eur J Pain*. 2014;18(4):559-66. Available from: doi: 10.1002/j.1532-2149.2013.00395.x

48. Riley EH, Wright RJ, Jun HJ, Hibert EN, Rich-Edwards JW. Hypertension in adult survivors of child abuse: observations from the Nurses' Health Study II. *J Epidemiol Community Health*. 2010;64(5):413-8. Available from: doi: 10.1136/jech.2009.095109

49. Rich-Edwards JW, Mason S, Rexrode K, Spiegelman D, Hibert E, Kawachi I, et al. Physical and Sexual Abuse in Childhood as Predictors of Early-Onset Cardiovascular Events in Women. *Circulation*. 2012;126(8):920-7. Available from: doi: 10.1161/CIRCULATIONAHA.111.076877

50. Harlow BL, Stewart EG. Adult-onset vulvodynia in relation to childhood violence victimization. *Am J Epidemiol*. 2005;161(9):871-80. Available from: doi: 10.1093/aje/kwi108

51. Beck JJH, Elzevier HW, Pelger RCM, Putter H, Voorham-van der Zalm PJ. Multiple Pelvic Floor Complaints Are Correlated with Sexual Abuse History. *J Sex Med*. 2009 Jan;6(1):193-8. Available from: doi: 10.1111/j.1743-6109.2008.01045.x

52. Postma R, Bicanic I, Vaart H, Laan E. Pelvic floor muscle problems mediate sexual problems in young adult rape victims. *J Sex Med*. 2013;10(8):1978-87. Available from: doi: 10.1111/jsm.12196

53. Coker AL, Hopenhayn C, DeSimone CP, Bush HM, Crofford L. Violence against Women Raises Risk of Cervical Cancer. *J Womens Health*. 2009;18(8):1179-85. Available from: doi: 10.1089/jwh.2008.1048

54. Leeners B, Stiller R, Block E, Gorres G, Imthurn B, Rath W. Effect of Childhood Sexual Abuse on Gynecologic Care as an Adult. *Psychosomatics*. 2007; 48(5):385-93. Available from: doi: 10.1176/appi.psy.48.5.385

55. Noll JG, Shenk CE, Putnam KT. Childhood Sexual Abuse and Adolescent Pregnancy: A Meta-analytic Update. *J Pediatr Psychol*. 2009;34(4):366-78. Available from: doi: 10.1093/jpepsy/jsn098

56. Madigan S, Wade M, Tarabulsy G, Jenkins JM, Shouldice M. Association between abuse history and adolescent pregnancy: a meta-analysis. *J Adolesc Health*. 2014;55(2):151-9. Available from: doi: 10.1016/j.jadohealth.2014.05.002

57. Fisher WA, Singh SS, Shuper PA, Carey M, Otchet F, MacLean-Brine D, et al. Characteristics of women undergoing repeat induced abortion. *CMAJ*. 2005;172(5):637-41. Available from: doi: 10.1503/cmaj.1040341

58. Lukasse M, Laanpere M, Karro H, Kristjansdottir H, Schroll A-M, Van Parys A-S, et al. Pregnancy intendedness and the association with physical, sexual and emotional abuse–a European multi-country cross-sectional study. *BMC Pregnancy Childbirth*. 2015;15(1):120. Available from: doi: 10.1186/s12884-015-0558-4

59. Sigurdardottir S, Halldorsdottir S. Time does *not* heal all wounds: A phenomenological study on the long-term consequences of childhood sexual abuse on Icelandic women's health and well-being. *The Icelandic Journal of Nursing*. 2009;85(3):38-49.

60. van Roode T, Dickson N, Herbison P, Paul C. Child sexual abuse and persistence of risky sexual behaviors and negative sexual outcomes over adulthood: Findings from a birth cohort. *Child Abuse Negl*. 2009;33(3):161-72. Available from: doi: 10.1016/j.chiabu.2008.09.006

61. Kendall-Tackett KA. Violence Against Women and the Perinatal Period : The Impact of Lifetime Violence and Abuse on Pregnancy, Postpartum, and Breastfeeding. *Trauma Violence Abuse*. 2007;8(3):344. Available from: doi: 10.1177/1524838007304406

62. Lukasse M, Henriksen L, Vangen S, Schei B. Sexual violence and pregnancy-related physical symptoms. *BMC Pregnancy Childbirth.* 2012;12(1):83. Available from: doi: 10.1186/1471-2393-12-83

63. Henriksen L, Vangen S, Schei B, Lukasse M. Sexual Violence and Antenatal Hospitalization. *Birth* 2013;40(4):281-8. Available from doi: 10.1111/birt.12063

64. Mason S, Tobias D, Clark C, Zhang C, Hu FB, Rich-Edwards J. Abuse in Childhood or Adolescence and Gestational Diabetes: A Retrospective Cohort Study. *Am J Prev Med*. 2016;50(4):436-44. Available from doi: 10.1016/j.amepre.2015.08.033

65. Leeners B, Stiller R, Block E, Görres G, Rath W. Pregnancy complications in women with childhood sexual abuse experiences. *J Psychosom Res*. 2010;69(5):503-10. Available from doi: 10.1016/j.jpsychores.2010.04.017

66. Eiríksdóttir VH, Valdimarsdóttir UA, Ásgeirsdóttir TL, Hauksdóttir A, Lund SH, Bjarnadóttir RI, et al. Pregnancy-Induced Hypertensive Disorders before and after a National Economic Collapse: A Population Based Cohort Study. *PloS ONE*. 2015;10(9):e0138534. Available from doi: 10.1371/journal.pone.0138534

67. Eiríksdóttir VH, Ásgeirsdóttir TL, Bjarnadóttir RI, Kaestner R, Cnattingius S, Valdimarsdóttir UA. Low Birth Weight, Small for Gestational Age and Preterm Births before and after the Economic Collapse in Iceland: A Population Based Cohort Study. *PLoS ONE*. 2013;8(12):e80499. Available from doi: 10.1371/journal.pone.0080499

68. Cnattingius S, Lambe M. Trends in smoking and Overweight during Pregnancy: Prevalence, risks of pregnancy complications, and adverse pregnancy outcomes. *Semin Perinatol*. 2002;26(4):286-95.

69. van der Hulst LA, Bonsel GJ, Eskes M, Birnie E, van Teijlingen E, Bleker OP. Bad experience, good birthing: Dutch low-risk pregnant women with a history of sexual abuse. *J Psychosom Obstet Gynaecol*. 2006;27(1):59-66.

70. Leeners B, Rath W, Block E, Görres G, Tschudin S. Risk factors for unfavorable pregnancy outcome in women with adverse childhood experiences. *J Perinat Med*. 2014;42(2):171-8. Available from doi: 10.1515/jpm-2013-0003

71. Nerum H, Halvorsen L, Øian P, Sørlie T, Straume B, Blix E. Birth outcomes in primiparous women who were raped as adults: a matched controlled study. *BJOG*. 2010;117(3):288-94. Available from doi: 10.1111/j.1471-0528.2009.02454.x

72. Wosu AC, Gelaye B, Williams MA. History of childhood sexual abuse and risk of prenatal and postpartum depression or depressive symptoms: an epidemiologic review. *Arch Womens Ment Health*. 2015b;18(5):659-71. Available from doi: 10.1007/s00737-015-0533-0

73. Rich-Edwards JW, James-Todd T, Mohllajee A, Kleinman K, Burke A, Gillman MW, et al. Lifetime maternal experiences of abuse and risk of pre-natal depression in two demographically distinct populations in Boston. *Int J Epidemiol*. 2011;40(2):375-84. Available from doi: 10.1093/ije/dyq247

74. Lara M, Navarrete L, Nieto L, Le H-N. Childhood abuse increases the risk of depressive and anxiety symptoms and history of suicidal behavior in Mexican pregnant women. *Rev Bras Psiquiatr*. 2015;37(3):203-10. Available from doi: 10.1590/1516-4446-2014-1479

75. Henriksen L, Schei B, Lukasse M. Lifetime sexual violence and childbirth expectations–A Norwegian population based cohort study. *Midwifery*. 2016;36:14-20. Available from doi: 10.1016/j.midw.2016.02.018

76. Eberhard-Gran M, Slinning K, Eskild A. Fear during labor: the impact of sexual abuse in adult life. *J Psychosom Obstet Gyneacol*. 2008;29(4):258-61. Available from doi: 10.1080/01674820802075998

77. Halvorsen L, Nerum H, Oian P, Sorlie T. Giving Birth with Rape in One's Past: A Qualitative Study. *Birth*. 2013;40(3):182-91. Available from doi: 10.1111/birt.12054

78. Montgomery E, Pope C, Rogers J. The re-enactment of childhood sexual abuse in maternity care: a qualitative study. *BMC Pregnancy Childbirth*. 2015;15(1):194. Available from doi: 10.1186/s12884-015-0626-9

79. Finnbogadóttir H, Dejin-Karlsson E, Dykes A-K. A multi-centre cohort study shows no association between experienced violence and labour dystocia in nulliparous women at term. *BMC Pregnancy Childbirth.* 2011;11(1):1-9. Available from doi: 10.1186/1471-2393-11-14

80. Schei B, Lukasse M, Ryding EL, Campbell J, Karro H, Kristjansdottir H, et al. A History of Abuse and Operative Delivery – Results from a European Multi-Country Cohort Study. *PLoS ONE*. 2014;9(1):e87579. Available from doi: 10.1371/journal.pone.0087579

81. Blencowe H, Cousens S, Chou D, Oestergaard M, Say L, Moller A-B, et al. Born Too Soon: The global epidemiology of 15 million preterm births. *Reprod Health*. 2013;10(1):S2. Available from doi: 10.1186/1742-4755-10-S1-S2

82. Muglia LJ, Katz M. The enigma of spontaneous preterm birth. *N Engl J Med*. 2010;362(6):529-35. Available from doi: 10.1056/NEJMra0904308

83. Wadhwa PD, Entringer S, Buss C, Lu MC. The contribution of maternal stress to preterm birth: issues and considerations. *Clinics in perinatology*. 2011;38(3):351-84. Available from doi: 10.1016/j.clp.2011.06.007

84. Rich-Edwards JW, Grizzard TA. Psychosocial stress and neuroendocrine mechanisms in preterm delivery. *Am J Obstet Gynecol*. 2005;192(5):S30-5. Available from doi: 10.1016/j.ajog.2005.01.072

85. Hedegaard M, Henriksen TB, Secher NJ, Hatch MC, Sabroe S. Do Stressful Life Events Affect Duration of Gestation and Risk of Preterm Delivery? *Epidemiology*. 1996;7(4):339-45.

86. Khashan AS, McNamee R, Abel KM, Mortensen PB, Kenny LC, Pedersen MG, et al. Rates of preterm birth following antenatal maternal exposure to severe life events: a population-based cohort study. *Hum Reprod*. 2009;24(2):429-37. Available from doi: 10.1093/humrep/den418

87. Seng J, Low L, Sperlich M, Ronis D, Liberzon I. Post - traumatic stress disorder, child abuse history, birthweight and gestational age : a prospective cohort study. *BJOG*. 2011;118(11):1329-39. Available from doi: 10.1111/j.1471-0528.2011.03071.x

88. Wosu AC, Gelaye B, Williams MA. Maternal history of childhood sexual abuse and preterm birth: an epidemiologic review. *BMC Pregnancy Childbirth*. 2015a;15(1):174. Available from doi: 10.1186/s12884-015-0606-0

89. Selk SC, Rich-Edwards JW, Koenen K, Kubzansky LD. An observational study of type, timing, and severity of childhood maltreatment and preterm birth. *J Epidemiol Community Health*. 2016;70(6):589-95.

90. Henriksen L, Schei B, Vangen S, Lukasse M. Sexual violence and neonatal outcomes: a Norwegian population-based cohort study. *BMJ Open*. 2014;4(10). Available from doi: 10.1136/jech-2015-206304

91. Urquia M, O'Campo P, Heaman M, Janssen P, Thiessen K. Experiences of violence before and during pregnancy and adverse pregnancy outcomes: An analysis of the Canadian Maternity Experiences Survey. *BMC Pregnancy Childbirth*. 2011;11(1):42. Available from doi: 10.1186/1471-2393-11-42

92. Shah PS, Shah J. Maternal exposure to domestic violence and pregnancy and birth outcomes: a systematic review and meta-analyses. *J Womens Health*. 2010;19(11):2017-31. Available from doi: 10.1089/jwh.2010.2051

93. Noll JG, Schulkin J, Trickett PK, Susman EJ, Breech L, Putnam FW. Differential pathways to preterm delivery for sexually abused and comparison women. *J Pediatr Psychol*. 2007b;32(10):1238-48. Available from doi: 10.1093/jpepsy/jsm046

94. Lukasse M, Vangen S, Øian P, Schei B. Childhood abuse and caesarean section among primiparous women in the Norwegian Mother and Child Cohort Study. *BJOG*. 2010a;117:1153-7. Available from doi: 10.1111/j.1471-0528.2010.02627.x

95. Heimstad R, Dahloe R, Laache I, Skogvoll E, Schei B. Fear of childbirth and history of abuse: implications for pregnancy and delivery. *Acta Obstet Gynecol Scand*. 2006;85(4):435-40.

96. Statistics Iceland. *Population by municipalities, sex and age 1 January 1998-2016 - Current municipalities 2016.* Available from: http://px.hagstofa.is/pxen/pxweb/en/Ibuar/Ibuar__mannfjoldi__2_byggdir__sveitarfelog/MAN02001.px/table/tableViewLayout1/?rxid=8cd92980-21af-4d3a-ad41-f4766e74c9b3. [Accessed 12th November 2016].

97. Fæðingaskráningin [The Icelandic Birth Registration]. *Skýrsla frá Fæðingaskráningunni fyrir árið 2010 [Report for the year 2010]*. Reykjavik: Landspitali, 2011. Available from: http://www.landspitali.is/library/Sameiginlegar-skrar/Gagnasafn/Rit-og-skyrslur/Faedingaskraningar/faedingarskraning_skyrsla_2010_2.pdf?download=true

98. OECD. *Compare your country*. Available from: http://www2.compareyourcountry.org/health# [Accessed 21st November 2016].

99. Birgisdottir H, Bjarnadottir RI, Kristjansdottir K, Geirsson RT. Maternal deaths in Iceland over 25 years. *Acta Obstet Gynecol Scand*. 2016;95(1):74-8. Available from doi: 10.1111/aogs.12797

100. Wang H, Liddell CA, Coates MM, Mooney MD, Levitz CE, Schumacher AE, et al. Global, regional, and national levels of neonatal, infant, and under-5 mortality during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*. 2014;384(9947):957-79. Available from doi: 10.1016/S0140-6736(14)60497-9

101. Landlæknisembættið [Directorate of Health]. *Meðgönguvernd heilbrigðra kvenna í eðlilegri meðgöngu. Klínískar leiðbeiningar.* [Prenatal care for normal pregnancy, clinical guidelines]. Reykjavik, 2010. Available from: https://www.landlaeknir.is/servlet/file/store93/item2548/4407.pdf

102. Þórunn Hrefna Sigurjónsdóttir. Fræin okkar hafa valdið hugarfarsbyltingu [Our seeds have changed the disposition, interview with Gudrun Agnarsdottir]. *Vera*. 2003;3.

103. Nesvold H, Worm AM, Vala U, Agnarsdottir G. Different Nordic facilities for victims of sexual assault: a comparative study. *Acta Obstet Gynecol Scand*. 2005;84(2):177-83. Available from doi: 10.1111/j.0001-6349.2005.00641.x

104. Landlæknisembættið [Directorate of Health]. *The Directorate of Health.* Available from: http://www.landlaeknir.is/english/#Functions [Accessed December 2nd 2016].

105. Fæðingaskráningin [The Icelandic Birth Registration]. *Skýrsla frá Fæðingaskráningunni fyrir árið 2005 [Report for the year 2005]*. Landspitali, 2006.

106. Gudnadóttir TA, Bateman BT, Hernádez-Díaz S, Luque-Fernandez MA, Valdimarsdottir U, Zoega H. Body Mass Index, Smoking and Hypertensive Disorders during Pregnancy: A Population Based Case-Control Study. *PLoS ONE*. 2016;11(3):e0152187. Available from doi: 10.1371/journal.pone.0152187

107. Rasmussen KM, Yaktine AL. *Weight Gain During Pregnancy: Reexamining the Guidelines*. Washington, DC: The National Academies Press, 2009.

108. Thorsdottir I, Torfadottir JE, Birgisdottir BE, Geirsson RT. Weight gain in women of normal weight before pregnancy: complications in pregnancy or delivery and birth outcome. *Obstet Gynecol.* 2002;99(5, Part 1):799-806.

109. IBM. *SPSS Statistics for Windows*. 20.0 ed. Armonk, NY: IBM-Corp; 2011.

110. IBM. *SPSS Statistics for Windows*. 22.0 ed. Armonk, NY: IBM-Corp; 2013.

111. Maršál K, Persson PH, Larsen T, Lilja H, Selbing A, Sultan B. Intrauterine growth curves based on ultrasonically estimated foetal weights. *Acta Pædiatrica*. 1996;85(7):843-8.

112. Rothman KJ. *Epidemiology: An Introduction*. New York: Oxford; 2002.

113. Nilsen RM, Vollset SE, Gjessing HK, Skjærven R, Melve KK, Schreuder P, et al. Self-selection and bias in a large prospective pregnancy cohort in Norway. *Paediatr Perinat Epidemiol.* 2009;23(6):597-608. Available from doi: 10.1111/j.1365-3016.2009.01062.x

114. Haraldsdottir S, Gudmundsson S, Bjarnadottir RI, Lund SH, Valdimarsdottir UA. Maternal geographic residence, local health service supply and birth outcomes. *Acta Obstet Gynecol Scand*. 2015;94(2):156-64. Available from doi: 10.1111/aogs.12534

115. Rich-Edwards JW, Spiegelman D, Lividoti Hibert EN, Jun HJ, Todd TJ, Kawachi I, et al. Abuse in childhood and adolescence as a predictor of type 2 diabetes in adult women. *Am J Prev Med*. 2010;39(6):529-36. Available from doi: 10.1016/j.amepre.2010.09.007

116. Perkonigg A, Owashi T, Stein MB, Kirschbaum C, Wittchen H-U. Posttraumatic Stress Disorder and Obesity: Evidence for a Risk Association. *Am J Prev Med*. 2009;36(1):1-8. Available from doi: 10.1016/j.amepre.2008.09.026

117. Adams SS, Eberhard-Gran M, Eskild A. Fear of childbirth and duration of labour: a study of 2206 women with intended vaginal delivery. *BJOG*. 2012;119(10):1238-46. Available from doi: 10.1111/j.1471-0528.2012.03433.x

118. Laursen M, Johansen C, Hedegaard M. Fear of childbirth and risk for birth complications in nulliparous women in the Danish National Birth Cohort. *BJOG*. 2009;116(10):1350-5. Available from doi: 10.1111/j.1471-0528.2009.02250.x

119. Leeners B, Stiller R, Block E, Gorres G, Rath W, Tschudin S. Prenatal care in adult women exposed to childhood sexual abuse. *J Perinat Med*. 2013;41(4):365-374. Available from doi: 10.1111/j.1471-0528.2009.02250.x

120. Saigal S, Doyle LW. An overview of mortality and sequelae of preterm birth from infancy to adulthood. *The Lancet*. 2008;371(9608):261-9. Available from doi: 10.1016/S0140-6736(08)60136-1

121. Mac Bird T, Bronstein JM, Hall RW, Lowery CL, Nugent R, Mays GP. Late preterm infants: birth outcomes and health care utilization in the first year. *Pediatrics*. 2010;126(2):e311-e9. Available from doi: 10.1542/peds.2009-2869

122. Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, et al. Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults. *Am J Prev Med*. 1998;14(4):245.

123. Suglia SF, Sapra KJ, Koenen KC. Violence and Cardiovascular Health: A Systematic Review. *Am J Prev Med*. 2015;48(2):205-12. Available from doi: 10.1016/j.amepre.2014.09.013

124. Masho SW, Ahmed G. Age at Sexual Assault And Posttraumatic Stress Disorder among Women: Prevalence, Correlates, And Implications for Prevention. *J Womens Health*. 2007;16(2):262-71. Available from doi: 10.1089/jwh.2006.M076

125. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. *The Lancet*. 2008;371(9606):75-84. Available from https://doi.org/10.1016/S0140-6736(08)60074-4

126. Horan DL, Hill LD, Schulkin J. Childhood sexual abuse and preterm labor in adulthood: an endocrinological hypothesis. *Womens Health Issues*. 2000;10(1):27-33.

127. Bublitz MH, Stroud LR. Childhood sexual abuse is associated with cortisol awakening response over pregnancy: Preliminary findings. *Psychoneuroendocrinology*. 2012;37(9):1425-30. Available from doi: 10.1016/j.psyneuen.2012.01.009

128. Bolten M, Wurmser H, Buske-Kirschbaum A, Papoušek M, Pirke K-M, Hellhammer D. Cortisol levels in pregnancy as a psychobiological predictor for birth weight. *Arch Womens Ment Health*. 2011;14(1):33-41. Available from doi: 10.1007/s00737-010-0183-1

129. Sigurðardóttir HH. "*Samfélagið er bara í ruglinu*" [The society is just off the rails"]. Fréttablaðið. 2011;11(289):36.

130. Foshee VA, Bauman KE, Ennett ST, Linder GF, Benefield T, Suchindran C. Assessing the long-term effects of the Safe Dates program and a booster in preventing and reducing adolescent dating violence victimization and perpetration. *Am J Public Health*. 2004;94(4):619-24.

131. Ministry of the Interior, Ministry of Education, Science and Culture and Ministry of Welfare. *Report by Raising Awareness of Sexual, Emotional and Physical Violence against Children 2012-2014*. Reykjavik, 2014.

132. Garcia-Moreno C, Zimmerman C, Watts C. Calling for action on violence against women: is anyone listening? *The Lancet*. 2017;389(10068):486-8. Available from: doi: 10.1016/S0140-6736(17)30271-4

133. Bailey BA. Effectiveness of a Pregnancy Smoking Intervention: The Tennessee Intervention for Pregnant Smokers Program. *Health Educ Behav*. 2015; 42(6):824-31. Available from: doi: 10.1177/1090198115590780

134. Hauge LJ, Torgersen L, Vollrath M. Associations between maternal stress and smoking: findings from a population-based prospective cohort study. *Addiction*. 2012;107(6):1168-73. Available from: doi: 10.1111/j.1360-0443.2011.03775.x

135. Lopez WD, Konrath SH, Seng JS. Abuse-Related Post-Traumatic Stress, Coping, and Tobacco Use in Pregnancy. *JOGNN*. 2011;40(4):422-31. Available from: doi: 10.1111/j.1552-6909.2011.01261.x

136. Sjúkratryggingar Íslands [Icelandic Health Insurance]. *Sálfræðiþjónusta* [Psychology services]. Available from: http://www.sjukra.is/heilbrigdisthjonusta/salfraedithjonusta-vid-born/ [Accessed 6th December 2016].

137. Sorbo MF, Grimstad H, Bjorngaard JH, Schei B, Lukasse M. Prevalence of sexual, physical and emotional abuse in the Norwegian mother and child cohort study. *BMC Public Health*. 2013;13(1):186. Available from: doi: 10.1186/1471-2458-13-186

138. Rouhe H, Salmela-Aro K, Toivanen R, Tokola M, Halmesmäki E, Saisto T. Obstetric outcome after intervention for severe fear of childbirth in nulliparous women – randomised trial. *BJOG*. 2013;120(1):75-84. Available from: doi: 10.1111/1471-0528.12011

139. Hodnett ED, Gates S, Hofmeyr GJ, Sakala C. Continuous support for women during childbirth. *Cochrane Database Syst Rev*. 2012;10:CD003766. Available from: doi: 10.1002/14651858.CD003766.pub2

140. Hunt P, Backman G, J.B. de Mesquita, Finer L, Khosla R, Korljan D, et al. Section 4.1:*The right to the highest attainable standard of health.* In: Detels R, Beaglehole R, Lansang MA, Gulliford M, editors. Oxford Textbook of Public Health. 5. USA: Oxford University Press; 2011.

141. UN Committee on Economic, Social and Cultural Rights (CESCR), General Comment No. 14: *The Right to the Highest Attainable Standard of Health (Art. 12 of the Covenant)*. Geneva, 2000. Available from: http://www.refworld.org/docid/4538838d0.html

142. World Medical Association. World medical association declaration of Helsinki: Ethical principles for medical research involving human subjects. *JAMA*. 2013;310(20):2191-4. doi: 10.1001/jama.2013.281053

143. Abrahams N, Devries K, Watts C, Pallitto C, Petzold M, Shamu S, et al. Worldwide prevalence of non-partner sexual violence: a systematic review. *The Lancet*. 2014;383(9929):1648-54. Available from: doi: 10.1016/S0140-6736(13)62243-6

Paper I

AOGS
ACTA Obstetricia et Gynecologica Scandinavica

AOGS MAIN RESEARCH ARTICLE

Risk factors and health during pregnancy among women previously exposed to sexual violence

AGNES GISLADOTTIR[1], BERNARD L. HARLOW[2], BERGLIND GUDMUNDSDOTTIR[1,3,4], RAGNHEIDUR I. BJARNADOTTIR[5], EYRUN JONSDOTTIR[4], THOR ASPELUND[1,6], SVEN CNATTINGIUS[7] & UNNUR A. VALDIMARSDOTTIR[1,8]

[1]Center of Public Health Sciences, University of Iceland, Reykjavik, Iceland, [2]Department of Epidemiology, University of Minnesota School of Public Health, Minneapolis, Minnesota, USA, [3]Psychology Department, University of Iceland, Reykjavik, Iceland, [4]Rape Trauma Service, Accident and Emergency Department, Landspitali University Hospital, Reykjavik, Iceland, [5]Icelandic Birth Register, Department of Obstetrics and Gynecology, Landspitali University Hospital, Reykjavik, Iceland, [6]Icelandic Heart Association, Kopavogur, Iceland, [7]Unit of Clinical Epidemiology, Karolinska Institute, Stockholm, Sweden, and [8]Department of Epidemiology, Harvard School of Public Health, Boston, Massachusetts, USA

Key words
Maternal behavior, maternal health, obesity, pregnancy, sexual violence, smoking, violence against women

Correspondence
Agnes Gisladottir, Center of Public Health Sciences, Stapi v/Hringbraut, 101 Reykjavik, Iceland. E-mail:agnesg@hi.is

Conflict of interest
The authors have stated explicitly that there are no conflicts of interest with regard to this article.

Please cite this article as: Gisladottir A, Harlow BL, Gudmundsdottir B, Bjarnadottir RI, Jonsdottir E, Aspelund T, et al. Risk factors and health during pregnancy among women previously exposed to sexual violence. Acta Obstet Gynecol Scand 2014; DOI: 10.1111/aogs.12331

Received: 4 February 2013
Accepted: 30 December 2013

DOI: 10.1111/aogs.12331

Abstract

Objective. To determine whether women exposed to sexual violence in adolescence or adulthood are at increased risk of adverse maternal characteristics during subsequent pregnancies. *Design.* Register-based cohort study. *Setting.* Iceland. *Population.* We identified 586 women who attended a Rape Trauma Service (RTS) between 1993 and 2008 and all subsequent births of these women up to April 2011 (n = 915). These pregnancies were compared with 1641 randomly selected pregnancies of women who had not attended the RTS and who gave birth during the same calendar month. *Methods.* Information on maternal smoking, body mass index and illicit drug use was obtained from maternal charts. We used Poisson regression to obtain multivariable adjusted relative risks (aRR) with 95% CI contrasting prevalence of outcomes in the two groups. *Main outcome measures.* Characteristics and risk factors during pregnancy, including maternal smoking, body mass index, weight gain during pregnancy, illicit drug use. *Results.* Compared with unexposed women, sexually assaulted women were younger and more often primiparous in subsequent pregnancy, more likely not to be employed (7.8% vs. 4.3%; aRR 2.42, 95% CI 1.49–3.94), not cohabiting (45.6% vs. 14.2%; aRR 2.15, 95% CI 1.75–2.65), smokers (45.4% vs. 13.5%; aRR 2.68, 95% CI 2.25–3.20), and more likely to have used illicit drugs during pregnancy (3.4% vs. 0.4%; aRR 6.27, 95% CI 2.13–18.43). Exposed primiparas were more likely to be obese (15.5% vs. 12.3%; aRR 1.56, 95% CI 1.15–2.12). *Conclusions.* Women with a history of sexual violence are more likely to have risk factors during pregnancy that may affect maternal health and fetal development.

Abbreviations: aRR, adjusted relative risk; BMI, body mass index; CI, confidence interval; IBR, Icelandic birth register; ICD, International Classification of Diseases codes; RR, relative risk; RTS, Rape Trauma Service.

Introduction

Sexual violence is one of the most commonly experienced traumatic events among women (1,2), and has been linked to negative health consequences, including poor self-assessed health, frequent sick leave (3), somatic symptoms (4), post-traumatic stress disorder (1,5), depression (6), anxiety, eating disorders (7), cervical cancer (8), pelvic pain (3,4) and vulvodynia (9). In addition, exposure to sexual violence has been associated with subsequent use of illicit drugs, alcohol (7) and smoking (10,11).

Knowledge about the potential influence of sexual violence on pregnancy outcomes is important for continued improvement of antenatal care services. Studies on subsequent pregnancies among sexually assaulted women are few and have, with some exceptions (12), focused on sexual abuse during childhood. The results have indicated that women exposed to sexual violence are more likely to become pregnant in adolescence (13), smoke (12,14), have a higher body mass index (BMI), report common complaints such as nausea, tiredness and backache (12,14) and to be hospitalized (15) during pregnancy. Sexual violence, especially recent, has also been linked to higher odds of prenatal depression (16). Moreover, a higher prevalence of gestational diabetes (17) and pre-eclampsia has been reported among women exposed to childhood abuse (17,18). Yet, definite conclusions from these studies are hampered by low response rates and retrospective self-reporting of exposure (12,14,18).

By linking data sources from the Rape Trauma Service (RTS) and the nationwide birth register, we were able to obtain independently collected and verified data on both sexual assaults and maternal health indicators during subsequent pregnancies. Our main aim was to investigate associations between sexual violence and women's subsequent characteristics and behavior during pregnancy. We specifically sought to understand the sociodemographic profile of victimized women at the time of their subsequent pregnancies and whether, compared with unexposed women, they were at increased risk of smoking, illicit drug use, obesity and maternal diseases during pregnancy. We also assessed whether the severity of the violence, age when exposed to sexual violence, or time from exposure to delivery affected the associations.

Materials and methods

We designed a register-based cohort study, linking data from the RTS at the Accident and Emergency Department of Landspitali University Hospital (the only tertiary referral hospital in Iceland; total population 319 000 in 2011) with data from the national Icelandic birth register (IBR).

The RTS opened in the capital city, Reykjavik, in March 1993, offering emergency services for sexually assaulted adolescents and adults. Information from medical records at the RTS has been registered in an electronic database (19). By 31 December 2008, 1421 women had attended the RTS at least once. The personal identification numbers of these women were then linked to the IBR and all subsequent pregnancies after attendance at the RTS were identified up to mid-April 2011. In total, 594 of these women (exposed group) subsequently became pregnant, resulting in a total of 925 deliveries (90% delivered after year 2000). For comparison, a data administrator at the University Hospital Information Technology Center used a computerized program to randomly select from the IBR two pregnancies of women with no record at the RTS and who gave birth in the same calendar month as every index-exposed woman. Of all unexposed pregnancies ($n = 1771$), 98.4% were singleton pregnancies compared with 98.7% in the exposed cohort. A majority of women attending the RTS reside in the capital area (19) where access to specialized maternity services is readily obtained. We therefore stratified the random selection of unexposed women according to the place of delivery of exposed women (within or outside the capital area). The groups varied with respect to citizenship as 98.9% of exposed women had Icelandic citizenship compared with 92.8% of the unexposed. Therefore, we also restricted our study population to Icelandic citizens (exposed 915; unexposed 1641 deliveries) giving a total study population of 2556 women.

The IBR contains information on parents and neonates and International Classification of Diseases (ICD) codes (20) on the pregnancy and delivery updated to ICD-10. The following codes were used to define pregnancy-related diagnoses: O13 (gestational hypertension without significant proteinuria); O11 (preeclampsia superimposed on chronic hypertension), O14 (preeclampsia), O15 (eclampsia); O24.4 (diabetes mellitus arising in pregnancy) and O24.9 (diabetes mellitus in pregnancy, unspecified). Information is registered by health professionals at each place of delivery and sent electronically to the IBR center.

Key Message

Pregnant women previously exposed to sexual violence are more likely than unexposed women to present with risk factors, such as smoking, illicit drug use and obesity, which are of pivotal importance for maternal health and fetal development.

Maternal smoking and illicit drug use, height and weight were manually retrieved from standardized maternity records by the first author (AG) and a trained research assistant, who were blinded with respect to the woman's exposure status. We obtained maternity records from all larger hospitals in the country (>25 deliveries in the cohorts) excluding one center that denied access.

The BMI (kg/m^2) was calculated from the first antenatal weight measurement, and total pregnancy weight gain was calculated as the difference between the last and first weight measurements. Gestational weight gain was categorized according to the Institute of Medicine recommendations (21) as 12.5–18 kg for underweight, 11.5–16 kg for normal weight, 7–11.5 kg for overweight and 5–9 kg for obese women. Weight gain analyses were restricted to those who carried singletons and had a weight measurement before day 140 of pregnancy ($n = 2064$) [first measurement on average at 90.4 days (SD 15.9), last at 269.9 day (SD 18.3)]. Smoking status was based on self-reported information at the first early antenatal visit and women were categorized as nonsmokers (including smokers who quit soon after onset of pregnancy), and as smokers with fewer than ten cigarettes/day, ten or more cigarettes/day, and undefined frequency. Illicit drug use was, like smoking, registered by antenatal care midwives based on self-reporting and drug testing for some women.

We categorized occupational status as employed, unemployed/on disability benefit/full-time homemaker or student. Time from exposure to delivery was calculated as number of months between the date of the assault as reported by the woman at the time of RTS registration [approximately 90% attended within 4 weeks of the assault (19)], and date of delivery. For women who had more than one RTS attendance, time from the most recent assault was used. Date of attendance was used as a marker of the assault date in two cases. Age categorization referred to first attendance.

The study was approved by the National Bioethics Committee (VSNb2010050009/03.7) and the Data Protection Authority (2010060504AT/–), with additional acceptance from hospital authorities and the Directorate of Health.

Statistical analysis

We compared the prevalence of characteristics, risk factors and health indicators between exposed and unexposed groups, using Poisson log-linear models with robust error variance to obtain relative risk (RR) with 95% CI. The RR represent a ratio of the proportion of exposed vs. unexposed women with index outcome or characteristic in each line. We analyzed separately all exposed women's pregnancies and each woman's first subsequent pregnancy after attendance at the RTS. Adjustments were made for age (continuous), parity (primipara or multipara), year of delivery and gestational length at first weight measurement for BMI and weight gain. We further repeated our main analyses on primiparous women. The association between exposure, maternal smoking and illicit drug use, weight-related risk factors, and maternal health by violence severity, age at attendance at the RTS, and time from assault were explored by first pregnancy after exposure, adjusting also for women's occupational status and BMI to isolate these from each outcome (data not shown). Data analysis was conducted with IBM SPSS Statistics version 20.0 (IBM Corporation, Armonk, NY, USA).

Results

Table 1 presents the background characteristics of the exposed women during all pregnancies and first pregnancy after attendance at the RTS, and for the unexposed women. Exposed women were younger during first (24.4 years) and all subsequent (25.3 years) pregnancies than unexposed women (mean age 29.3 years), more likely to be unemployed, on disability benefit or homemakers, and less likely to be cohabiting. The mean number of prenatal visits was 11.3 for exposed primiparas and 11.0 for unexposed primiparas. It was common that the first pregnancy after sexual assault was the exposed woman's first (75.8%).

Table 2 shows maternal risk factors and health during all pregnancies and first subsequent pregnancy, compared with unexposed women. Exposure to sexual violence was significantly associated with smoking and illicit drug use in first and all subsequent pregnancies. After adjustment for age, parity, and year of delivery, exposed women were more than twice as likely as unexposed women to be smokers and more than three times as likely to be heavy smokers. Exposed women were six times more likely than unexposed to have used illicit drugs at some point during pregnancy. Exposure to sexual violence was in first and all subsequent pregnancies marginally associated with obesity and gestational weight gain below recommendations. Exposed primiparas were at increased risk of being obese (RR 1.56, 95% CI 1.15–2.12) and possibly for gaining weight below recommendations (RR 1.34, 95% CI 0.99–1.81). We observed no significant differences with respect to maternal ICD diagnoses. Adjusting for women's occupational status had no influence on the associations (data not shown).

The association between smoking ten or more cigarettes/day in the first pregnancy after assault did not vary by severity of the sexual violence, age at the assault

Table 1. Background characteristics of women during all pregnancies and first pregnancy after attendance at the Rape Trauma Service and a population of unexposed women who had not attended the Rape Trauma Service before their pregnancy.

	Unexposed women		Exposed women, all pregnancies				Exposed women, first subsequent pregnancy			
	n	%	*n*	%	RR[a]	95% CI	*n*	%	RR[a]	95% CI
	1641		915				586			
Woman's age at time of delivery (years)										
19 or younger	60	3.7	119	13.0	2.06	1.45–2.92	117	20.0	2.13	1.49–3.04
20–24	269	16.4	331	36.2	1.86	1.58–2.18	225	38.4	1.46	1.22–1.74
25–29	547	33.3	273	29.8	0.99	0.86–1.12	143	24.4	0.79	0.66–0.95
30–34	445	27.1	136	14.9	0.70	0.58–0.84	67	11.4	0.71	0.54–0.95
35 or older	320	19.5	56	6.1	0.38	0.27–0.53	34	5.8	0.53	0.35–0.80
Woman's occupational status										
Employed	1275	77.7	606	66.2	0.95	0.89–1.01	393	67.1	0.95	0.89–1.03
Unemployed, disability pension or at home	70	4.3	105	11.5	1.88	1.33–2.65	46	7.8	2.42	1.49–3.94
Student	268	16.3	172	18.8	0.95	0.78–1.15	124	21.2	0.92	0.74–1.14
Missing	28	1.7	32	3.5			23	3.9		
Partner's occupational status										
Employed	1381	84.2	683	74.6	1.00	0.95–1.04	424	72.4	1.00	0.94–1.06
Unemployed, disability pension or at home	12	0.7	54	5.9	4.38	2.10–9.14	34	5.8	4.09	1.72–9.71
Student	127	7.7	70	7.7	0.70	0.51–0.96	51	8.7	0.60	0.43–0.85
Missing	121	7.4	108	11.8			77	13.1		
Cohabitation										
Cohabiting	1395	85.0	535	58.5	0.81	0.76–0.86	312	53.2	0.76	0.70–0.82
Not cohabiting	233	14.2	372	40.7	1.99	1.66–2.39	267	45.6	2.15	1.75–2.65
Missing	13	0.8	8	0.9			7	1.2		
Residence										
Capital area	1082	65.9	594	64.9	1.01	0.98–1.04	392	66.9	1.00	0.97–1.04
Other	515	31.4	288	31.5	0.99	0.95–1.03	170	29.0	1.00	0.96–1.04
Missing	44	2.7	33	3.6			24	4.1		
Parity										
No previous delivery	643	39.2	444	48.5	0.86	0.79–0.94	444	75.8	1.31	1.20–1.42
One or more previous deliveries	998	60.8	471	51.5	1.09	1.01–1.17	142	24.2	0.55	0.47–0.65
Number of prenatal visits										
≤10	823	50.2	407	44.5	0.86	0.77–0.95	225	38.4	0.81	0.70–0.93
>10	818	49.8	508	55.5	1.15	1.05–1.25	361	61.6	1.17	1.07–1.29

[a]Relative risk, comparing exposed women's characteristics with unexposed women's characteristics. Adjusted for all other variables in the table and year of delivery.

or time since the assault (Table 3). Women who were older than 20 years at the time of assault, or who delivered within 3 years after being assaulted, were ten times more likely to have used illegal drugs at some point during pregnancy. The BMI, gestational weight gain, and maternal ICD diagnoses in first subsequent pregnancies were analyzed by exposure severity, age of attendance to the RTS and time since assault (data not shown). Overall, the results changed minimally. Women attending the RTS at ≥20 years of age and those delivering within 3 years after the assault showed a two-fold risk of being diagnosed with gestational diabetes (RR 1.99, 95% CI 1.01–3.95, and RR 2.60, 95% CI 1.14–5.90, respectively), but after adjusting for BMI, these estimates were not statistically significant (RR 1.23, 95% CI 0.65–2.30 and RR 1.88, 95% CI 0.65–5.40, respectively).

Women who attended the RTS in 2009–2010 were not included in our record linkage and may theoretically have been randomly selected into the unexposed cohort. To alleviate these concerns for misclassification of exposure, we repeated our analyses, restricting them to women delivering before 1 January 2010 and the results remained almost unchanged (data not shown).

Discussion

Women exposed to sexual violence in adolescence or early adulthood and attending the RTS were younger

Table 2. Risk factors and health during all pregnancies and first subsequent pregnancy after attendance at the Rape Trauma Service, compared with a population of unexposed women who had not attended the Rape Trauma Service before their pregnancy.

	Unexposed women		Exposed women, all pregnancies				Exposed women, first subsequent pregnancy			
	n	%	*n*	%	RR[a]	95% CI	*n*	%	RR[a]	95% CI
	1641		915				586			
Smoking during pregnancy										
Nonsmokers (past or never smokers)	1267	77.2	444	48.5	0.67	0.62–0.73	274	46.8	0.63	0.58–0.69
Smokers	222	13.5	379	41.4	2.59	2.19–3.07	266	45.4	2.68	2.25–3.20
≤9 cigarettes per day	54	3.3	99	10.8	2.67	1.86–3.84	68	11.6	2.58	1.76–3.79
≥10 cigarettes per day	66	4.0	118	12.9	3.26	2.31–4.59	81	13.8	3.55	2.46–5.12
Undefined amount	102	6.2	162	17.7	2.18	1.68–2.84	117	20.0	2.24	1.68–3.00
Missing	152	9.3	92	10.1			46	7.8		
Early pregnancy body mass index										
<18.5	23	1.4	21	2.3	1.08	0.58–2.02	17	2.9	1.20	0.63–2.29
18.5–24.9	758	46.2	426	46.6	0.95	0.87–1.05	294	50.2	0.98	0.89–1.08
25.0–29.9	410	25.0	210	23.0	0.97	0.83–1.14	124	21.2	0.88	0.73–1.07
≥30.0 or higher	253	15.4	148	16.2	1.17	0.94–1.45	90	15.4	1.20	0.96–1.51
Missing	197	12.0	110	12.0			61	10.4		
Weight gain during pregnancy[b]										
Below recommendations	275	20.9	163	21.8	1.19	0.98–1.43	97	19.9	1.16	0.94–1.43
Adequate	494	37.5	265	35.4	0.97	0.85–1.10	168	34.4	0.98	0.85–1.14
Above recommendations	514	39.1	305	40.8	0.94	0.84–1.06	216	44.3	0.93	0.82–1.05
Missing	33	2.5	15	2.0			7	1.4		
Illegal drug use during pregnancy										
Yes, at least once during pregnancy	6	0.4	29	3.2	5.81	2.27–14.86	20	3.4	6.27	2.13–18.43
Missing	173	10.5	114	12.5			63	10.8		
Gestational hypertension	46	2.8	29	3.2	1.18	0.73–1.90	25	4.3	1.31	0.80–2.16
Preeclampsia	62	3.8	27	3.0	0.70	0.44–1.11	26	4.4	0.83	0.52–1.33
Gestational diabetes	39	2.4	25	2.7	1.37	0.76–2.48	15	2.6	1.47	0.78–2.77

[a]Relative risks of each outcome with unexposed women as a reference group. Adjusted for age, parity and year of delivery. Body mass index was additionally adjusted for pregnancy length at first weight measurement in an antenatal visit and weight gain was adjusted for pregnancy length at both first and last measurement.

[b]Restricted to women carrying singletons with a weight measurement before week 20 of pregnancy (n = 2064). Based on Institute of Medicine recommendations for weight gain.

when they had children, more likely to be unemployed, receiving disability benefit or not working outside their home, and less likely to be co-habiting. They were also more likely to smoke and to have used illicit drugs at least once during their first and subsequent pregnancies. Our data also suggest a trend towards more obesity and lower gestational weight gain among women exposed to sexual violence, particularly among primiparous women. Possibly limited by small numbers we found no statistically significant differences between exposed and unexposed women regarding gestational hypertension or preeclampsia.

Smoking and obesity are important risk factors for an adverse pregnancy outcome and potentially amenable to preventive efforts (22). One of every two exposed women smoked during pregnancy and there was a three-fold likelihood of smoking more than ten cigarettes per day compared with the unexposed women. During the same period the prevalence of daily smoking among women aged 15–49 years in Iceland decreased from 29% in 1996 to 13% in 2010 (23). Our prevalence rates are considerably higher than the 22% reported among exposed Norwegian women (12). Since we classified former smokers as nonsmokers, this is probably a conservative estimate. Women who are unable to quit smoking during pregnancy have high levels of anxiety and depressive symptoms (24). Obstetric risks can be lowered by total cessation or even diminished smoking (22), but alternative approaches may be needed to accomplish smoking cessation or reduction among women exposed to sexual violence.

Even though the relative risk of illicit drug use was high, only a small proportion of the exposed women were affected. Data on exposures and outcomes were collected independently, which reduced the risk of differential misclassification; however, social status may affect

Table 3. Maternal daily cigarette smoking and illicit drug use at some point during first subsequent pregnancy by violence severity, age and time.

	Smoking of ≥10 cigarettes				Illicit drug use			
	n[a]	%	RR[b]	95% CI	*n*[a]	%	RR[b]	95% CI
Unexposed	1489	4.4	ref.		1468	0.4	ref.	
Severity of the exposure								
First pregnancy after any sexual violence	540	15.0	3.55	2.46–5.12	523	3.8	6.27	2.13–18.43
First pregnancy after penetrative sexual violence	387	15.8	3.71	2.51–5.49	376	4.0	7.33	2.25–23.87
Age at time of first attendance[c]								
<20 years	311	12.2	2.17	1.33–3.54	302	3.6	2.46	0.95–6.39
≥20 years	227	18.9	4.04	2.81–5.83	219	4.1	10.89	3.93–30.13
Missing	2				2			
Time from assault to first delivery[c]								
<3 years	217	20.3	3.55	2.27–5.54	209	5.7	9.52	2.62–34.64
3–6 years	190	15.3	3.54	2.18–5.74	184	3.3	4.82	1.26–18.47
≥6 years	127	6.3	2.19	0.98–4.89	125	1.6	2.20	0.48–10.12
Missing	6				5			

[a]Number of women with available information and the proportion with each risk factor.

[b]Relative risks adjusted for age, parity and year of delivery.

[c]Some women attended the Rape Trauma Service more than once. Age categorization is according to age at first attendance. Time between assault and delivery was calculated from the most recent assault to date of delivery.

whether women are indeed asked or screened for illicit drug use. This would affect our point estimates because exposed women are, for example, more likely to be unemployed or on disability benefit.

We had no information on BMI at the time of the assault; so, we do not know whether these exposed women were already more obese or if they gained weight as a result of the assault. Sexual violence (25,26) and post-traumatic stress disorder (27) have been reported to increase women's risk of becoming obese. Exposed primiparas were both more at risk of obesity and at risk of weight gain below the Institute of Medicine recommendations. We are not aware of other studies looking at gestational weight gain in relation to previous sexual violence. The increased risk of gestational diabetes observed among exposed women appeared to be mediated by higher BMI. Previous findings have indicated a dose–response association between sexual assault in childhood or adolescence and type 2 diabetes, partially explained by higher BMI (26). Others have reported stressful life events within a year before the birth to be a risk factor for gestational diabetes (28). Similarly a higher prevalence of preeclampsia among women exposed to any abuse (18) or a high level of abuse (17) in childhood has been suggested. Self-reported violence and varying study sizes may, at least in part, account for the discrepancy in findings.

An important strength of this study was that the information on sexual violence was collected independently of outcome ascertainment, which reduces risk of bias. There are, however, also limitations. First, we defined our exposed cohort as all women who attended the RTS through 2008 and subsequently gave birth. However, we presume that only a proportion of sexually assaulted women in the population seek help after exposure and therefore, some of the women we assigned as "unexposed" have inevitably been exposed to sexual violence, either in childhood or later. This misclassification suggests that the point estimates presented in our tables may be an underestimate of the true effects of exposure on maternal characteristics, behaviors and health during pregnancy. Second, we did not have information on each woman's perception of the assault, how severely it affected her, or information on received support (professional or other). Midwives in antenatal health care are encouraged to look for signs of domestic violence (29), but we lack information on whether women were asked about exposure to violence and what care they received. Third, our study is limited by small numbers, particularly in analyses on rare maternal outcomes. Last, nor did we have detailed information on characteristics, health or adverse health behaviors of women before the exposure. Hence, it cannot be disentangled whether many of the observed associations between sexual violence and pregnancy characteristics, such as smoking, unemployment, and obesity, reflect prior status of the women, consequences of the assault or both. Nevertheless, due to the relevance of these factors for maternal and infant health, our findings have clinical and public health importance.

In summary, we found that women exposed to sexual violence present with characteristics and health behaviors, such as smoking and illicit drug use, that can be harmful to pregnancy outcomes. In addition to effects on maternal health, these modifiable maternal characteristics can affect fetal development, which underscores the public health importance of our findings. Hence, in antenatal care, it is essential to offer special attention and support to women who have been exposed to sexual violence.

Acknowledgments

We thank Birna Bjorg Masdottir and Ingibjorg Richter for their work on the record linkage. We are also grateful to Agnes Bjorg Tryggvadottir, Audur Sjofn Thorisdottir and Thyri Asta Hafsteinsdottir for help with the data gathering, Gunnar Tomasson and Dr Vilhjalmur Rafnsson for helpful comments and Dr Örn Ólafsson for statistical support.

Funding

This study was funded by the Icelandic Research Fund for Graduate Students (Rannis) and the Landspitali University Hospital Research Fund.

References

1. Frans O, Rimmo P-A, Aberg L, Fredrikson M. Trauma exposure and post-traumatic stress disorder in the general population. Acta Psychiatr Scand. 2005;111:291.
2. Amstadter A, Aggen S, Knudsen G, Reichborn-Kjennerud T, Kendler K. Potentially traumatic event exposure, posttraumatic stress disorder, and Axis I and II comorbidity in a population-based study of Norwegian young adults. Soc Psychiatry Psychiatr Epidemiol. 2013;48:215–23.
3. Hilden M, Schei B, Swahnberg K, Halmesmaki E, Langhoff-Roos J, Offerdal K, et al. A history of sexual abuse and health: a Nordic multicentre study. BJOG. 2004;111:1121–7.
4. Paras ML. Sexual abuse and lifetime diagnosis of somatic disorders: a systematic review and metaanalysis. JAMA. 2009;302:550–61.
5. Pietrzak RH, Goldstein RB, Southwick SM, Grant BF. Prevalence and Axis I comorbidity of full and partial posttraumatic stress disorder in the United States: results from wave 2 of the National Epidemiologic Survey on Alcohol and Related Conditions. J Anxiety Disord. 2011;25:456–65.
6. Wise LA, Zierler S, Krieger N, Harlow BL. Adult onset of major depressive disorder in relation to early life violent victimisation: a case–control study. Lancet. 2001; 358:881–7.
7. Jonas S, Bebbington P, McManus S, Meltzer H, Jenkins R, Kuipers E, et al. Sexual abuse and psychiatric disorder in England: results from the 2007 Adult Psychiatric Morbidity Survey. Psychol Med. 2011;41:709–19.
8. Coker AL, Hopenhayn C, DeSimone CP, Bush HM, Crofford L. Violence against Women Raises Risk of Cervical Cancer. J Womens Health. 2009;18:1179–85.
9. Harlow BL, Stewart EG. Adult-onset vulvodynia in relation to childhood violence victimization. Am J Epidemiol. 2005;161:871–80.
10. Nelson EC. Childhood sexual abuse and risks for licit and illicit drug-related outcomes: a twin study. Psychol Med. 2006;36:1473.
11. Nichols HB, Harlow BL. Childhood abuse and risk of smoking onset. J Epidemiol Community Health. 2004;58:402–6.
12. Lukasse M, Henriksen L, Vangen S, Schei B. Sexual violence and pregnancy-related physical symptoms. BMC Pregnancy Childbirth. 2012;12:83.
13. Noll JG, Shenk CE, Putnam KT. Childhood sexual abuse and adolescent pregnancy: a meta-analytic update. J Pediatr Psychol. 2009;34:366–78.
14. Lukasse M, Schei B, Vangen S, Øian P. Childhood abuse and common complaints in pregnancy. Birth. 2009;36:190–9.
15. Leeners B, Stiller R, Block E, Görres G, Rath W. Pregnancy complications in women with childhood sexual abuse experiences. J Psychosom Res. 2010;69:503–10.
16. Rich-Edwards JW, James-Todd T, Mohllajee A, Kleinman K, Burke A, Gillman MW, et al. Lifetime maternal experiences of abuse and risk of pre-natal depression in two demographically distinct populations in Boston. Int J Epidemiol. 2011;40:375–84.
17. Roberts Al, Lyall K, Rich-Edwards JW, Ascherio A, Weisskopf MG. Association of maternal exposure to childhood abuse with elevated risk for autism in offspring. JAMA Psychiatry. 2013;70:508–15.
18. Lukasse M, Vangen S, Øian P, Schei B. Childhood abuse and caesarean section among primiparous women in the Norwegian Mother and Child Cohort Study. BJOG. 2010;117:1153–7.
19. Gisladottir A, Gudmundsdottir B, Gudmundsdottir R, Jonsdottir E, Gudjonsdottir GR, Kristjansson M, et al. Increased attendance rates and altered characteristics of sexual violence. Acta Obstet Gynecol Scand. 2012;91: 134–42.
20. World Health Organization. International Classification of Diseases, Version 10. Geneva: WHO, 1992.
21. Rasmussen KM, Yaktine AL. Weight Gain During Pregnancy: Reexamining the Guidelines. Washington, DC: The National Academies Press, 2009.
22. Cnattingius S, Lambe M. Trends in smoking and overweight during pregnancy: prevalence, risks of pregnancy complications, and adverse pregnancy outcomes. Semin Perinatol. 2002;26:286–95.

23. Public Health Institute of Iceland. Smoking habits by sex and age 1994–2010. Reykjavik: Statistics Iceland. Available online at: http://www.statice.is (accessed May 18, 2012).
24. Hauge LJ, Torgersen L, Vollrath M. Associations between maternal stress and smoking: findings from a population-based prospective cohort study. Addiction. 2012;107:1168–73.
25. Noll JG, Zeller MH, Trickett PK, Putnam FW. Obesity risk for female victims of childhood sexual abuse: a prospective study. Pediatrics. 2007;120:e61–e7.
26. Rich-Edwards JW, Spiegelman D, Lividoti Hibert EN, Jun HJ, Todd TJ, Kawachi I, et al. Abuse in childhood and adolescence as a predictor of type 2 diabetes in adult women. Am J Prev Med. 2010;39:529–36.
27. Perkonigg A, Owashi T, Stein MB, Kirschbaum C, Wittchen H-U. Posttraumatic stress disorder and obesity: evidence for a risk association. Am J Prev Med. 2009;36:1–8.
28. Hosler AS, Nayak SG, Radigan AM. Stressful events, smoking exposure and other maternal risk factors associated with gestational diabetes mellitus. Paediatr Perinat Epidemiol. 2011;25:566–74.
29. Directorate of Health. Maternal Care for Mother's with Normal Pregnancy. Seltjarnarnes: Directorate of Health, 2008.

Paper II

PLOS ONE

RESEARCH ARTICLE

Obstetric Outcomes of Mothers Previously Exposed to Sexual Violence

Agnes Gisladottir[1]*, Miguel Angel Luque-Fernandez[2,3], Bernard L. Harlow[4], Berglind Gudmundsdottir[5,6], Eyrun Jonsdottir[5], Ragnheidur I. Bjarnadottir[7], Arna Hauksdottir[1], Thor Aspelund[1,8], Sven Cnattingius[9], Unnur A. Valdimarsdottir[1,3,10]

1 Center of Public Health Sciences, University of Iceland, Reykjavik, Iceland, **2** London School of Hygiene and Tropical Medicine, Department of Non-Communicable Diseases Epidemiology, London, United Kingdom, **3** Harvard School of Public Health, Boston, Massachusetts, United States of America, **4** Boston University School of Public Health, Boston, Massachusetts, United States of America, **5** Rape Trauma Service and the Trauma Center, Landspitali - The National University Hospital of Iceland, Reykjavik, Iceland, **6** Psychology Department, University of Iceland, Reykjavik, Iceland, **7** Department of Obstetrics and Gynecology, Landspitali - The National University Hospital of Iceland, Reykjavik, Iceland, **8** The Icelandic Heart Association, Kopavogur, Iceland, **9** Unit of Clinical Epidemiology, Karolinska Institutet, Stockholm, Sweden, **10** Department of Medical Epidemiology, Karolinska Institutet, Stockholm, Sweden

* agnesg@hi.is

OPEN ACCESS

Citation: Gisladottir A, Luque-Fernandez MA, Harlow BL, Gudmundsdottir B, Jonsdottir E, Bjarnadottir RI, et al. (2016) Obstetric Outcomes of Mothers Previously Exposed to Sexual Violence. PLoS ONE 11(3): e0150726. doi:10.1371/journal.pone.0150726

Editor: Jodi Pawluski, University of Rennes-1, FRANCE

Received: September 3, 2015

Accepted: February 17, 2016

Published: March 23, 2016

Data Availability Statement: Data in this study were obtained from national registers. National data protection laws apply; data can be requested from the Directorate of Health (contact: Guðrún K. Guðfinnsdóttir, gudkrg@landlaeknir.is).

Funding: This work was supported by The Icelandic Research Fund for Graduate Students, RAN090310-0736, www.rannis.is (AG). The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. It was also supported by the Landspitali University Hospital Research Fund, http://www.landspitali.is/visindi-og-menntun/visindastarfsemi/visindasjodur-lsh/ (AG).

Abstract

Background

There is a scarcity of data on the association of sexual violence and women's subsequent obstetric outcomes. Our aim was to investigate whether women exposed to sexual violence as teenagers (12–19 years of age) or adults present with different obstetric outcomes than women with no record of such violence.

Methods

We linked detailed prospectively collected information on women attending a Rape Trauma Service (RTS) to the Icelandic Medical Birth Registry (IBR). Women who attended the RTS in 1993–2010 and delivered (on average 5.8 years later) at least one singleton infant in Iceland through 2012 formed our exposed cohort (n = 1068). For each exposed woman's delivery, nine deliveries by women with no RTS attendance were randomly selected from the IBR (n = 9126) matched on age, parity, and year and season of delivery. Information on smoking and Body mass index (BMI) was available for a sub-sample (n = 792 exposed and n = 1416 non-exposed women). Poisson regression models were used to estimate Relative Risks (RR) with 95% confidence intervals (CI).

Results

Compared with non-exposed women, exposed women presented with increased risks of maternal distress during labor and delivery (RR 1.68, 95% CI 1.01–2.79), prolonged first stage of labor (RR 1.40, 95% CI 1.03–1.88), antepartum bleeding (RR 1.95, 95% CI 1.22–3.07) and emergency instrumental delivery (RR 1.16, 95% CI 1.00–1.34). Slightly higher risks were seen for women assaulted as teenagers. Overall, we did not observe differences

The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Competing Interests: The authors have declared that no competing interests exist.

between the groups regarding the risk of elective cesarean section (RR 0.86, 95% CI 0.61–1.21), except for a reduced risk among those assaulted as teenagers (RR 0.56, 95% CI 0.34–0.93). Adjusting for maternal smoking and BMI in a sub-sample did not substantially affect point estimates.

Conclusion

Our prospective data suggest that women with a history of sexual assault, particularly as teenagers, are at increased risks of some adverse obstetric outcomes.

Introduction

Violence, including sexual violence, is a worldwide public health problem [1]. Exposure to sexual violence has been linked with increased risks of various negative physical [2–4] and mental [5–7] health consequences. Various mechanisms have been hypothesized, including biological, behavioral and emotional, yet further studies are needed to better understand and act on these complex pathways [8]. Associations have also been reported between exposure to sexual violence and subsequent risk factors such as illicit drug- or alcohol use [5, 9], smoking [9] and high body mass index (BMI)[10]; associations that also have been observed among women in subsequent pregnancies [11–15].

Sexual violence involves the body parts of human reproduction and indeed some survivors of rape have described re-experiencing the assault during labor and delivery [16]. Although the number of studies has increased during the last decade, knowledge on the potential influence of sexual violence on maternal and obstetric outcomes is still scarce. Women who have been exposed to sexual violence have been reported to be at increased risk of being hospitalized during pregnancy [17, 18], reporting common pregnancy complaints (for example nausea, backache, and tiredness) [12, 13] and fearing childbirth before [19] or during labor [20].

Few studies have addressed whether a history of sexual violence increases the risk of labor complications, such as labor dystocia; some studies have reported prolonged second stage of labor in women exposed in adulthood [21, 22], while others have not found any associations between sexual violence and labor dystocia [14, 23]. Similarly, findings from studies on the association between sexual violence and risk of cesarean section or instrumental vaginal deliveries are mixed. Some studies have reported an association (at least for subgroups of exposed women) with elective cesareans [14, 24], emergency cesareans [14], or either [21, 22], while others have not found such associations [15, 25]. Vaginal instrumental deliveries have in some studies been associated with a history of sexual violence [21, 22] while such an association has not been confirmed in other studies [14, 15, 24]. These contradictory findings inevitably reflect the vast methodological challenges in most previous studies, including retrospective self-reports of exposure [12–15, 18–20, 23–25] or selection of small clinical samples, limiting the generalizability of the findings [21, 22]. Furthermore, some [12, 17, 25] but not all [11, 13–15, 18–24] previous studies have been restricted to sexual abuse during childhood. A recent report from the World Health Organization calls for increased research to fill existing knowledge gap on the health consequences of sexual violence [1]. Thus, to add to previous studies on obstetric outcomes among sexual violence survivors, larger population-based follow-up studies of medically registered indices of sexual violence are needed for improved understanding, and prevention, of potential adverse consequences in pregnancy and labor.

In Reykjavik, Iceland, prospectively collected information on women seeking trauma services for sexual assault is available from 1993 and onwards, providing an opportunity for complete follow-up of subsequent births in the nationwide electronic Icelandic Medical Birth Registry (IBR). Using these resources, it is possible to conduct studies that complement some of the methodological shortcomings of many previous studies. We aimed to investigate the associations between women's sexual violence exposure as teenagers or adults and adverse obstetric outcomes later in their lives. We further aimed to identify whether the risk of adverse outcomes varied by age at and time from sexual violence exposure.

Materials and Methods

The study was accepted by The National Bioethics Committee (VSNb2010050009/03.7) and The Data Protection Authority (2013040591HGK/—), with acceptance from Landspitali and The Directorate of Health. No participants were contacted; the data were analyzed anonymously.

The Rape Trauma Service (RTS) opened in March 1993 at the accident and emergency department of Landspitali—the National University Hospital of Iceland. The RTS provides emergency services for sexually assaulted individuals who are 12 years old and older, of whom most report severe sexual violence (penetration). The data on assaulted women are registered by attending health care professionals independent of this study. The services and data registration are further described in our previous study [26]. Upon attendance to the RTS, individuals are registered with their unique personal identification number. For the preparation of the exposed cohort, a data administrator at the hospital performed a record linkage of the unique identification numbers of women attending RTS from 1993 to 2011 to the Icelandic Birth Register to obtain information on obstetric outcomes. In total, 670 exposed women with Icelandic citizenship delivered 1068 singleton infants in Iceland in the period following attendance until the end of follow-up (December 31st 2012). Time from assault to delivery was on average 5.8 years (median 5.1 years, interquartile range 5.6 years).

We considered all mothers in the IBR who had not attended the RTS through Dec 31st 2011 as being non-exposed. For each exposed mother's delivery, we aimed to randomly select ten deliveries, by Icelandic mothers, with a computerized program for our non-exposed cohort, with the following matching criteria: *Age* (a) $\leq$19 years, b) 20–39 years, matched on exact age, c) $\geq$40 years), *parity* (primipara or multipara), and *calendar season of delivery* (January-April, May-August, or September-December of the same year). We restricted our analysis to singletons and, if randomly selected more than once, applied each delivery by a non-exposed mother only once in our analyses. This resulted in a study population of 9126 deliveries of non-exposed mothers and 1068 deliveries of exposed mothers.

The IBR includes information on every delivery in Iceland from gestational week 22. Data is registered by health professionals at each antenatal clinic and birthplace, and is sent electronically after delivery to the IBR, where it is verified by a secretary. Variables include information on mother and infant, International Classification of Diseases codes for all diagnosis (ICD) and NOMESCO Classification of Surgical Procedures (NCSP) codes. All earlier ICD codes in the IBR have been updated according to the tenth version (ICD -10).

ICD—10 codes were used to define the following outcomes: *Labor dystocia* (primary (O62.0), secondary (O62.1) and unspecified (O62.2) dystocia, prolonged first (O63.0) and second (O63.1) latent phase, or unspecified prolonged labor (O63.9)), *maternal distress during labor and delivery* (O75.0), *antepartum bleeding* (O44-46, including placental abruption O45), *elective caesarean section* (O82.0), and *emergency caesarean section* (O82.1).

The following NCSP codes were used to define obstetric interventions: *Induced labor* (MAXC00, 02, 09), *instrumental vaginal delivery* (either forceps or vacuum extraction) (MASE00, 03, 96; MASF00, 10, 96, MASG03, 13, or ICD-10 O81.0, O81.1, O81.2, O81.3, O81.4, O81.5), and *emergency instrumental delivery* (defined as either vaginal instrumental delivery or emergency cesarean delivery).

Women's occupation (registered in the IBR) was roughly categorized for this study as being a student, not working (unemployed, full-time at home or on disability benefit) and employed/missing (missing reported in our previous article <2–4%).

Statistical analysis

Using Poisson log-linear models, we assessed differences in risk of labor characteristics and delivery interventions between exposed and non-exposed cohorts. Results are presented as prevalence rate ratios or relative risks (RR) with 95% confidence intervals (CI). Due to the matched design, we inherently adjusted for age, parity, and season of delivery in our crude models. In our secondary models, we additionally adjusted for socio-economic factors (marital and occupational status). We further analyzed the data stratified on: a) Woman's age at the time of attendance to the RTS; *teenagers* (12–19 years of age, median 17years) or *adults* (≥20 years, median 23 years), which reflects before and after the general age at which most Icelandic students complete a four-year elective high-school education. b) Time from exposure to delivery; ≤5 or >5 years, which reflects the median time from assault to delivery, 5.1 years. The time stratified analysis were adjusted for maternal age, parity (nulliparous or multiparous), and year of delivery. Women who had an elective cesarean section were excluded from other analyses.

Additional analysis. The IBR does not include electronic information about smoking and BMI. However, we have information about these manually collected variables in our previous study about risk factors and health during pregnancy [11]. This previous study consisted of a sub-sample of exposed women within our current dataset, those who attended the RTS through 2008 and delivered to mid-April 2011, while the non-exposed women differ from those in the current study (due to different matching criteria and fewer non-exposed women in the previous study). The results of the previous study [11] showed that exposed women were at increased risk of sustained smoking during pregnancy as well as marginally higher risk of obesity when compared to non-exposed women. Therefore, to explore the role of these risk factors for labor and delivery outcomes, we performed additional analyses and show RRs with and without adjustment for smoking and BMI in the sub-sample (n = 792 exposed and n = 1416 non-exposed women).

Data analysis was conducted with IBM SPSS Statistics version 20.0 (Armonk, NY: IBM Corp.).

Results

Table 1 shows the matching variables and other background characteristics between exposed and non-exposed women. The three matching variables, maternal age, parity, and season, were comparable between the exposed and non-exposed cohorts. Compared to non-exposed women, exposed women were less frequently employed or cohabiting, and a higher proportion of their deliveries occurred in the capital.

Table 2 shows the prevalence and risks of the studied labor characteristics in exposed versus non-exposed women, and also in our additional analysis where information on smoking and BMI was available. Compared to non-exposed women, exposed women were at a 40 percent increased risk of having a prolonged first stage of labor, whereas no difference was found

Table 1. Background characteristics comparing women exposed versus non-exposed to sexual violence.

	Non-exposed		Exposed	
	n 9126	% 89.5%	n 1068	% 10.5%
Age at delivery (years)				
≤19	955	10.5%	119	11.1%
20–24	3085	33.8%	368	34.5%
25–29	2906	31.8%	335	31.4%
30–34	1571	17.2%	176	16.5%
≥35	609	6.7%	70	6.6%
Parity				
Primiparas	4308	47.2%	504	47.2%
Multiparas	4818	52.8%	564	52.8%
Season of delivery				
January–April	2865	31.4%	343	32.1%
May–August	3126	34.3%	361	33.8%
September–December	3135	34.4%	364	34.1%
Occupational Status				
Employed/missing	6166	67.6%	581	54.4%
Student	2023	22.2%	228	21.3%
Not working (disability, unemployed, full time at home)	937	10.3%	259	24.3%
Marital status				
Cohabiting	7055	77.3%	631	59.1%
Not cohabiting	1944	21.3%	420	39.3%
Missing	127	1.4%	17	1.6%
Place of delivery				
Capital (Landspitali)	6123	67.1%	828	77.5%
Other	3003	32.9%	240	22.5%

doi:10.1371/journal.pone.0150726.t001

regarding prolonged second stage. Exposed women were also at 60 percent increased risk of being diagnosed with maternal distress during labor and delivery, and at a twofold risk of antepartum bleeding. We found no differences between the groups with respect to induced labor or dystocia. Adding socio-economic factors (occupation and marital status) to the models resulted in minimal change of the reported point estimates (S1 Table). Analysis restricted to the subsample revealed no substantial differences in point estimates when adding smoking and BMI to the model.

Table 3 shows the same outcomes as Table 2, now stratified by age at attendance to the RTS. Compared to non-exposed women, the relative risks were generally higher for women exposed as teenagers than for women exposed later in life; a 28% increased risk of induced labor, a 29% increased risk of labor dystocia, a 60% increased risk of having a prolonged first stage of labor, and a twofold risk of maternal distress during labor and delivery. However, the risk of antepartum bleeding was twofold increased among those assaulted in adulthood, while the risk was not significant for those exposed earlier. Among women exposed as teenagers (n = 629), 273 deliveries occurred ≤5 years of the assault and 356 occurred later. The corresponding figures for deliveries among women exposed as adults (n = 396) were 235 and 161, respectively. Time stratified analysis showed mostly comparable estimates, irrespective of the proximity from the assault to the delivery (S2 Table).

Table 2. Comparison of labor characteristics among women exposed versus non-exposed to sexual violence.

	Full dataset						Sub-sample[a]							
	Non-exposed women		Exposed women				Non-exposed women		Exposed women					
	n	%	n	%	RR[b]	95% CI	n	%	n	%	RR[c]	95% CI	Adj RR[cd]	95% CI
Total[e]	**8699**	**89.5**	**1025**	**10.5**			**1530**	**63.7**	**873**	**36.3**				
Induced labor	2273	26.1	291	28.4	1.09	0.98–1.21	368	24.1	229	26.2	1.09	0.95–1.25	1.08	0.93–1.26
Labor dystocia	729	8.4	101	9.5	1.18	0.96–1.47	124	8.1	87	10.0	1.17	0.88–1.57	1.26	0.89–1.77
Prolonged first stage of labor	292	3.4	48	4.7	1.40	1.03–1.88	45	2.9	39	4.5	1.50	0.96–2.36	1.38	0.84–2.25
Prolonged second stage of labor	356	4.1	45	4.4	1.07	0.77–1.49	56	3.7	39	4.5	1.22	0.79–1.90	1.40	0.89–2.23
Maternal distress during labor and delivery	96	1.1	19	1.9	1.68	1.01–2.79	21	1.4	16	1.8	1.56	0.81–3.01	1.40	0.67–2.92
Antepartum bleeding	96	1.1	22	2.1	1.95	1.23–3.07	35	2.3	17	1.9	1.08	0.59–1.98	0.81	0.41–1.58
Placental abruption	36	0.4	7	0.7	1.66	0.74–3.72	6	0.4	6	0.7	2.38	0.69–8.26	1.72	0.45–6.53

[a]Exposed and non-exposed women within our previous dataset with manually retrieved information on smoking and BMI.

[b]Relative Risks with non-exposed women as a reference group. Data matched on age, parity and season of delivery.

[c]Relative Risks with non-exposed women as a reference group. Data adjusted for age, parity, year and month of delivery.

[d]Additionally adjusted for smoking (in 2 categories, no/quit vs. yes) and body mass index (BMI).

[e]Women who underwent elective cesarean section were excluded from all analysis in this table.

doi:10.1371/journal.pone.0150726.t002

Table 3. Comparison of labor characteristics among women exposed versus non-exposed to sexual violence: Stratified by age at rape trauma consultation.

	Non-exposed women		Age at rape trauma consultation <20 years[a]				Age at rape trauma consultation ≥20 years[a]			
					Model				Model	
	n	%	n	%	RR[b]	95% CI	n	%	RR[b]	95% CI
Total	**8699**	**89.5**	**629**	**6.7**			**396**	**4.1**		
Induced labor	2273	26.1	192	30.5	1.17	1.03–1.33	99	25.0	0.96	0.80–1.15
Labor dystocia	729	8.4	68	10.8	1.29	1.01–1.65	33	8.3	0.99	0.67–1.46
Prolonged first stage of labor	292	3.4	34	5.4	1.61	1.14–2.28	14	3.5	1.05	0.62–1.79
Prolonged second stage of labor	356	4.1	26	4.1	1.01	0.68–1.51	19	4.8	1.17	0.69–1.99
Maternal distress during labor and delivery	96	1.1	14	2.2	2.02	1.12–3.64	5	1.3	1.14	0.47–2.78
Antepartum bleeding	96	1.1	12	1.9	1.73	0.96–3.12	10	2.5	2.28	1.21–4.33
Placental abruption	36	0.4	3	0.5	1.15	0.36–3.73	4	1.0	2.44	0.88–6.78

[a]Those who attended the Rape Trauma Service more than once were categorized according to age at first attendance.

[b]Relative Risks with non-exposed women as a reference group.

doi:10.1371/journal.pone.0150726.t003

Table 4. Comparison of delivery interventions among women exposed versus non-exposed to sexual violence.

	Full dataset						Sub-sample[a]							
	Non-exposed women		Exposed women				Non-exposed women		Exposed women					
	n	%	n	%	RR[b]	95% CI	n	%	n	%	RR[c]	95% CI	Adj RR[cd]	95% CI
Total	**9126**	**89.5**	**1068**	**10.5**			**1614**	**64.1**	**903**	**35.9**				
Elective cesarean section	427	4.7	43	4.0	0.86	0.61–1.21	84	5.2	30	3.3	0.92	0.59–1.45	1.18	0.74–1.88
Total[e]	**8699**	**89.5**	**1025**	**10.5**			**1530**	**63.7**	**873**	**36.3**				
Emergency cesarean section	842	9.7	117	11.4	1.18	0.97–1.44	161	10.5	102	11.7	1.29	0.99–1.67	1.26	0.94–1.69
Instrumental vaginal delivery	698	8.0	93	9.1	1.13	0.91–1.40	114	7.5	84	9.6	1.29	0.98–1.70	1.30	0.96–1.74
Emergency instrumental delivery[f]	1540	17.7	210	20.5	1.16	1.00–1.34	275	18.0	186	21.3	1.29	1.07–1.56	1.28	1.05–1.58

[a]Exposed and non-exposed women within our previous dataset with manually retrieved information on smoking and BMI.

[b]Relative Risks with non-exposed women as a reference group. Data matched on age, parity and season of delivery.

[c]Relative Risks with non-exposed women as a reference group. Data adjusted for age, parity, year and month of delivery.

[d]Additionally adjusted for smoking (in 2 categories, no/quit vs. yes) and body mass index (BMI).

[e]Women who underwent elective cesarean section were excluded from other analysis in this table.

[f]Either emergency cesarean section or instrumental vaginal delivery.

doi:10.1371/journal.pone.0150726.t004

Table 4 shows risks of delivery interventions in women exposed to sexual violence versus non-exposed women, both in our full cohort and our sub-sample. Exposed women were at an increased risk of having emergency instrumental deliveries, compared to non-exposed women. We found no difference regarding elective cesarean sections. Additional adjustment for socio-economic status did not change the point estimates substantially (S1 Table). The point estimates were comparable in crude models and when adjusting for smoking and BMI in our sub-sample.

Table 5 shows delivery interventions according to exposure status stratified by age at attendance to the RTS. Women exposed as teenagers were less likely to have an elective cesarean section but at a 20% increased risk of emergency instrumental deliveries, compared to non-exposed women. No statistically significant differences were found when comparing women exposed in adulthood to non-exposed women. The results remained mostly constant across categories of time from assault to delivery (S3 Table).

Lastly, restricting deliveries of exposed women to each woman's first subsequent delivery following the exposure (whether it was her first delivery or not) showed similar results overall, with somewhat less statistical power (S4 Table).

Discussion

The findings from this register-based study indicate an increased risk of some obstetric and delivery complications among women with history of sexual violence. Exposed women, especially those assaulted as teenagers (12–19 years of age), were at increased risks of labor dystocia (mainly prolonged first stage of labor), maternal distress during labor and delivery, and emergency instrumental delivery (vaginal instrumental delivery or emergency cesarean section), compared to non-exposed women. We found no difference regarding elective cesarean section

Table 5. Comparison of delivery interventions among women exposed versus non-exposed to sexual violence: Stratified by age at rape trauma consultation.

	Non-exposed women		Age at rape trauma consultation <20 years[a]				Age at rape trauma consultation ≥20 years[a]			
					Model				Model	
	n	%	n	%	RR[b]	95% CI	n	%	RR[b]	95% CI
Total	**9126**	**89.5**	**646**	**6.3**			**422**	**4.1**		
Elective cesarean section	427	4.7	17	2.6	0.56	0.34–0.93	26	6.2	1.32	0.84–2.06
Total[c]	**8699**	**89.5**	**629**	**6.5**			**396**	**4.1**		
Emergency cesarean section	842	9.7	70	11.1	1.15	0.89–1.49	47	11.9	1.23	0.91–1.65
Instrumental vaginal delivery	698	8.0	65	10.3	1.29	1.00–1.66	28	7.1	0.88	0.61–1.28
Emergency instrumental delivery[d]	1540	17.7	135	21.5	1.21	1.02–1.44	75	18.9	1.07	0.85–1.36

[a]Those who attended the Rape Trauma Service more than once were categorized according to age at first attendance.

[b]Relative Risks with non-exposed women as a reference group.

[c]Women who underwent elective cesarean section were excluded from other analysis.

[d]Either emergency cesarean section or instrumental vaginal delivery.

doi:10.1371/journal.pone.0150726.t005

overall. However, those assaulted as teenagers were at a lower risk of elective cesareans compared to non-exposed women. Finally, exposed women (especially those assaulted 20 years or older) were at increased risk of antepartum bleeding.

Previous studies have shown that women exposed to sexual violence are at an increased risk of fear of childbirth [19, 20], which may partly explain some of our findings, i.e. with respect to longer duration of delivery [27], assisted delivery (marginally significantly) [19], and emergency cesarean section [28]. Psychological interventions for fear of childbirth have proven effective [29], and continuous one-to-one support during labor is associated with a reduced risk of instrumental deliveries and shorter labor [30]. We are not aware of other studies reporting an association between sexual assault and maternal distress during labor and delivery, nor a prolonged first stage of labor. The first stage is characterized by dilation of the cervix and includes (frequent) examinations of progress. In a qualitative study from Norway [16], rape survivors described progress examinations as an invasion and that their rape was re-activated during childbirth. They also reported feelings of helplessness and struggle, and some felt that their body refused to give birth. In addition, women exposed to sexual violence may have an impaired confidence in health care professionals [31], which may also partially explain these findings. It is therefore important that health care providers acknowledge that conducting routine clinical work without preparing the woman can have negative effects and re-activate rape experiences [16]. Stress hormones peak during labor [32] but studies are needed to examine whether possible biologic dysregulation of the stress-response systems [8] among sexually assaulted women affect the production of labor hormones, and, therefore, obstruct the progress of labor. Obesity has been associated both with sexual violence [10] and a prolonged first stage of labor [33], but our risk estimates remained similar after adjustment for BMI and smoking in the sub-sample. We found that women exposed as teenagers were at increased risk of induction of labor. This finding aligns with the results of a previous study where the authors suggested that induction of labor may act as a way to retain control [14].

Antepartum bleeding was more common among assaulted women, especially those who attended the RTS as adults. Increased risk of hospitalization due to antepartum bleeding has been reported for women with a history of sexual violence, in a dose-response manner by violence severity; adjustment for physical violence attenuated the association [18]. Placental

abruption is associated with smoking, which could have attributed to some of the risk, since our former study indicates that this age group of exposed women had a high risk of persistent smoking (and illicit drug use) during pregnancy [11]. We have no information on smoking status at the time of the exposure, thus we cannot disentangle whether the women had started to smoke before or after the sexual assault.

Our findings on delivery interventions add to previous mixed findings [14, 15, 19, 24, 25]. Notably, our data suggest that women assaulted as teenagers are less likely to have an elective cesarean section, compared to non-exposed women. In contrast, two of the largest and most recent studies in this field show increased risks of elective cesarean sections, both for all exposed women [14] and for subgroups [24]. An elective cesarean section is less likely than instrumental vaginal delivery and emergency cesarean section to result in a negative birth experience [34], which are interventions that were more prevalent among our teenage-exposed women than non-exposed women. Further studies are needed to assess which obstetric interventions are most beneficial in terms of obstetric and perinatal outcomes for exposed women. Yet, our risk estimate for emergency instrumental deliveries was modest (overall RR 1.16). To avoid these interventions and the risk of negative consequences, an increased prenatal support for pregnant exposed women may be needed.

Our data suggest that age at time of sexual assault may be a critical factor for subsequent delivery outcomes. Adversities in childhood have been associated with various negative health outcomes in a dose-response manner [35]. In a recent systematic review, consistent positive associations were found between studies on childhood exposure to violence and cardio-vascular disease, whereas studies on adult exposure revealed mixed findings [36]. Also, the risk of post-traumatic stress disorder (PTSD) has been reported somewhat greater for women exposed to sexual violence in childhood than for those exposed 18 years or older [37]. Among women exposed to child sexual abuse, re-victimization in adulthood increases the association with psychiatric disorders [5]. Pathways by which women assaulted as teenagers are at greater risks for later negative health outcomes than those assaulted later are not clear, but exposure during a more sensitive age period and risk of re-victimization may contribute to the differences somewhat. Interestingly, time passed from sexual assault did not seem to affect the age-stratified analyses. The vast majority of our study population was exposed to severe sexual violence [26] which may partly explain discrepancies with previous studies.

A major strength of our study is the population-based, prospective and independent registration of exposure and outcomes by health care professionals. Using registry data, we did not have to rely on women's participation (which can induce selection bias) or deal with recall bias from retrospective self-reports. We are unaware of other studies that have been able to utilize such data sets and methods within this field. Nevertheless, our study also has several limitations. First, some women in the non-exposed cohort may still have been exposed to severe sexual violence, yet not attended the RTS (suggested prevalence of rape/rape attempt among women after the age of 15 in the general population is 13% [38]). If there is indeed a true association between sexual violence and the tested outcomes, this would result in an underestimation of the relative risks. Second, our exposed women all disclosed their experience and sought medical attention, the vast majority within a month after the assault [26]. Some of them utilized the psychological support/ trauma focused treatment offered at the RTS. Therefore, they may have worked through the assault to a greater extent than women who had been sexually assaulted but did not attend the RTS and were thus assigned a non-exposed status in our study. This could also lead to an underestimation of the relative risks. Third, it is indeed a limitation that smoking and BMI are not electronically registered in the IBR. However, we could analyze the potential effects of these variables on our reported associations in our previous dataset where we collected and registered these variables manually [11]. It did not affect our

interpretation. Finally, while our exposed cohort is well-defined, it is small, and we indeed lack statistical power to detect differences between groups for rare outcomes.

In conclusion, our findings indicate that women who were sexually assaulted as teenagers or in adulthood are, on average 5.8 years after the exposure, at increased risks of pregnancy and delivery complications such as antepartum bleeding, maternal distress, prolonged first stage of labor and emergency instrumental deliveries. Overall, women who were assaulted as teens show greater risks of adverse outcomes. Yet, the risk estimates of delivery complications were modest and most exposed women gave birth without complications. Nevertheless, further research is needed to address how these survivors can be supported during pregnancy and delivery.

Supporting Information

S1 Table. Supplementary Table A. Comparison of labor characteristics and delivery interventions among women exposed versus non-exposed to sexual violence: With adjustment for socio-economic status.
(DOCX)

S2 Table. Supplementary Table B. Comparison of labor characteristics among women exposed versus non-exposed to sexual violence: By time between assault and delivery.
(DOCX)

S3 Table. Supplementary Table C. Comparison of delivery interventions among women exposed versus non-exposed to sexual violence: By time from assault to delivery.
(DOCX)

S4 Table. Supplementary table D. Labor characteristics and delivery interventions among women exposed versus non-exposed to sexual violence: Restricted to each exposed woman's first subsequent delivery following the exposure.
(DOCX)

Acknowledgments

We thank Ingibjorg Richter and Birna Bjorg Masdottir for their work on data recruitment and Dr. Sigrun Helga Lund for data assistance. Agnes Bjorg Tryggvadottir, Audur Sjofn Thorisdottir and Thyri Asta Hafsteinsdottir are thanked for their important help with the data gathering, and coworkers at the Centre of Public Health Sciences at the University of Iceland are thanked for helpful comments throughout the process.

Author Contributions

Conceived and designed the experiments: AG BLH SC UAV. Analyzed the data: AG UAV TA. Wrote the paper: AG MALF BLH BG EJ RIB AH TA SC UAV. Drafted the manuscript: AG UAV. Contributed to interpretation of data: AG MALF BLH BG EJ RIB AH TA SC UAV.

References

1. García-Moreno C, Zimmerman C, Morris-Gehring A, Heise L, Amin A, Abrahams N, et al. Addressing violence against women: a call to action. The Lancet. 2015; 385(9978):1685–95. doi: 10.1016/S0140-6736(14)61830-4
2. Riley EH, Wright RJ, Jun HJ, Hibert EN, Rich-Edwards JW. Hypertension in adult survivors of child abuse: observations from the Nurses' Health Study II. J Epidemiol Community Health. 2010; 64 (5):413–8. doi: 10.1136/jech.2009.095109 PMID: 20445210

3. Scott KM, Koenen KC, Aguilar-Gaxiola S, Alonso J, Angermeyer MC, Benjet C, et al. Associations between Lifetime Traumatic Events and Subsequent Chronic Physical Conditions: A Cross-National, Cross-Sectional Study. PLOS ONE. 2013; 8(11):e80573. doi: 10.1371/journal.pone.0080573 PMID: 24348911
4. Paras ML. Sexual Abuse and Lifetime Diagnosis of Somatic Disorders: A Systematic Review and Meta—analysis. JAMA. 2009; 302(5):550–61. doi: 10.1001/jama.2009.1091 PMID: 19654389
5. Jonas S, Bebbington P, McManus S, Meltzer H, Jenkins R, Kuipers E, et al. Sexual abuse and psychiatric disorder in England: results from the 2007 Adult Psychiatric Morbidity Survey. Psychol Med. 2011; 41(04):709–19. doi: 10.1017/S003329171000111X
6. Chen LP, Murad MH, Paras ML, Colbenson KM, Sattler AL, Goranson EN, et al. Sexual Abuse and Lifetime Diagnosis of Psychiatric Disorders: Systematic Review and Meta—analysis. Mayo Clinic Proceedings. 2010; 85(7):618. doi: 10.4065/mcp.2009.0583 PMID: 20458101
7. Lindert J, von Ehrenstein O, Grashow R, Gal G, Braehler E, Weisskopf M. Sexual and physical abuse in childhood is associated with depression and anxiety over the life course: systematic review and meta-analysis. Int J Public Health. 2014; 59(2):359–72. doi: 10.1007/s00038-013-0519-5 PMID: 24122075
8. Walsh K, Galea S, Koenen KC. Mechanisms Underlying Sexual Violence Exposure and Psychosocial Sequelae: A Theoretical and Empirical Review. Clinical Psychology: Science and Practice. 2012; 19 (3):260–75. doi: 10.1111/cpsp.12004
9. Nelson EC. Childhood sexual abuse and risks for licit and illicit drug—related outcomes: a twin study. Psychol Med. 2006; 36(10):1473. PMID: 16854248
10. Noll JG, Zeller MH, Trickett PK, Putnam FW. Obesity Risk for Female Victims of Childhood Sexual Abuse: A Prospective Study. Pediatrics. 2007; 120(1):e61–e7. doi: 10.1542/peds.2006-3058 PMID: 17606550
11. Gisladottir A, Harlow BL, Gudmundsdottir B, Bjarnadottir RI, Jonsdottir E, Aspelund T, et al. Risk factors and health during pregnancy among women previously exposed to sexual violence. Acta Obstet Gynecol Scand. 2014; 93(4):351–8. doi: 10.1111/aogs.12331 PMID: 24490826
12. Lukasse M, Schei B, Vangen S, Øian P. Childhood Abuse and Common Complaints in Pregnancy. Birth. 2009; 36(3):190–9. doi: 10.1111/j.1523-536X.2009.00323.x PMID: 19747265
13. Lukasse M, Henriksen L, Vangen S, Schei B. Sexual violence and pregnancy-related physical symptoms. BMC Pregnancy Childbirth. 2012; 12(1):83. Epub 2012/08/14. doi: 10.1186/1471-2393-12-83
14. Henriksen L, Schei B, Vangen S, Lukasse M. Sexual violence and mode of delivery: a population-based cohort study. BJOG. 2014; 121(10):1237–44. doi: 10.1111/1471-0528.12923 PMID: 24939396
15. van der Hulst LA, Bonsel GJ, Eskes M, Birnie E, van Teijlingen E, Bleker OP. Bad experience, good birthing: Dutch low-risk pregnant women with a history of sexual abuse. J Psychosom Obstet Gynaecol. 2006; 27(1):59–66. Epub 2006/06/07. PMID: 16752877
16. Halvorsen L, Nerum H, Oian P, Sorlie T. Giving Birth with Rape in One's Past: A Qualitative Study. Birth-Issues in Perinatal Care. 2013; 40(3):182–91. doi: 10.1111/birt.12054
17. Leeners B, Stiller R, Block E, Görres G, Rath W. Pregnancy complications in women with childhood sexual abuse experiences. J Psychosom Res. 2010; 69(5):503–10. doi: 10.1016/j.jpsychores.2010.04.017 PMID: 20955870
18. Henriksen L, Vangen S, Schei B, Lukasse M. Sexual Violence and Antenatal Hospitalization. Birth-Issues in Perinatal Care. 2013; 40(4):281–8. doi: 10.1111/birt.12063
19. Heimstad R, Dahloe R, Laache I, Skogvoll E, Schei B. Fear of childbirth and history of abuse: implications for pregnancy and delivery. Acta Obstet Gynecol Scand. 2006; 85(4):435–40. Epub 2006/04/14. doi: 10.1080/00016340500432507 PMID: 16612705
20. Eberhard-Gran M, Slinning K, Eskild A. Fear during labor: the impact of sexual abuse in adult life. J Psychosom Obstet Gyneacol. 2008; 29(4):258–61. doi: 10.1080/01674820802075998
21. Nerum H, Halvorsen L, Øian P, Sørlie T, Straume B, Blix E. Birth outcomes in primiparous women who were raped as adults: a matched controlled study. BJOG. 2010; 117(3):288–94. doi: 10.1111/j.1471-0528.2009.02454.x PMID: 20015304
22. Nerum H, Halvorsen L, Straume B, Sørlie T, Øian P. Different labour outcomes in primiparous women that have been subjected to childhood sexual abuse or rape in adulthood: a case—control study in a clinical cohort. BJOG. 2012:n/a–n/a. doi: 10.1111/1471-0528.12053
23. Finnbogadóttir H, Dejin-Karlsson E, Dykes A-K. A multi-centre cohort study shows no association between experienced violence and labour dystocia in nulliparous women at term. BMC Pregnancy Childbirth. 2011; 11(1):1–9. doi: 10.1186/1471-2393-11-14

24. Schei B, Lukasse M, Ryding EL, Campbell J, Karro H, Kristjansdottir H, et al. A History of Abuse and Operative Delivery—Results from a European Multi-Country Cohort Study. PLOS ONE. 2014; 9(1): e87579. doi: 10.1371/journal.pone.0087579 PMID: 24498142

25. Lukasse M, Vangen S, Øian P, Schei B. Childhood abuse and caesarean section among primiparous women in the Norwegian Mother and Child Cohort Study. BJOG. 2010; 117:1153–7. doi: 10.1111/j.1471-0528.2010.02627.x PMID: 20528868

26. Gisladottir A, Gudmundsdottir B, Gudmundsdottir R, Jonsdottir E, Gudjonsdottir GR, Kristjansson M, et al. Increased attendance rates and altered characteristics of sexual violence. Acta Obstet Gynecol Scand. 2012; 91(1):134–42. Epub 2011/09/29. doi: 10.1111/j.1600-0412.2011.01283.x PMID: 21943075

27. Adams SS, Eberhard-Gran M, Eskild A. Fear of childbirth and duration of labour: a study of 2206 women with intended vaginal delivery. BJOG. 2012; 119(10):1238–46. Epub 2012/06/28. doi: 10.1111/j.1471-0528.2012.03433.x PMID: 22734617

28. Laursen M, Johansen C, Hedegaard M. Fear of childbirth and risk for birth complications in nulliparous women in the Danish National Birth Cohort. BJOG. 2009; 116(10):1350–5. doi: 10.1111/j.1471-0528.2009.02250.x PMID: 19538412

29. Rouhe H, Salmela-Aro K, Toivanen R, Tokola M, Halmesmäki E, Saisto T. Obstetric outcome after intervention for severe fear of childbirth in nulliparous women—randomised trial. BJOG. 2013; 120 (1):75–84. doi: 10.1111/1471-0528.12011 PMID: 23121002

30. Hodnett ED, Gates S, Hofmeyr GJ, Sakala C. Continuous support for women during childbirth. Cochrane Database Syst Rev. 2012; 10:CD003766. Epub 2012/10/19. doi: 10.1002/14651858.CD003766.pub4 PMID: 23076901

31. Leeners B, Stiller R, Block E, Gorres G, Rath W, Tschudin S. Prenatal care in adult women exposed to childhood sexual abuse. J Perinat Med. 2012:1–10. Epub 2013/01/15. doi: 10.1515/jpm-2011-0086

32. Alehagen S, Wijma K, Lundberg U, Melin B, Wijma B. Catecholamine and cortisol reaction to childbirth. International Journal of Behavioral Medicine. 2001; 8(1):50–65.

33. Norman SM, Tuuli MG, Odibo AO, Caughey AB, Roehl KA, Cahill AG. The effects of obesity on the first stage of labor. Obstet Gynecol. 2012; 120(1):130–5. doi: 10.1097/AOG.0b013e318259589c PMID: 22914401

34. Elvander C, Cnattingius S, Kjerulff KH. Birth Experience in Women with Low, Intermediate or High Levels of Fear: Findings from the First Baby Study. Birth. 2013; 40(4):289–96. doi: 10.1111/birt.12065 PMID: 24344710

35. Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, et al. Relationship of Childhood Abuse and Household Dysfunction to Many of the Leading Causes of Death in Adults. Am J Prev Med. 1998; 14(4):245. PMID: 9635069

36. Suglia SF, Sapra KJ, Koenen KC. Violence and Cardiovascular Health: A Systematic Review. Am J Prev Med. 2015; 48(2):205–12. doi: 10.1016/j.amepre.2014.09.013 PMID: 25599905

37. Masho SW, Ahmed G. Age at Sexual Assault And Posttraumatic Stress Disorder among Women: Prevalence, Correlates, And Implications for Prevention. Journal of Women's Health (15409996). 2007; 16 (2):262–71. doi: 10.1089/jwh.2006.M076

38. Karlsdottir E, Arnalds AA. Rannsokn a ofbeldi gegn konum. Reynsla kvenna a aldrinum 18–80 ara a Islandi [Research on violence against women: The experiences of Women Aged 18–80 in Iceland]. (In Icelandic. English abstract available). Reykjavik: Rannsoknarstofnun í barna- og fjolskylduvernd, 2010.

Paper III

Neonatal outcomes in infants of women with past exposure to sexual violence: a follow-up study

Agnes Gisladottir,[a] Sven Cnattingius,[b] Miguel Angel Luque-Fernandez,[c,j] Thordur Thorkelsson,[d] Arna Hauksdottir,[a] Berglind Gudmundsdottir,[e, f] Ragnheidur I. Bjarnadottir,[g] Thor Aspelund,[a, h] Bernard L. Harlow,[i] Unnur A. Valdimarsdottir[a, j]

[a]Center of Public Health Sciences, University of Iceland, Reykjavik, Iceland
[b]Unit of Clinical Epidemiology, Karolinska Institutet, Stockholm, Sweden
[c]London School of Hygiene and Tropical Medicine, Department of Non-Communicable Diseases Epidemiology, London, United Kingdom
[d]Neonatal Inensive Care Unit, Landspitali - The National University Hospital of Iceland, Reykjavik, Iceland
[e]Mental health services, Landspitali - The National University Hospital of Iceland, Reykjavik, Iceland
[f]Psychology Department, University of Iceland, Reykjavik, Iceland
[g]Department of Obstetrics and Gynecology, Landspitali - The National University Hospital of Iceland, Reykjavik, Iceland
[h]The Icelandic Heart Association, Kopavogur, Iceland
[i]Boston University School of Public Health, Boston, Massachusetts, USA.
[j]Harvard School of Public Health, Department of Epidemiology, Boston, Massachusetts, USA

Correspondence:
Agnes Gisladottir
Center of Public Health Sciences,
University of Iceland.
Stapi v/Hringbraut
101 Reykjavik
Iceland
Tel: 00354 525 5486
agnesg@hi.is

Running title: Sexual violence and subsequent neonatal outcomes
Word count: 2857

Abstract

Objective

To investigate associations between exposure to sexual violence in adolescence or adulthood and subsequent risks of adverse neonatal outcomes.

Design

A population-based follow-up study.

Setting

Iceland

Population

Exposed group: 1067 neonates of 666 women who attended a Rape Trauma Service (RTS) on average 6 years before childbirth. Non-exposed group: 9104 randomly selected neonates.

Methods

Identification numbers of women attending the RTS (1993 - 2011) were linked to the national Medical Birth Registry to identify subsequent births (through 2012). Matched by maternal age, parity, and season of delivery, the non-exposed group was selected among mothers who had not attended the RTS before childbirth. Poisson regression was used to estimate relative risks (RR) with 95% confidence intervals (CI).

Main outcome measures

Birth weight, gestational age, and other neonatal health indicators.

Results

Compared to the non-exposed group, neonates of mothers exposed to sexual violence were on average lighter (3573.6 g vs. 3675.6 g, p<0.01), had an increased risk of being born preterm (RR 1.49, 95% CI 1.13, 1.97), and of being transferred to the neonatal intensive care unit (RR 1.35, 95% CI 1.05, 1.73). Adjusting for concurrent cohabiting and occupational status attenuated somewhat the RR of preterm birth (RR 1.30, 95% CI 0.98, 1.74). The relative risks of adverse outcomes tended to be larger among neonates of mothers exposed to sexual violence as teenagers.

Conclusion

Offspring of mothers previously exposed to sexual violence may be at increased risks of preterm birth and some adverse neonatal outcomes.

Tweetable abstract

Women exposed to sexual violence in adolescence or adulthood are at increased risk of preterm deliveries in subsequent pregnancies.

Keywords: Sexual violence, neonatal outcomes, preterm birth, birth weight

Sexual violence, defined broadly as any sexual act which is not with the victim's consent but with coercion of the perpetrator,[1] is a prevalent worldwide major public health problem.[2] Exposure to sexual violence has been associated with increased risk of various negative mental[3] and physical[2, 4] health consequences. Compared to non-exposed women, women previously exposed to sexual violence present with an increased risk of smoking,[5] hospitalization during pregnancy,[6] and prenatal depression symptoms[7]. Mixed findings have been reported regarding risks of delivery interventions, such as cesarean or vaginal instrumental deliveries[8-10] and maternal health diagnoses.[5, 11]

Self-reported lifetime exposure to sexual violence[12] or recent exposure to sexual or physical violence[13] are associated with risk of preterm birth (PTB),[12, 13] low birth weight (LBW), and small for gestational age (SGA);[12] differences which have generally not sustained multivariable adjustment for e.g. socio-economic factors.[12, 13] However, previous studies on sexual violence exposure and subsequent neonatal outcomes have often relied on retrospective self-reports of exposure,[12-15] and some studies have also suffered other types of threats to internal validity, including selection bias. [15]

Leveraging prospectively and independently collected information on exposure and outcome registered irrespective of the current study, we investigated potential associations between past exposure to sexual violence (in adolescence or adulthood), and risks of adverse neonatal outcomes in later pregnancies.

Methods

In this register-based study, data from a Rape Trauma Service (RTS) were linked with data from the Icelandic Medical Birth Registry (IBR).

Ascertainment of exposure

The RTS and electronic registration of all attendance records is described in our previous articles.[5, 16] The RTS opened in March 1993 at Landspitali, the National University Hospital of Iceland, and provides emergency services for sexually assaulted individuals from the age of 12 years, most of whom report recent exposure to severe sexual violence (penetration) by a stranger or a friend.[16] Personal identification numbers of all attendees are registered at the RTS upon attendance. To identify our exposed cohort, the identification numbers of women who sought services since opening in 1993 through December 31st 2011 were linked to the IBR to obtain information on subsequent deliveries. A data administrator at Landspitali was in charge of all linkages. In total, 666 exposed women subsequently delivered at least one live born singleton infant (range 1-6 infants) in Iceland (total number of infants n=1067) until the end of follow-up, December 31st 2012, on average 6 years (range 0- 19 years) after their RTS attendance.

All mothers in the IBR who had not attended the RTS through 2011 were considered non-exposed. For each exposed mother's birth, ten births by Icelandic mothers were randomly selected with a computerized program for our non-exposed comparison cohort. The selection was done with matching by three background characteristics: *Maternal age* (a) ≤19 years, b) 20-39 years matched by exact age, c) ≥40 years), *parity* (dichotomized as primipara or multipara), and *calendar season of delivery* (January-April, May-August, or September-December of the same calendar year). After the matching, we restricted our cohort to live born singleton infants, and the same non-exposed birth was only used once. The study population included 9104 infants of non-exposed mothers and 1067 infants of exposed mothers.

Background and key outcome variables

Data on every delivery in Iceland from 22 weeks of gestation are registered in the IBR. The material includes maternal background information and measurements and health diagnosis of the infant, according to the 10th version of the International Classification of Diseases codes (ICD - 10, earlier codes have been updated) and Nomesco Classification of Surgical Procedures (NCSP) codes. Based on information in the IBR, we classified women's occupation as being a student, not working (unemployed, full-time at home, or on disability benefit) and employed/missing (missing estimated <2-4%).[5] Cohabiting with partner or not cohabiting is also registered in the IBR. Smoking and BMI are only registered in paper – based maternity records. This information was not manually collected for this study, but are available for a sub-cohort in a previous study.[5]

NCSP code ZXX30 was used to identify *epidural analgesia*. For antenatal diagnosis, *gestational diabetes* was defined as O24.4 or 24.9, *gestational hypertension* as O13, and *preeclampsia* as O11, 14, or 15. When ultrasound assessment of *gestational age* was not available (n=11), last menstrual period was used. *PTB* was defined as birth before 37 completed weeks of gestation (<259 days) and births between 32 and 36 weeks (224 and 258 days) were considered *moderately PTBs*. We considered elective cesarean sections (ICD-10 code O82.0) and induced labor (NCSP codes MAXC00, 02 or 09) as *medically indicated* births. Other births were considered *spontaneous.*

SGA was defined as fetal growth in the lowest 10th percentile. We used a Scandinavian formula[17] to calculate fetal growth rate index, which adjusts for gestational age and sex. A cut-off value of fetal growth rate index below the 10th percentile was identified separately for our non-exposed cohort. This cut-off value was then used to define SGA in our study population. *Transferal to the Neonatal Intensive Care Unit* (NICU) is a variable registered in the IBR.

Secondary outcome variables

The following ICD - 10 codes were used to examine neonatal health outcomes: *Singleton, born in hospital* (a primary diagnosis, infants with no other diagnosis) (Z38.0), *pneumonia or respiratory distress* (J15, J18, P23, P36, P22, P25), *neonatal jaundice* (P59.0, P59.9), *cephalhaematoma due to birth injury* (P12.0), and *other neonatal hypoglycemia* (P70.4).

Statistical analysis

Differences in background characteristics between the groups were analyzed using the Chi-square significance test for categorical variables, at a significance level of $\alpha = 0.05$. Linear regression models were used to compare the means for continuous outcomes. We used Poisson log-linear models to assess differences in the prevalence of neonatal outcomes between the exposed and non-exposed groups. Then, we derived unadjusted and adjusted relative risks (RR) and their 95% confidence intervals (CI), respectively.

Given the matching criteria used for the sample selection of the non-exposed group, crude models were inherently adjusted for maternal age, parity, season, and year of delivery. We additionally performed secondary analyses where we adjusted for concurrent socio-economic status (cohabiting and occupational status). Further, we analyzed the effects of age and time in stratified analyses. Mother's age at (first) attendance to the RTS was stratified as being *teenagers* (12-19 years of age, median 17 years) or *adults* (≥20 years, median 23 years). This cut-off in age was chosen since it reflects the general age at which most Icelandic students complete a four-year elective high-school education. We also stratified by elapsed time between assault and delivery,

since we hypothesized that women who were assaulted more close to delivery were at higher risk of adverse neonatal outcomes than those who delivered later. Elapsed time was calculated as number of months between the day of the (latest) assault and day of delivery, dichotomized into ≤5 or >5 years (median time was 5.1 years). Time stratified analyses were adjusted for maternal age, parity (primiparous or multiparous), and year of delivery.

Data analysis was conducted with IBM SPSS Statistics version 20.0 (Armonk, NY: IBM Corp.).

Results

In Table 1, the matching variables are shown in addition to other background characteristics. Mother's occupation and cohabiting status differed considerably between the groups; exposed mothers were less likely to be working, and to cohabit with a partner ($p<0.01$, respectively). Mode of delivery did not vary significantly between the groups while epidural analgesia was more prevalent among the exposed mothers. Exposed mothers were more often diagnosed with gestational diabetes ($p=0.01$), marginally more often with gestational hypertension ($p=0.08$), but less often with preeclampsia ($p<0.05$).

Table 2 presents a comparison of gestational age and size at birth between the groups. The median gestational age was the same in both groups, but the exposed group delivered on average one day earlier than the non-exposed group. Compared with infants of non-exposed mothers, infants of exposed mothers weighed on average 102 g less, had shorter birth length and smaller head circumference ($p<0.01$).

Table 3 shows prevalence and risks of various neonatal outcomes in exposed and non-exposed groups. Compared to the non-exposed group, the exposed group was at an increased risk of PTB (RR 1.49, [95% CI 1.13, 1.97], especially in the category of moderately PTB (RR 1.64 [95% CI 1.24, 2.19], not shown in table). Adjusting for socio-economic status lowered the relative risks for PTB, but the exposed group remained at an increased risk of moderately PTB (RR 1.43 [95% CI 1.07, 1.93]). The exposed group had a marginally increased risk of SGA, but not after adjustment for socio-economic status. Compared with non-exposed neonates, the risk of being transferred to the

neonatal intensive care unit was increased by approximately 30% among neonates of the exposed group, both before and after multivariable adjustments.

Table 4 shows a comparison of neonatal outcomes stratified by age at attendance to the RTS and time from attendance to birth. Compared to the non-exposed group, the risk estimates were larger for infants of mothers assaulted as teenagers than those assaulted in adulthood. To some extent, the risk was also larger when those exposed as teenagers gave birth ≤5 years of the assault than later. Neonates of teenage mothers who gave birth ≤5 years from assault had a 90% increased risk of being transferred to the NICU or having an Apgar score <7 at 5 minutes. No statistically significant difference was found for neonates of mothers assaulted as adults who delivered more than 5 years later.

Compared to offspring of the non-exposed group, neonates in the exposed group were less often diagnosed with the sole diagnosis of being a singleton born in hospital, a diagnosis which reflects normal birth outcome. Neonates in the exposed group were at increased risks of neonatal hypoglycemia and possibly also neonatal jaundice (Table 5).

Discussion

Main findings

With prospectively collected data, our data suggest that neonates of mothers previously exposed to such trauma are at increased risk of being born preterm and being transferred to the NICU, as well as some adverse neonatal health outcomes, compared to infants of non-exposed mothers. These increases in risks were mostly pronounced in infants of mothers who were exposed as teenagers and delivered within five years from the assault.

Strength and limitations

A major strength of our study is the population-based and prospective method, where information on exposure and outcomes were registered independently by health care professionals. This reduced the possibilities of selection bias and eliminate recall bias, and enabled a complete follow-up of pregnancies and neonatal outcomes of women who had sought medical services for sexual violence. Also, most women in the population had access to the services at the RTS though geographical restrictions may have applied in some cases. Both the RTS and maternal health care/delivery units are parts of the governmental national health care and at no additional cost to the attendees. We are unaware of other studies that have been able to utilize such data sets and methods within this field.

Nonetheless, our method is not without limitations. Our exposure estimation is not complete; the RTS, located at the emergency department, may serve the most violent incidents, but chronic abuse and assaults by known perpetrators may be underrepresented.[16] Further, we do not have information on whether background characteristics, e.g. age or socio-economic status, affect women's help seeking behavior to the RTS. The estimated prevalence of rape/rape attempt in the general population is 13% among women after the age of 15 years ,[18] and the proportion of women attending RTS was much less, even though the attendance rates increased from 1998 through 2007.[16] Thus, some women in the non-exposed group may have been exposed to sexual violence, even though they did not attend the RTS. Given that there is a true association with the exposure and risks, misclassification of exposure status would result in an underestimation of the risks we investigated. Second, our exposed women sought

medical attention, the vast majority shortly after the assault,[16] and some received a trauma focused treatment at the RTS. Therefore, they may have worked through their experience more than those who had been exposed to sexual violence but did not attend the RTS. This could also lead to an underestimation of the RRs. Third, we did not have statistical power to detect small effects, e.g. as in the case of very PTB, SGA and neonatal diagnosis. Last, we also lacked information on smoking and BMI, which are not electronically registered in the IBR. These factors may act as confounders, effect-modifiers, or mediators of the association between sexual violence and adverse neonatal outcomes. However, these factors are strongly associated with socio-economic status, which when accounted for did not change the relative risk considerably, except for the relative risk of PTB.

Interpretations

Preterm birth is a substantial cause of neonatal morbidity and mortality.[19, 20] The etiology of PTB is complex and not well understood, but suggested associations include infections, smoking, and socio-economic factors[20, 21]. All of these factors are relevant for the underlying mechanism between sexual violence and PTB. The somewhat lower RRs we found after adjusting for mother's concurrent socio-economic status were therefore anticipated.[20] We do not have information on mother's socio-economic status at the time of exposure; thus, it cannot be disentangled whether it is a confounder or a mediator in the association between sexual violence exposure and PTB. This scenario also applies to the study design of the MoBa study,[12] where the crude odds ratio (OR=1.28) of PTB among mothers with self-reported accounts of past sexual violence, was attenuated in adjusted models (including education, smoking and mental distress during pregnancy).

In a review, Wosu et al.[14] called for further studies on child sexual abuse and PTB and suggested that studies should analyze sub-categories of PTB. We found an increased risk of PTB overall among exposed women, and also showed our results for moderately PTB separately. However, we did not have statistical power to conclude whether there was a risk difference in very PTB. Yet, even moderately preterm neonates are at an increased risk of both morbidity and mortality.[19, 22]

Antenatal depression is associated with PTB, [23, 24] and a risk increase has been reported both among women having major depressive disorder and posttraumatic stress disorder (PTSD) during pregnancy.[25] Moreover, prenatal antidepressant use is associated with an increased risk of PTB.[25, 26] We do not have information on mental health or antenatal medication use, but given the increased risk of prenatal depression[7, 27] (and PTSD)[3] among sexual violence survivors, we cannot rule out that such morbidities or medication use mediate our findings.[25, 26] Further, women with anxiety and depression are less likely to quit smoking during pregnancy,[28] and we have previously reported an increased prevalence of smoking during pregnancy in our sub-cohort.[5]. Smoking is a known risk factor for neonatal morbidity, but cessation interventions during pregnancy can lower the risks of adverse neonatal outcomes[29] and may therefore be of great importance. Among other suggested pathways between sexual violence and adverse neonatal outcomes is elevated cortisol levels during late pregnancy, which have been associated with child sexual abuse,[30] shorter birth length and lower birthweight.[31]

We have previously reported an increased risk of obesity (for primiparas) in a subgroup of our exposed study population.[5] Results from a previous study indicate that infants of mothers with high BMI are at an increased risk of NICU admissions, which may partly be mediated via neonatal hypoglycemia.[32] We lacked information on maternal

BMI in this study, but our exposed women were more frequently diagnosed with gestational diabetes, which is closely associated with BMI.[33] Also, our exposed group was at increased risk of (moderately) PTB, which could have attributed to some of the risk increase in neonatal hypoglycemia.[22]

The risk estimates for SGA were marginally significant overall, but the point estimate diminished when we adjusted for socio-economic status, which could to some extent have reflected maternal smoking, a known risk factor for SGA.[34]

Our findings indicate that younger age and shorter time from assault may be important for risk of adverse neonatal outcomes. We are not aware of other studies on sexual violence and subsequent neonatal outcomes showing results stratified by age and time. In our previous study, smoking rates were twice as high in the exposed teenage group compared to non-exposed women, while fourfold higher for those assaulted as adults compared to non-exposed women.[5] Even though the confidence intervals overlapped, smoking is an unlikely explanation for the observed differences in neonatal risks by age at assault. However, the odds of prenatal depression are inversely associated with time from assault,[7] and re-victimization in adulthood increases the association between child sexual abuse and psychiatric disorders.[35] We lack information on women's mental health status, but Seng et al.[36] reported more favorable neonatal outcomes not only among trauma-resilient mothers, but also those who have experienced traumatic events but recovered from PTSD, when compared to those with prenatal PTSD. Therefore, psychological support may be of great importance for exposed women's subsequent neonatal outcomes.

Conclusion

Our data suggest that a mother's past exposure to sexual violence may be associated with an increased risk of neonatal complications, including preterm births and transferals to the neonatal intensive care unit. Exposure during the teenage years and <5 years between the assault and delivery were the strongest risks factors for these adverse outcomes.

Acknowledgements

We thank Eyrun Jonsdottir, the supervisor of the Rape Trauma Service for her contribution, and coworkers at the Center of Public Health Sciences for their input. We also thank Ingibjorg Richter and Birna Bjorg Masdottir for their essential work on the linkage and Agnes Bjorg Tryggvadottir and Audur Sjofn Thorisdottir for assistance with data gathering.

Disclosure of interest

None.

Contribution to authorship

AG and UAV designed the study and drafted the manuscript

AG UAV and TA analyzed the data

SC, ThTh and RIB advised on neonatal outcomes and diagnoses.

AG SC MALF ThTh AH BG RIB TA BLH and UAV revised the manuscript for critical content. All authors interpreted the data, read and approved the final version.

Details of ethics approval

The study was approved by the National Bioethics Committee (VSNb2010050009/03.7) and The Data Protection Authority (2013040591HGK/--), with acceptance from Landspitali and The Directorate of Health.

Funding

The study was funded by The Icelandic Research Fund for Graduate Students, Landspitali University Hospital Research Fund and Soroptimist International of Europe Scholarship Fund.

References

1. Jewkes R, Sen P, Garcia-Moreno C. World report on violence and health. Chapter 6. Sexual violence. Geneva: World Health Organization; 2002.
2. García-Moreno C, Zimmerman C, Morris-Gehring A, Heise L, Amin A, Abrahams N, et al. Addressing violence against women: a call to action. The Lancet. 2015;385(9978):1685-95.
3. Chen LP, Murad MH, Paras ML, Colbenson KM, Sattler AL, Goranson EN, et al. Sexual abuse and lifetime diagnosis of psychiatric disorders: systematic review and meta-analysis. Mayo Clin Proc. 2010 Jul;85(7):618-29.
4. Wegman HL, Stetler C. A Meta-Analytic Review of the Effects of Childhood Abuse on Medical Outcomes in Adulthood. Psychosomatic Medicine. 2009 October 2009;71(8):805-12.
5. Gisladottir A, Harlow BL, Gudmundsdottir B, Bjarnadottir RI, Jonsdottir E, Aspelund T, et al. Risk factors and health during pregnancy among women previously exposed to sexual violence. Acta Obstet Gynecol Scand. 2014;93(4):351-8.
6. Henriksen L, Vangen S, Schei B, Lukasse M. Sexual Violence and Antenatal Hospitalization. Birth-Issues in Perinatal Care. 2013 Dec;40(4):281-8.
7. Rich-Edwards JW, James-Todd T, Mohllajee A, Kleinman K, Burke A, Gillman MW, et al. Lifetime maternal experiences of abuse and risk of pre-natal depression in two demographically distinct populations in Boston. Int J Epidemiol. 2011;40(2):375-84.
8. Schei B, Lukasse M, Ryding EL, Campbell J, Karro H, Kristjansdottir H, et al. A History of Abuse and Operative Delivery – Results from a European Multi-Country Cohort Study. PLoS ONE. 2014;9(1):e87579.
9. Henriksen L, Schei B, Vangen S, Lukasse M. Sexual violence and mode of delivery: a population-based cohort study. BJOG. 2014;121(10):1237-44.
10. Gisladottir A, Luque-Fernandez MA, Harlow BL, Gudmundsdottir B, Jonsdottir E, Bjarnadottir RI, et al. Obstetric Outcomes of Mothers Previously Exposed to Sexual Violence. PLoS One. 2016;11(3):e0150726.
11. Roberts Al, Lyall K, Rich-Edwards J, W. Ascherio A, Weisskopf MG. Association of maternal exposure to childhood abuse with elevated risk for autism in offspring. JAMA Psychiatry. 2013;70(5):508-15.
12. Henriksen L, Schei B, Vangen S, Lukasse M. Sexual violence and neonatal outcomes: a Norwegian population-based cohort study. BMJ Open. 2014;4(10).
13. Urquia M, O'Campo P, Heaman M, Janssen P, Thiessen K. Experiences of violence before and during pregnancy and adverse pregnancy outcomes: An analysis of the Canadian Maternity Experiences Survey. BMC Pregnancy Childbirth. 2011;11(1):42.
14. Wosu AC, Gelaye B, Williams MA. Maternal history of childhood sexual abuse and preterm birth: an epidemiologic review. BMC Pregnancy Childbirth. 2015a;15(1):174.
15. Nerum H, Halvorsen L, Straume B, Sørlie T, Øian P. Different labour outcomes in primiparous women that have been subjected to childhood sexual abuse or rape in adulthood: a case–control study in a clinical cohort. BJOG. 2012:n/a-n/a.
16. Gisladottir A, Gudmundsdottir B, Gudmundsdottir R, Jonsdottir E, Gudjonsdottir GR, Kristjansson M, et al. Increased attendance rates and altered characteristics of sexual violence. Acta Obstet Gynecol Scand. 2012 Jan;91(1):134-42.
17. Maršál K, Persson PH, Larsen T, Lilja H, Selbing A, Sultan B. Intrauterine growth curves based on ultrasonically estimated foetal weights. Acta Pædiatrica. 1996;85(7):843-8.
18. Karlsdottir E, Arnalds AA. Rannsokn a ofbeldi gegn konum. Reynsla kvenna a aldrinum 18-80 ara a Islandi [Research on violence against women: The experiences of Women Aged 18-80 in Iceland]. (In Icelandic. English abstract available). Reykjavik: Rannsoknarstofnun í barna- og fjolskylduvernd 2010.

19. Saigal S, Doyle LW. An overview of mortality and sequelae of preterm birth from infancy to adulthood. The Lancet. 2008;371(9608):261-9.
20. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. The Lancet. 2008;371(9606):75-84.
21. Muglia LJ, Katz M. The enigma of spontaneous preterm birth. New England Journal of Medicine. 2010;362(6):529-35.
22. Mac Bird T, Bronstein JM, Hall RW, Lowery CL, Nugent R, Mays GP. Late preterm infants: birth outcomes and health care utilization in the first year. Pediatrics. 2010;126(2):e311-e9.
23. Grigoriadis S, VonderPorten EH, Mamisashvili L, Tomlinson G, Dennis C-L, Koren G, et al. The impact of maternal depression during pregnancy on perinatal outcomes: a systematic review and meta-analysis. The Journal of clinical psychiatry. 2013;74(4):321-41.
24. Grote NK, Bridge JA, Gavin AR, Melville JL, Iyengar S, Katon WJ. A Meta-analysis of Depression During Pregnancy and the Risk of Preterm Birth, Low Birth Weight, and Intrauterine Growth Restriction. Archives of general psychiatry. 2010;67(10):1012-24.
25. Yonkers K, Smith MV, Forray A, et al. Pregnant women with posttraumatic stress disorder and risk of preterm birth. JAMA Psychiatry. 2014.
26. Huang H, Coleman S, Bridge JA, Yonkers K, Katon W. A meta-analysis of the relationship between antidepressant use in pregnancy and the risk of preterm birth and low birth weight. General hospital psychiatry. 2014;36(1):13-8.
27. Wosu AC, Gelaye B, Williams MA. History of childhood sexual abuse and risk of prenatal and postpartum depression or depressive symptoms: an epidemiologic review. Arch Womens Ment Health. 2015b Oct;18(5):659-71.
28. Hauge LJ, Torgersen L, Vollrath M. Associations between maternal stress and smoking: findings from a population-based prospective cohort study. Addiction. 2012;107(6):1168-73.
29. Bailey BA. Effectiveness of a Pregnancy Smoking Intervention: The Tennessee Intervention for Pregnant Smokers Program. Health Education & Behavior. 2015 July 8, 2015.
30. Bublitz MH, Stroud LR. Childhood sexual abuse is associated with cortisol awakening response over pregnancy: Preliminary findings. Psychoneuroendocrinology. 2012;37(9):1425-30.
31. Bolten M, Wurmser H, Buske-Kirschbaum A, Papoušek M, Pirke K-M, Hellhammer D. Cortisol levels in pregnancy as a psychobiological predictor for birth weight. Archives of Women's Mental Health. 2011;14(1):33-41.
32. Suk D, Kwak T, Khawar N, VanHorn S, Salafia CM, Narula P. Increasing Maternal Body Mass Index During Pregnancy Increases Neonatal Intensive Care Unit Admission in Near and Full-term Infants. The Journal of Maternal-Fetal & Neonatal Medicine. 2015:1-17.
33. Cnattingius S, Lambe M. Trends in smoking and Overweight during Pregnancy: Prevalence, risks of pregnancy complications, and adverse pregnancy outcomes. Semin Perinatol. 2002;26(4):286-95.
34. Campbell MK, Cartier S, Xie B, Kouniakis G, Huang W, Han V. Determinants of small for gestational age birth at term. Paediatric and perinatal epidemiology. 2012;26(6):525-33.
35. Jonas S, Bebbington P, McManus S, Meltzer H, Jenkins R, Kuipers E, et al. Sexual abuse and psychiatric disorder in England: results from the 2007 Adult Psychiatric Morbidity Survey. Psychol Med. 2011;41(04):709-19.
36. Seng J, Low L, Sperlich M, Ronis D, Liberzon I. Post - traumatic stress disorder, child abuse history, birthweight and gestational age : a prospective cohort study. Bjog : an

1 International Journal of Obstetrics and Gynaecology (Formerly : British Journal of Obstetrics
2 and Gynaecology). 2011;118(11):1329-39.
3
4

Table 1. Comparison of background and infant characteristics by mother's sexual violence exposure status

	Non-exposed		Exposed		
	n	%	n	%	
	9104	**89.5**	**1067**	**10.5**	**p-value**
Age at delivery (years)					0.91
≤19	951	10.4	119	11.2	
20-24	3080	33.8	368	34.5	
25-29	2900	31.9	335	31.4	
30-34	1566	17.2	176	16.5	
35 or older	607	6.7	69	6.5	
Parity					0.99
Primiparas	4293	47.2	503	47.1	
Multiparas	4811	52.8	564	52.9	
Season of delivery					0.92
January - April	2861	31.4	342	32.1	
May - August	3115	34.2	361	33.8	
September - December	3128	34.4	364	34.1	
Infant's sex					0.64
Male	4684	51.4	557	52.2	
Female	4420	48.6	510	47.8	
Occupational status					<0.01
Employed/missing	6150	67.6	581	54.5	
Student	2018	22.2	227	21.3	
Not working	936	10.3	259	24.3	
Cohabiting status					<0.01
Cohabiting	7047	77.4	631	59.1	
Not cohabiting	1931	21.2	419	39.3	
Missing	126	1.4	17	1.6	
Place of delivery					<0.01
Capital (Landspitali)	6104	67.0	827	77.5	
Other	3000	33.0	240	22.5	
Mode of delivery					0.27
Spontaneous vaginal	7137	78.4	814	76.3	
Vaginal instrumental	698	7.7	93	8.7	
Cesarean Section	1269	13.9	160	15.0	
Epidural analgesia	2417	26.5	322	30.2	0.01

Antenatal diagnoses					
Gestational diabetes (O24.4 or O24.9)	204	2.2	37	3.5	0.01
Gestational hypertension (O13)	225	2.5	36	3.4	0.08
Preeclampsia (O11, 14, 15)	329	3.6	26	2.4	<0.05

Table 2. Comparison of gestational age and size at birth between infants of exposed versus non-exposed mothers

					p-values [a]	
	N	**Median**	**Mean**	**StDev**	**A**	**B**	**C**
Gestational age (days)					<0.01		0.08
Non-exposed	9099	281.00	279.69	11.78			
Exposed	1065	281.00	278.69	12.30			
Birth weight (grams)					<0.01	<0.01	<0.01
Non-exposed	9104	3690.00	3675.58	553.23			
Exposed	1067	3580.00	3573.62	539.89			
Length (cm)					<0.01	<0.01	<0.01
Non-exposed	9098	52.00	51.45	2.73			
Exposed	1066	51.00	50.91	2.45			
Head circum-ference (cm)					<0.01	<0.01	<0.01
Non-exposed	9090	36.00	35.65	1.62			
Exposed	1067	35.50	35.39	1.60			

[a] Linear regression models. A: Crude model (inherently adjusted for age, parity and season of delivery). B: Adjusted for gestational age. C: Adjusted for SES.

Table 3. Comparison of neonatal outcomes between mothers exposed versus non-exposed to sexual violence

	Non-exposed		Exposed					
					Model[a]		Model[ab]	
	n	%	n	%	RR[c]	95% CI	RR[c]	95% CI
Total	**9104**	**89.5**	**1067**	**10.5**				
Term delivery (37-41 weeks)	8329	91.5	948	88.8	0.97	0.95-0.99	0.98	0.95-1.00
Preterm delivery (≤36 weeks)	360	4.0	63	5.9	1.49	1.13-1.97	1.30	0.98-1.74
Spontaneous	249	3.9	44	6.0	1.55	1.12-2.14	1.34	0.95-1.89
Medically indicated	111	4.1	19	5.7	1.38	0.84-2.26	1.21	0.74-1.98
Small for gestational age (10th percentile)	907	10.0	125	11.7	1.18	0.98-1.42	1.06	0.87-1.28
Transferal to the Neonatal Intensive Care Unit (NICU)	431	4.7	68	6.4	1.35	1.05-1.73	1.31	1.02-1.68
Apgar score < 7 at 5 minutes	213	2.3	34	3.2	1.36	0.96-1.94	1.33	0.92-1.92

[a]Data mathced on maternal age, parity and season of delivery

[b]Adjusted for socio-economic factors (maternal occupation and marital status)

[c]Relative risks, with infants of non-exposed mothers as a reference group.

Table 4. Comparison of neonatal outcomes by mother's exposure level: Stratified by time from exposure to outcome and age at exposure, n=10,171 infants

	Non-exposed mother		Mother exposed <20 years of age[a]				Mother exposed ≥ 20 years of age[a]			
					Model				Model	
	n	%	n	%	RR[b]	95% CI	n	%	RR[b]	95% CI
Total	**9104**		**646**				**421**			
Preterm delivery	360	4.0	41	6.4	1.61	1.14-2.26	22	5.2	1.32	0.86-2.03
Delivery ≤5 years of the assault[ac]			*18*	*6.6*	*1.68*	*1.05-2.69*	*16*	*6.5*	*1.66*	*1.03-2.68*
Delivery >5 years of the assault[ac]			*23*	*6.2*	*1.56*	*1.01-2.41*	*6*	*3.4*	*0.85*	*0.39-1.88*
SGA (10th percentile)	907	10.0	78	12.1	1.22	0.96-1.53	47	11.2	1.12	0.83-1.51
Delivery ≤5 years of the assault[ac]			*39*	*14.2*	*1.30*	*0.97-1.76*	*30*	*12.1*	*1.26*	*0.88-1.80*
Delivery >5 years of the assault[ac]			*39*	*10.5*	*1.09*	*0.79-1.49*	*17*	*9.8*	*1.01*	*0.59-1.71*
Transferal to the NICU	431	4.7	*47*	*7.3*	1.54	1.15-2.06	21	5.0	1.05	0.69-1.61
Delivery ≤5 years of the assault[ac]			*19*	*6.9*	*1.92*	*1.22-3.00*	*12*	*4.9*	*1.13*	*0.66-1.92*
Delivery >5 years of the assault[ac]			*28*	*7.5*	*1.36*	*0.93-1.99*	*9*	*5.2*	*0.88*	*0.47-1.66*
Apgar score below 7 at 5 minutes	213	2.3	*22*	*3.4*	1.46	0.95-2.23	12	2.9	1.22	0.69-2.15
Delivery ≤5 years of the assault[ac]			*13*	*4.7*	*1.89*	*1.08-3.32*	*4*	*1.6*	*0.63*	*0.24-1.67*
Delivery >5 years of the assault[ac]			*9*	*2.4*	*1.24*	*0.64-2.39*	*8*	*4.6*	*1.91*	*0.94-3.87*

[a]Those who attended the Rape Trauma Service more than once were categorized according to age at first attendance and date of the latest assault.

[b]Relative Risks with infants of non-exposed mothers as a reference group.

[c]Time stratified analyses were adjusted for age, parity and year of delivery.

Deliveries ≤5 years of the assault, n=274 for mothers exposed in adolescence and n=247 for mothers exposed in adulthood.

Deliveries >5 years of the assault, n=370 for mothers exposed in adolescence and n= 174 for mothers exposed in adulthood.

Table 5. Neonatal diagnoses. Comparison of infants of mothers exposed versus non-exposed to sexual violence

	Non-exposed		Exposed			
	n	**%**	**n**	**%**	**RR[a]**	**95% CI**
ICD-10 diagnosis						
Singleton, born in hospital (infant with no other diagnosis) (Z38.0)	7099	78.0	758	71.0	0.91	0.87-0.95
Pneumonia or respiratory distress (J15, J18, P23, P36, P22, P25)	296	3.2	42	3.9	1.21	0.88-1.67
Neonatal jaundice (P59.0, P59.9)	370	4.1	57	5.3	1.31	0.98-1.76
Cephalhaematoma due to birth injury (P12.0)	116	1.3	14	1.3	1.03	0.58-1.84
Other neonatal hypoglycaemia (P70.4)	79	0.9	20	1.9	2.16	1.33-3.50

[a]Inherently adjusted for maternal age, parity and season of delivery

Appendix

Approvals and a research-based checklist

Miðstöð í Lýðheilsuvísindum við HÍ
Dr. Unnur A. Valdimarsdóttir
Stapa v/Hringbraut
101 REYKJAVÍK

Persónuvernd

Rauðarárstíg 10 105 Reykjavík
sími: 510 9600 bréfasími: 510 9606
netfang: postur@personuvernd.is
veffang: personuvernd.is

Reykjavík, 28. júlí 2010
Tilvísun: 2010060504AT/--

Heimild

samkvæmt 3. mgr. 15. gr. laga nr. 74/1997 og 8. mgr. 1. gr. 8. gr. laga nr. 41/2007, veitt í samræmi við 1. og 7. tl. 1. mgr. 4. gr. reglna nr. 712/2008 um tilkynningarskylda og leyfisskylda vinnslu persónuupplýsinga, sbr. 33. gr. laga nr. 77/2000 um persónuvernd og meðferð persónuupplýsinga.

I.
Umsókn

Persónuvernd hefur borist umsókn Unnar A. Valdimarsdóttur, forstöðumanns Miðstöðvar í lýðheilsuvísindum við HÍ, Berglindar Guðmundsdóttur, sálfræðings á Landspítalanum, Bernards Harlow, prófessors og deildarforseta faraldsfræðideildar Minnesota-háskóla, Ragnheiðar Bjarnadóttur, fæðinga- og kvensjúkdómalæknis, og Agnesar Gísladóttur, doktorsnema, dags. 28. júní 2010, um heimild til samkeyrslu viðkvæmra persónuupplýsinga, í tilefni af rannsókninni „Fæðingarútkomur kvenna sem hafa orðið fyrir kynferðisofbeldi (e. Adverse birth outcomes among victims of sexual violence)".

Í umsókninni er tilgangur vinnslunnar sagður vera að kanna hvort konur, sem hafa orðið fyrir kynferðisofbeldi, séu í aukinni hættu á erfiðleikum/vandamálum tengdum meðgöngu og fæðingu síðar á lífsleiðinni. Rannsóknin miðar að því að greina áhættuhlutfall óæskilegra meðgöngu/fæðingarútkoma meðal kvenna sem hafa orðið fyrir kynferðisofbeldi (e. exposed) þegar tíðni slíkra útkoma í óútsettum konum (bakgrunnsþýðinu, e. unexposed) er höfð til viðmiðunar.

Unnið verður með upplýsingar úr ópersónugreinanlegum gagnagrunni Neyðarmóttöku Landspítalans, en það er rafrænn gagnagrunnur yfir alla þá einstaklinga sem leitað hafa aðstoðar hjá Neyðarmóttökunni frá 1993–2007. Lykill sem tengir kennitölu einstaklinga við númer þeirra hjá Neyðarmóttökunni er aðgreindur frá gagnagrunninum en lykillinn er nauðshnlegur til að hægt sé að nota gögnin í rannsóknarskyni með samtengingu gagnagrunna. Upplýsinga um dagsetningu brots, aldur brotaþola, alvarleika brots, sögu um fyrri áföll, nýtingu þjónustu, hvort þolandi hafi kært árásina, tengsl þolanda og geranda og önnur einkenni kynferðisofbeldisins verður aflað úr grunninum.

Upplýsinga um afbrigði og lengd fæðingar, íhlutanir og aðgerðir í fæðingu, sjúkdómsgreiningu móður og barns, apgar-skor barns, fæðingarþyngd og meðgöngulengd verður aflað úr Fæðingaskrá Landlæknis. Einnig verður unnið með upplýsingar um aldur móður, hjúskaparstöðu og atvinnu, fyrri fæðingar/fósturlát, meðgöngulengd, fósturstöðu, tímasetningu fæðingar, fæðingarstað og þjónustustig í heilbrigðisþjónustu við fæðingu. Unnið verður með gögn úr fæðingaskrá til og með 31. desember 2009.

Upplýsinga um reykingar, áfengis- eða vímuefnaneyslu móður á meðgöngu og BMI-stuðul móður verður aflað úr mæðraskrá og upplýsingar um menntunarstig móður verða fengnar frá Hagstofu Íslands og notaðar til samanburðar og leiðréttingar í tölfræðilegri úrvinnslu.

Varðandi samkeyrslu framangreindra skráa segir í umsókninni:

> „Samkeyrslan fer þannig fram:
> 1) Afmörkun rannsóknarhóps. Með samkeyrslu kennitalna kvenna sem leitað hafa til Neyðarmóttöku við fæðingarskrá eru: a) fæðingar kvenna sem hafa verið útsettar fyrir kynferðisofbeldi auðkenndar (1/0), b) tilviljunarúrtak 5 samanburðarkvenna/fæðinga fyrir hverja útsetta konu/fæðingu (parað með fyrrgreindum hætti) valið. Ábyrgð í samvinnu við rannsakendur: Upplýsingatæknisvið LSH.
>
> 2) Öflun mikilvægra leiðréttingarþátta: a) Menntunarstig þátttakenda er fengið frá Hagstofu Íslands með eftirfarandi hætti: Starfsmaður upplýsingatæknisviðs LSH fer með kennitölur útsettra og óútsettra kvenna á Hagstofuna. Þar eru upplýsingar um menntun samkeyrðar. Starfsmenn hvorugrar stofnunarinnar hafa upplýsingar um hvaða kennitala tilheyrir útsettum hópi (fyrir kynferðisofbeldi) og hver ekki. Menntunarupplýsingar eru síðan færðar inn í rannsóknargagnagrunn á Upplýsingasviði LSH. b) Upplýsingar um reykingar á meðgöngu og BMI móður eru fengnar úr mæðraskrám. Doktorsnemi verkefnisins (AG) fær kennitölur útsettra og óútsettra kvenna á upplýsingatæknisviði LSH og flettir upplýsingum upp í mæðraskrám. Doktorsneminn er þannig blindur gagnvart því hvort þátttakendur eru útsettar eða óútsettar fyrir kynferðislegu ofbeldi. Upplýsingarnar úr mæðraskrám eru síðan færðar inn í miðlægan rannsóknargagnagrunn á upplýsingatæknisviði LSH.
>
> Dulkóðun og rannsóknarvinnslugrunnur útbúinn: Þegar allar upplýsingar eru komnar inn í grunninn, eru kennitölur dulkóðaðar af starfsmanni Upplýsingatæknisviðs LSH og rannsóknarvinnslugrunnur tilbúinn. Samkeyrsla persónuupplýsinga verður gerð samkvæmt Öryggishandbók Landlæknisembættisins á LSH. Að samkeyrslu lokinni verður lykli með dulkóðun gagna eytt samkvæmt verkferli Öryggishandbókar Landlæknisembættisins.“

Þá segir í umsókninni að viðkvæm heilsufarsgögn rannsóknarinnar verði með öllu ópersónugreinanleg í vinnslugrunni þeim er Upplýsingatæknisvið LSH útbýr og þess gætt að við greiningu gagna verði aldrei farið niður í svo litla hópa að unnt verði að þekkja einstaklinga úr af

þeim sem til þekkja. Gögn verða varðveitt í vinnslugrunni á tölvutæku formi hjá rannsakendum. Lykli sem tengir saman kennitölur og dulkóðaðar kennitölur verður eytt að samkeyrslu lokinni. Ábyrgðaraðili mun sjá til þess að gögnum verði eytt eigi síðar en 5 árum eftir að rannsókn lýkur.

II.

Leyfisskyld og tilkynningarskyld vinnsla
Ábyrgðaraðili og leyfishafi

Samkvæmt 7. tölul. 1. mgr. 7. gr. reglna Persónuverndar nr. 712/2008 er miðlun viðkvæmra persónuupplýsinga í þágu vísindarannsóknar háð leyfi stofnunarinnar, enda standi ábyrgðaraðili þeirra upplýsinga sem miðlað er ekki að rannsókninni. Samkvæmt 1. tölul. 1. mgr. 7. gr. sömu reglna er samkeyrsla skráa með viðkvæmum persónuupplýsingum auk þess háð leyfi Persónuverndar, nema þegar einvörðungu eru samkeyrðar upplýsingar úr þjóðskrá um nöfn, kennitölur, fyrirtækjanúmer, heimilisföng, aðsetur og póstnúmer; aðeins eru samkeyrðar skrár sama ábyrgðaraðila, þó að undanskildum miðlægum skrám sem innihalda viðkvæmar persónuupplýsingar; eða samkeyrslan byggist á skriflegu samþykki eða lagafyrirmælum. Engin af þessum undantekningum á við um umrædda samkeyrslu upplýsinga frá Neyðarmóttöku LSH og Hagstofu Íslands við Fæðingaskrá Landlæknis, m.a. þar sem um er að ræða miðlægar skrár með viðkvæmum persónuupplýsingum. Þarf því leyfi með stoð í 1. tölul. 1. mgr. 7. gr.

Fæðingaskrá er varðveitt á Landspítala-háskólasjúkrahúsi en Landlæknisembættið skipuleggur skrána og er ábyrgðarmaður hennar, sbr. 4. tölul. 2. mgr. og 4. mgr. 8. gr. laga nr. 41/2007 um landlækni. Samkvæmt 8. mgr. sömu greinar, sbr. 3. mgr. 15. gr. laga nr. 74/1997 um réttindi sjúklinga, þarf leyfi Persónuverndar til aðgangs að þeirri skrá.

III.

Leyfisskilmálar

Persónuvernd hefur fjallað um umsókn Unnar A. Valdimarsdóttur, Berglindar Guðmundsdóttur, Bernards Harlow, Ragnheiðar Bjarnadóttur og Agnesar Gísladóttur, dags. 28. júní 2010, í ljósi 1. og 7. tölul. 1. mgr. 7. gr. reglna nr. 712/2008 um tilkynningarskylda og leyfisskylda vinnslu persónuupplýsinga, sbr. 33. gr. laga nr. 77/2000 um persónuvernd og meðferð persónuupplýsinga, og 8. mgr. 8. gr., sbr. 4. tölul. 2. mgr. 8. gr. laga nr. 41/2007 um landlækni, sbr. 3. mgr. 15. gr. laga nr. 74/1997 um réttindi sjúklinga. Með vísan til þessara ákvæða, sem og m.a. að virtum ákvæðum 29., 33. og 34. gr. í formálsorðum persónuverndartilskipunarinnar nr. 95/46/EB og ákvæði 9. tölul. 1. mgr. 9. gr. laga nr. 77/2000, hefur stofnunin ákveðið að veita umbeðið leyfi til vinnslu persónuupplýsinga vegna rannsóknarinnar „Fæðingarútkomur kvenna sem hafa orðið fyrir kynferðisofbeldi (e. Adverse birth outcomes among victims of sexual violence)".

Leyfi þetta gildir til 31. desember 2014 og er bundið eftirfarandi skilyrðum:

1. Ábyrgðaraðili að vinnslu persónuupplýsinga

Unnar A. Valdimarsdóttir, hjá miðstöð Lýðheilsuvísinda við HÍ, Berglind Guðmundsdóttir, hjá Landspítalanum, Bernard Harlow, hjá faraldsfræðideild Minnesota-háskóla, Ragnheiður Bjarnadóttir, fæðinga- og kvensjúkdómalæknir, og Agnes Gísladóttir, doktorsnemi, teljast vera ábyrgðaraðilar vinnslunnar í skilningi 4. tölul. 2. gr. laga nr. 77/2000, sbr. niðurlag II. kafla hér að framan, og jafnframt handhafar leyfis þessa (hér eftir nefnd „leyfishafar"). Fer Unnur A. Valdimarsdóttir með allt fyrirsvar gagnvart Persónuvernd um alla þætti er varða þetta leyfi, þ. á m. álitaefni er upp kunna að rísa um það hvort vinnsla persónuupplýsinga hafi verið í samræmi við lög, reglur og ákvæði þessa leyfis. Að því er varðar miðlun frá Landlæknisembættinu fer Sigríður Haraldsdóttir með fyrirsvar.

2. Lögmæt vinnsla persónuupplýsinga og þagnarskyld

a. Leyfishafi ber ábyrgð á því að vinnsla persónuupplýsinga vegna rannsóknarinnar fullnægi ávallt kröfum 1. mgr. 7. gr. laga nr. 77/2000.

b. Farið skal með upplýsingar, sem skráðar eru vegna rannsóknarinnar, í samræmi við lög nr. 77/2000, lög nr. 55/2009 um sjúkraskrár, lög nr. 74/1997 um réttindi sjúklinga og læknalög nr. 53/1988. Hvílir þagnarskylda á leyfishafa og öðrum þeim sem koma að rannsókninni um heilsufarsupplýsingar sem unnið er með, sbr. 15. gr. laga nr. 53/1988. Þagnarskylda helst þótt látið sé af störfum við rannsóknina.

c. Taki háskólanemar eða aðrir, sem ekki teljast til löggiltra heilbrigðisstétta, þátt í framkvæmd rannsóknarinnar skulu þeir undirrita sérstaka þagnarskylduyfirlýsingu, þar sem þeir m.a. ábyrgjast að tilkynna leyfishafa ef í rannsóknargögnum eru viðkvæmar persónuupplýsingar um þá sem eru eða hafa verið maki viðkomandi, skyldir eða mægðir honum í beinan legg eða að öðrum lið til hliðar eða tengdir honum með sama hætti vegna ættleiðingar. Er viðkomandi þá óheimilt að kynna sér gögn um þá einstaklinga. Leyfishafa eða fulltrúa hans ber að votta rétta undirskrift hlutaðeigandi og dagsetningu slíkrar yfirlýsingar og koma henni til Persónuverndar innan tveggja vikna frá útgáfu leyfis þessa eða frá því að viðkomandi hefur störf við rannsóknina. Þagnarskyldan er byggð á 3. mgr. 35. gr. laga nr. 77/2000. Á heimasíðu Persónuverndar er að finna staðlað eyðublað fyrir þagnarskylduyfirlýsingu. Ef þagnarskylduyfirlýsingum er ekki skilað innan tilskilins frests getur Persónuvernd afturkallað leyfi þetta.

d. Leyfi þetta heimilar einvörðungu að safnað verði úr sjúkraskrám þeim heilsufarsupplýsingum sem gildi hafa fyrir rannsókn leyfishafa og samrýmast markmiðum hennar. Hafi sjúkraskrárupplýsingar í sjúkraskrá verið merktar sérstaklega viðkvæmar í samræmi við 2. mgr. 13. gr. laga nr. 55/2009 heimilar leyfi þetta eingöngu að slíkum upplýsingum verði safnað hafi þær augljóst vægi fyrir gæði rannsóknar og niðurstöður.

e. Leyfi þetta heimilar ekki rannsakendum aðgang að sjúkraskrárupplýsingum hafi viðkomandi sjúklingur eða umboðsmaður hans lagt bann við því að rannsakandi, eða annar tiltekinn aðili sem starfar á hans vegum, hafi slíkan aðgang að sjúkraskrá viðkomandi skv. 4. mgr. 13. gr. sjúkraskrárlaga nr. 55/2009.

3. Vinnuferli – Dulkóðun

a. Öll rannsóknargögn skulu varðveitt á dulkóðuðum kennitölum eingöngu.

b. Þær upplýsingar, sem heimilt er að samkeyra, eru annars vegar upplýsingar frá Neyðarmóttöku Landspítala-háskólasjúkrahúss og Hagstofu Íslands, sbr. kafla I. í leyfi þessu, og hins vegar tilgreindar upplýsingar úr Fæðingarskrá.

c. Starfsmaður upplýsingatæknisviðs LSH skal dulkóða upplýsingar frá Neyðarmóttöku, Hagstofu og úr Fæðingaskrá með sama hætti. Greiningarlykill skal varðveittur á öruggum stað og aðeins vera aðgengilegur umsjónarmanninum.

d. Upplýsingar frá Landspítalanum og Hagstofu Íslands, sem sendar eru Upplýsingatæknisviði Landspítala, skulu sendar því með öruggum hætti, s.s. á geisladiski sem komið er til skila í innsigluðu umslagi.

e. Þegar þær heilbrigðisupplýsingar, sem leyfi þetta tekur til, hafa verið skráðar í rannsóknargögn, og eftir atvikum verið staðreynt að þær séu réttar, og gögnin að öðru leyti verið fullgerð, skal tryggja að þar liggi ekki fyrir auðkenning á því frá hvaða einstaklingi upplýsingarnar stafa, þ.e. með því að eyða greiningarlykli. Ber Unnur A. Valdimarsdóttir ábyrgð á því að senda Persónuvernd tilkynningu um eyðinguna.

4. Öryggi við vinnslu persónuupplýsinga

Leyfishafa ber að gera viðeigandi tæknilegar og skipulagslegar öryggisráðstafanir til að vernda persónuupplýsingar gegn óleyfilegum aðgangi í samræmi við 11. og 12. gr. laga nr. 77/2000. Þar er m.a. áskilið að:

a. beita skuli ráðstöfunum sem tryggja nægilegt öryggi miðað við áhættu af vinnslunni og eðli þeirra gagna sem verja á, með hliðsjón af nýjustu tækni og kostnaði við framkvæmd þeirra, og
b. tryggja skuli að áhættumat og öryggisráðstafanir við vinnslu persónuupplýsinga séu í samræmi við lög, reglur og fyrirmæli Persónuverndar um hvernig tryggja skal öryggi upplýsinga, þ.m.t. þá staðla sem hún ákveður að skuli fylgt.

Leyfishafi ber ábyrgð á því að hver sá er starfar í umboði hans og hefur aðgang að persónuupplýsingum vinni aðeins með þær í samræmi við skýr fyrirmæli sem hann gefur og að því marki að falli innan skilyrða leyfis þessa, nema lög mæli fyrir á annan veg, sbr. 3. mgr. 13. gr. laga nr. 77/2000.

5. Varðveisla og eyðing gagna

a. Ávallt skal tryggt að rannsóknargögn séu varðveitt á tryggum stað og aðeins þar sem lögum samkvæmt er heimilt að varðveita þau.
b. Að lokinni þeirri rannsókn, sem leyfi þetta tekur til, þó eigi síðar en við lok gildistíma leyfisins hinn 31. desember 2014, ber að eyða öllum rannsóknargögnum.

6. Almennir skilmálar

a. Leyfishafi ber ábyrgð á að farið sé með öll persónuauðkennd gögn sem sjúkragögn í samræmi við lög, reglur og ákvæði þessa leyfis.
b. Leyfishafi skal ábyrgjast að engir aðrir en hann fái í hendur persónugreinanleg gögn sem sérstaklega verður aflað í þágu þessarar rannsóknar.
c. Óski leyfishafi þess að hætta rannsókn ber honum að leggja þetta leyfi inn til Persónuverndar á skriflegan og sannanlegan hátt. Skal þá tilgreina hvort þeim persónuupplýsingum, sem unnar voru á grundvelli þessa leyfis, hafi verið eytt. Að öðrum kosti úrskurðar Persónuvernd um hvort persónuupplýsingunum skuli eytt eða þær varðveittar með ákveðnum skilyrðum.
d. Leyfishafa ber að veita Persónuvernd, starfsmönnum og tilsjónarmönnum hennar allar umbeðnar upplýsingar um vinnslu persónuupplýsinga sé eftir því leitað í þágu eftirlits. Brot á ákvæði þessu getur varðað afturköllun á leyfinu.
e. Persónuvernd getur látið gera úttekt á því hvort leyfishafi fullnægi skilyrðum laga nr. 77/2000 og reglna sem settar eru samkvæmt þeim eða einstökum fyrirmælum. Getur Persónuvernd ákveðið að hann skuli greiða þann kostnað sem af því hlýst. Persónuvernd getur einnig ákveðið að leyfishafi greiði kostnað við úttekt á starfsemi, við undirbúning útgáfu vinnsluleyfis og annarrar afgreiðslu. Persónuvernd skal þá gæta þess að sá sérfræðingur, sem framkvæmir umrædda úttekt, undirriti yfirlýsingu um að hann lofi að gæta þagmælsku um það sem hann fær vitneskju um í starfsemi sinni og leynt ber að fara eftir lögum eða eðli máls. Brot á slíkri þagnarskyldu varðar refsingu samkvæmt 136. gr. almennra hegningarlaga. Þagnarskyldan helst þótt látið sé af starfi.
f. Leyfi þetta er háð því skilyrði að einungis verði safnað þeim upplýsingum sem *nauðsynlegar* eru vegna rannsóknarinnar.

Virðingarfyllst

Sigrún Jóhannesdóttir

VÍSINDASIÐANEFND

Vegmúla 3, 108 Reykjavík,

Sími: 551 7100, Bréfsími: 551 1444

netfang: visindasidanefnd@vsn.stjr.is

Unnur Anna Valdimarsdóttir
Grenimel 2
107 Reykjavík

Reykjavík 22. júní 2010
Tilv.: VSNb2010050009/03.7

Efni: Varðar: 10-077-S1 Fæðingarútkomur kvenna sem hafa orðið fyrir kynferðisofbeldi. (e. Adverse birth outcomes among victims of sexual violence).

Vísindasiðanefnd þakkar svarbréf þitt, dags. 22.06.2010 vegna áðursendra athugasemda við ofangreinda rannsóknaráætlun sbr. bréf nefndarinnar dags. 01.06.2010. Í bréfinu koma fram svör og skýringar til samræmis við athugasemdir Vísindasiðanefndar og því fylgdi nýr og endurbættur spurningalisti til þátttakenda rannsóknarinnar, þar sem kemur betur fram hvað verður skráð af rannsakendum á stöðluðu spurningablaði frá Landspítalanum ásamt leyfi frá lækningaforstjóra Landspítala.

Fjallað var um svarbréf þitt og önnur innsend gögn á fundi Vísindasiðanefndar 22.06.2010 og voru þau talin fullnægjandi.

Rannsóknaráætlunin er endanlega samþykkt af Vísindasiðanefnd.

Vísindasiðanefnd bendir rannsakendum vinsamlegast á að birta VSN tilvísunarnúmer rannsóknarinnar þar sem vitnað er í leyfi nefndarinnar í birtum greinum um rannsóknina. Jafnframt fer Vísindasiðanefnd fram á að fá send afrit af, eða tilvísun í, birtar greinar um rannsóknina. Rannsakendur eru minntir á að tilkynna rannsóknarlok til nefndarinnar.

Með kveðju,
f.h. Vísindasiðanefndar,

dr. med., Björn Rúnar Lúðvíksson, læknir, formaður

LANDLÆKNISEMBÆTTIÐ
Directorate of Health

Unnur Anna Valdimarsdóttir
Stapi v/Hringbraut
101 Reykjavík

Seltjarnarnesi, 30. júní 2010
2010050171/5.6.1/HBS/hbs

Efni: Aðgangur að gögnum úr Fæðingaskrá vegna rannsóknarinnar: "Adverse birth outcomes among victims of sexual violence".

Landlæknisembættið vísar til umsóknar þinnar sem barst þann 14. maí s.l. Í umsókninni er óskað eftir aðgangi að gögnum úr Fæðingaskrá vegna rannsóknar á fæðingarútkomum kvenna sem orðið hafa fyrir kynferðisofbeldi, þegar leyfi Vísindasiðanefndar og Persónuverndar liggja fyrir. Samkvæmt umsóknargögnum verða kennitölur kvenna sem leituðu til Neyðarmóttökunnar eftir að hafa orðið fyrir alvarlegu kynferðisofbeldi (1993-2007) samkeyrðar við Fæðingaskrá (1993-2009). Þau gögn sem óskað er eftir úr Fæðingaskrá varða m.a. afbrigði og lengd fæðingar, íhlutanir og aðgerðir í fæðingu, sjúkdómsgreiningar móður og barns, Apgar skor barns, fæðingarþyngd og meðgöngulengd.

Landlæknisembættið sér því ekkert til fyrirstöðu að umsækjandi fái aðgang að umræddum gögnum með vísan í 9. tölulið 9. gr. laga um persónuvernd og meðferð persónuupplýsinga nr. 77/2000, að því tilskyldu að rannsóknin fái leyfi Persónuverndar og Vísindasiðanefndar. Afrit af báðum leyfum þurfa að berast Landlæknisembættinu áður en aðgangur er veittur að umbeðnum gögnum.

Virðingarfyllst,

Sigríður Haraldsdóttir
Sviðsstjóri heilbrigðistölfræðisviðs

Afrit: Agnes Gísladóttir
Vísindasiðanefnd
Persónunefnd

LANDSPÍTALI
HÁSKÓLASJÚKRAHÚS

Unnur Anna Valdimarsdóttir
dósent, forstöðumaður miðstöðvar í
lýðheilsuvísindum Háskóla Íslands
Stapa v. Hringbraut
101 Reykjavík

19.05.2010
Tilv. 16
ÞH/eí

Efni: Adverse birth outcomes among victims of sexual violence

Ágæta Unnur Anna.

Vísað er til bréfs þíns til framkvæmdastjóra lækninga, dags. 10.05.2010 þar sem óskað er heimildar til að ofangreind rannsókn fari fram á Landspítala. Um er að ræða rannsókn Agnesar Gísladóttur til doktorsprófs í lýðheilsuvísindum við læknadeild Háskóla Íslands. Doktorsnefnd hennar skipa Unnur Anna Valdimarsdóttir (leiðbeinandi og ábyrgðarmaður), Ragnheiður Bjarnadóttir, sérfræðilæknir og umsjónarmaður fæðingarskrár LSH, Berglind Guðmundsdóttir, sálfræðingur á neyðarmóttöku Landspítala og Bernard Harlow, prófessor við háskólann í Minnesota. Í bréfi þínu óskar þú einnig eftir aðgangi að sjúkraskrám sem tengjast rannsókninni.

Hér með er veitt heimild til að ofangreind rannsókn fari fram á Landspítala undir þinni stjórn og í því samstarfi sem að ofan greinir. Jafnframt er veittur aðgangur að sjúkraskrám sem tengjast rannsókninni. Leyfi þetta er háð því að fyrir liggi samþykki Vísindasiðanefndar og Persónuverndar en fram kemur að sótt hefur verið um hvort tveggja.

Með kveðju og ósk um gott rannsóknargengi,

Þórður Harðarson
prófessor, yfirlæknir

Ólafur Baldursson
framkvæmdastjóri lækninga

Afrit:

Björn Rúnar Lúðvíksson, formaður Vísindasiðanefndar
Sigrún Jóhannesdóttir, forstjóri Persónuverndar
Ragnheiður Bjarnadóttir, sérfræðilæknir
Berglind Guðmundsdóttir, sálfræðingur

Miðstöð í Lýðheilsuvísindum við HÍ
Dr. Unnur A. Valdimarsdóttir, dósent
Stapa
v. Hringbraut
101 Reykjavík

Persónuvernd

Rauðarárstíg 10 105 Reykjavík
sími: 510 9600 bréfasími: 510 9606
netfang: postur@personuvernd.is
veffang: personuvernd.is

Reykjavík, 27. janúar 2014
Tilvísun: 2013040591HGK/--

Efni: Viðbótarleyfi vegna rannsóknarinnar „Fæðingarútkomur kvenna sem hafa orðið fyrir kynferðisofbeldi"

Persónuvernd vísar til bréfs yðar, dags. 29. apríl 2013, þar sem þér óskið eftir að mega bæta við rannsóknargögnum vegna rannsóknarinnar „Fæðingarútkomur kvenna sem hafa orðið fyrir kynferðisofbeldi". Í erindi yðar segir m.a. eftirfarandi:

> „Vinna við ofangreinda rannsókn er vel á veg komin; hefur ein vísindagrein þegar verið send til birtingar og tvær aðrar eru í undirbúningi. Til þess að auka tölfræðilegan styrk rannsóknarinnar og til að draga megi afdráttarlausar ályktanir af niðurstöðum hennar óskum við hér með eftir útvíkkun á gagnasafninu á eftirfarandi hátt:
>
> a) Að eftirfylgd í Fæðingaskrá verði lengd til 31. desember 2012 (var áður til 31. desember 2009)
>
> b) Að fæðingum sem notaðar eru til viðmiðunar verði fjölgað úr 5 í 10
>
> c) Að konum sem leituðu til Neyðarmóttökunnar á árunum 2008-2011 og síðar fæddu barn til 31. desember 2012 verði bætt við hóp útsettra kvenna
>
> Samkeyrsla verður gerð á sama hátt og áður á vegum starfsmanns í Hag- og upplýsingadeild Landspítala. Rannsakendur fá eins og áður til vinnslu rannsóknargrunn án persónuauðkenna (kennitalna) og því er engin leið að bera kennsl á einstaka þátttakanda, hvorki í úrvinnslu rannsóknarinnar né í birtingu niðurstaðna hennar."

Hafa Persónuvernd borist undirritaðar yfirlýsingar frá embætti landlæknis, dags. 19. júní 2013, og Landspítala, dags. 12. ágúst 2013, þar sem heimilað er að gagnasafn rannsóknarinnar verði útvíkkað og að starfsmaður Landspítala framkvæmi samkeyrslu upplýsinganna, eins og lýst er í framangreindu erindi yðar.

Þá hefur Persónuvernd verið í bréfaskiptum við yður og Upplýsingatæknisvið LSH á tímabilinu

október 2013 til janúar 2014 til þess að afla upplýsinga um framkvæmd rannsóknarinnar, einkum m.t.t. þeirra upplýsinga sem Upplýsingatæknisvið LSH afhendir yður að lokinni samkeyrslu gagna frá Neyðarmóttöku vegna nauðgana, embætti landlæknis og Hagstofu Íslands. Með vísun til síðasta svarbréfs yðar til stofnunarinnar, þar sem m.a. segir að afrúnaðar verði tilteknar breytur í þeim vinnslugrunni sem yður verður afhentur frá Upplýsingatæknisviði LSH, hefur Persónuvernd fallist á beiðni yðar um viðbótarleyfi, sbr. bréf stofnunarinnar til yðar, dags. 17. janúar sl.

Það tilkynnist yður hér með að Persónuvernd gerir ekki athugasemdir við fyrirhugaðar breytingar á framkvæmd rannsóknarinnar, þ.e. að gagnasafnið verði útvíkkað með þeim hætti sem lýst er hér að framan og kom fram í bréfi yðar, dags. 29. apríl 2013, n.t.t. að bætt verði við rannsóknargögn upplýsingum úr fæðingaskrá landlæknis fyrir tímabilið 31. desember 2009-31. desember 2012, að viðmiðunarfjöldi fæðinga verði breyttur úr 5 í 10, að bætt verði við rannsóknargögn upplýsingum um þær konur sem leituðu til Neyðarmóttökunnar á árunum 2008-2011 og síðar fæddu barn til 31. desember 2012, enda verði áfram farið að öllum þeim skilmálum sem kveðið er á um í áður útgefnu leyfi stofnunarinnar til yðar vegna rannsóknarinnar, dags. 28. júlí 2010.

Aftur á móti setur Persónuvernd nú það viðbótarskilyrði að Upplýsingatæknisviði LSH er einungis heimilt að afhenda yður umræddan vinnslugrunn að lokinni samkeyrslu þar sem eftirfarandi breytur hafa verið afrúnaðar:

- Fæðingardagur barns - breytist í fæðingarmánuð barns
- Póstnúmer móður - breytist í fæðingarstaður barns (innan/utan höfuðborgarsvæðis)
- Ríkisfangi föður sleppt; ríkisfang móður miðist við íslenskt/erlent
- Hjúskaparstöðu móður sleppt; sambúð móður og föður haldið eftir (já/nei)
- Starfi föður sleppt; starf móður afrúnað í: í launuð vinna/nemi/annað

Vakin er athygli á því að umrætt leyfi Persónuverndar, dags. 28. júlí 2010, er í gildi til 31. desember 2014, og ber þá m.a. að eyða greiningarlykli svo að ekki liggi fyrir auðkenning á því frá hvaða einstaklingi upplýsingarnar stafa.

Virðingarfyllst

Helga Grethe Kjartansdóttir

Afrit:
Landspítali háskólasjúkrahús
Ingibjörg Richter
Upplýsingatæknisviði
v. Hringbraut
101 Reykjavík
...
Embætti landlæknis
Sigríður Haraldsdóttir, sviðsstjóri heilbrigðisupplýsingasvið
Barónsstíg 47

VÍSINDASIÐANEFND

Hafnarhúsið, Tryggvagata 17
101 Reykjavík,

Sími: 551 7100, Bréfsími: 551 1444

netfang: visindasidanefnd@vsn.stjr.is

Dr. Unnur Anna Valdimarsdóttir
Grenimel 2
107 Reykjavík

Reykjavík 7. maí 2013
Tilv.: VSNb2010050009/03.7

Efni: Varðar: 10-077-V2 Fæðingarútkomur kvenna sem hafa orðið fyrir kynferðisofbeldi. (e. Adverse birth outcomes among victims of sexual violence).

Á fundi sínum 07.05.2013 fjallaði Vísindasiðanefnd um umsókn þína dags. 29.04.2013, vegna viðbótar nr. 2 við ofangreinda rannsóknaráætlun.

Í bréfinu kemur fram að til þess að auka tölfræðilegan styrk rannsóknarinnar og til að draga megi afdráttarlausari ályktanir af niðurstöðum hennar óska rannsakendur eftir útvíkkun á gagnasafninu á eftirfarandi hátt:

1. Að eftirfylgd í Fæðingarskrá verði lengd til 31. desember 2012, var áður 31. desember 2009.

2. Að fæðingum sem notaðar eru til viðmiðunar verði fjölgað úr 5 í 10.

3. Að konum sem leituðu til Neyðarmóttökunnar á árunum 2008-2011 og síðar fæddu barn til 31. desember 2012 verði bætt við hóp útsettra kvenna.

Vísindasiðanefnd hefur farið yfir bréf þitt og gerir ekki athugasemdir við tilgreindar breytingar. Viðbót nr. 2 ásamt fylgigögnum við ofangreinda rannsókn, er endanlega samþykkt af Vísindasiðanefnd.

Áréttað er að ábyrgðarmanni ber að láta stofnanir, sem áður hafa veitt leyfi vegna framkvæmdar rannsóknarinnar, vita af ofangreindri breytingu á rannsóknaráætluninni.

Með kveðju,
f.h. Vísindasiðanefndar,

Gísli Ragnarsson, varaformaður

Embætti landlæknis
Directorate of Health

Unnur Anna Valdimarsdóttir
Háskóla Íslands, Stapa v/ Hringbraut
101 Reykjavík

Reykjavík, 19. júní 2013
2010050171/5.6.1/gkg

Efni: Viðbótarleyfi

Vísað er í bréf embættisins til rannsakanda, dags. 30. júní 2010, þar sem samþykktur var aðgangur að gögnum úr fæðingaskrá vegna rannsóknarinnar „*Adverse birth outcomes among victims of sexual violence*".

Með umsókn dags. 10. júní 2013 fer rannsakandi fram á eftirfarandi viðbætur við rannsóknina:

a) Að lengja eftirfylgd í fæðingaskrá til 31. desember 2012.
b) Að fæðingum sem notaðar eru til viðmiðunar verði fjölgað úr 5 í 10.
c) Að fá upplýsingar úr fæðingaskrá um konur sem fyrirhugað er að bæta við úrtakið, þ.e. konur sem leituðu til Neyðarmóttöku á árunum 2008-2011 og síðar fæddu barn (fram til 31. desember 2012).

Embætti landlæknis fellst hér með á umbeðna viðbót. Samþykki þetta er þó háð því skilyrði að viðbótin fái leyfi Persónuverndar og Vísindasiðanefndar. Afrit af báðum leyfum þurfa að berast Embætti landlæknis áður en aðgangur er veittur að umbeðnum gögnum.

Virðingarfyllst,

Sigríður Haraldsdóttir
sviðsstjóri
heilbrigðisupplýsingasvið

Afrit: Persónuvernd
Vísindasiðanefnd

LANDSPÍTALI
HÁSKÓLASJÚKRAHÚS

Fr. Unnur Anna Valdimarsdóttir
dósent, forstöðumaður miðstöðvar í
lýðheilsuvísindum Háskóla Íslands
Stapa v. Hringbraut
101 Reykjavík

12. ágúst 2013
Tilv. 16
ÓB/gþ

Efni: Adverse birth outcomes among victims of sexual violence

Ágæta Unnur Anna.

Vísað er til bréfs þíns til framkvæmdastjóra lækninga, dags. 10.06.2013. Í bréfi þínu er óskað heimildar fyrir aðgangi að gögnum Neyðarmóttöku og samkeyrslu kennitalna, ásamt aðgangi að mæðraskrám, með vísan til óskar þinnar um heimild til að útvíkka gagnasafn ofangreindrar rannsóknar á eftirfarandi hátt:

- Að eftirfylgd í fæðingaskrá verði lengd til 31. desember 2012 (var áður til 31. desember 2009).
- Að fæðingum, sem notaðar eru til viðmiðunar, verði fjölgað úr 5 í 10.
- Að konum, sem leituðu til Neyðarmóttökunnar á árunum 2008 – 2011 og síðar fæddu barn til 31. desember 2012, verði bætt við hóp útsettra kvenna.

Fram kemur í bréfinu að samkeyrsla verður gerð á sama hátt og áður á vegum starfsmanns í hag- og upplýsingadeild Landspítala og að rannsakendur fá, eins og áður, til vinnslu rannsóknargrunn án persónuauðkenna (kennitalna).

Hér með er veitt heimild fyrir því að gagnasafn ofangreindrar rannsóknar verði útvíkkað eins og að ofan greinir og jafnframt er veittur aðgangur að sjúkraskrám sem tengjast rannsókninni.

Leyfi þetta er háð því að fyrir liggi samþykki Vísindasiðanefndar og Persónuverndar en fram kemur að sótt hefur verið um hvort tveggja og mun aðgangur að sjúkraskrám verða opnaður þegar þær heimildir liggja fyrir.

Með kveðju og ósk um gott rannsóknargengi,

Ólafur Baldursson
framkvæmdastjóri lækninga

Afrit: Kristján Erlendsson, formaður Vísindasiðanefndar
Hörður H Helgason, s. forstjóri Persónuverndar
Ragnheiður Bjarnadóttir, sérfræðilæknir
Berglind Guðmundsdóttir, sálfræðingur

GÁTLISTI

Agnes Björg Tryggvadóttir, Berglind Guðmundsdóttir og Eyrún Jónsdóttir

Þátttakandi nr.: _____ Dagsetning brots: _____ Dagsetning komu: _____

Um komu á Neyðarmóttöku

1. Mánuður
1. Janúar
2. Febrúar
3. Mars
4. Apríl
5. Maí
6. Júní
7. Júlí
8. Ágúst
9. September
10. Október
11. Nóvember
12. Desember

2. Vikudagur
1. Mánudagur
2. Þriðjudagur
3. Miðvikudagur
4. Fimmtudagur
5. Föstudagur
6. Laugardagur
7. Sunnudagur

3.a Tímasetning árásar
1. Morgni dags (08-12)
2. Eftir hádegi (12-16)
3. Síðdegis (16-20)
4. Að kvöldlagi (20-00)
5. Snemma nætur (00-04)
6. Seinni hluta nætur/Árla morguns (04-08)
7. Að næturlagi (00-08)
8. Upplýsingar vantar

3.b Tímasetning komu á NM
1. Morgni dags (08-12)
2. Eftir hádegi (12-16)
3. Síðdegis (16-20)
4. Að kvöldlagi (20-00)
5. Snemma nætur (00-04)
6. Seinni hluta nætur/Árla morguns (04-08)
7. Upplýsingar vantar

4. Tími frá árás að komu
1. 0-6 klst
2. 6-12 klst
3. 13-24 klst
4. 25-48 klst
5. 49-72 klst
6. 3-4 sólarhringar
7. 4-5 sólarhringar
8. 5-7 sólarhringar
9. 1-2 vikur
10. 2-4 vikur
11. 4 vikur – 3 mánuðir
12. 3 – 6 mánuðir
13. 6 mánuðir – 1 ár
14. Meira en 1 ár
15. Upplýsingar vantar

5. Kom á NM...
1. Ein/n
2. Í fylgd
3. Upplýsingar vantar

a. Ef í fylgd, með hverjum? *(Merkja við allt sem við á)*
1. Móður
2. Föður
3. Vini/Vinkonu
4. Maka
5. Ættingja
6. Lögreglu
7. Sjúkrabíl
8. Öðrum

b. Hverjum: _____

Um þolanda

6. Aldur: _____

7. Kyn
1. Karl
2. Kona

8. Þjóðerni þolanda
1. Íslenskt
2. Annað:

a. Land: _____
3. Upplýsingar vantar

9. Saga um sjálfvígshugsanir
1. Já
2. Nei
3. Ekki vitað

10. Forsaga um sjálfsvígstilraun/ir
1. Já
2. Nei
3. Ekki vitað

11. Lyfjanotkun við komu
1. Já
2. Nei
3. Upplýsingar vantar

a. Ef já, hvers konar lyf?
1. Verkjalyf
2. Geðlyf
3. Annað

b. Lyf: _____
4. Upplýsingar vantar

12. Fyrri áföll
1. Já
2. Nei
3. Upplýsingar vantar

a. Ef já, hvers konar áfall?
1. Nauðgun/nauðgunartilraun
2. Kynferðisleg misnotkun
3. Líkamlegt ofbeldi
4. Heimilisofbeldi (búið við ofbeldi, vitni af)
5. Annars konar áfall (t.d. slys, dauðsfall, skilnaður)
6. Upplýsingar vantar

b. Ef 12a er 1, varð þolandi þunguð í kjölfar fyrri nauðgunar?
1. Já 2. Nei 3. Upplýsingar vantar

c. Ef já, fóstureyðing eftir fyrri nauðgun?
1. Já 2. Nei 3. Upplýsingar vantar

13. Leitað áður til NM
1. Já
2. Nei
3. Upplýsingar vantar

14. Greind fötlun hjá þolanda
1. Já
2. Nei
3. Upplýsingar vantar

a. Hver er fötlunin?
1. Þroskaskerðing
2. Líkamleg fötlun
3. Langvarandi líkamlegur sjúkdómur
4. Upplýsingar vantar

15. Starf
1. Full starf
2. Hlutastarf
3. Heimavinnandi
4. Öryrki
5. Námsmaður
6. Í námi og hlutastarfi
7. Atvinnulaus
8. Annað

a. Hvað: _____
9. Upplýsingar vantar

16. Hjúskaparstaða
1. Gift/ur
2. Einhleyp/ur
3. Í föstu sambandi
4. Í sambúð
5. Fráskilin/n
6. Ekkja/ekkill
7. Upplýsingar vantar

17. Saga um geðræn vandamál
1. Já 2. Nei 3. Upplýsingar vantar

18. Saga um áfengisvanda/-meðferð
1. Já 2. Nei 3. Upplýsingar vantar

19. Saga um vímuefnavanda/-meðferð
1. Já 2. Nei 3. Upplýsingar vantar

20. Fyrri meðferð hjá sálfræðingi eða geðlækni
1. Já 2. Nei 3. Upplýsingar vantar

21. Mansal
1. Já 2. Nei 3. Upplýsingar vantar

22. Vændi
1. Já 2. Nei 3. Upplýsingar vantar

23. Nýtur félagslegrar þjónustu
1. Já 2. Nei 3. Upplýsingar vantar

24. Þekkt neyslusaga foreldra/fjölskyldu
1. Já 2. Nei 3. Upplýsingar vantar

25. Tengsl þolanda við geranda *(Merkja tengsl við alla gerendur ef margir)*
1. Ókunnug/ur
2. Kannast við (<24 klst)
3. Kunningi
4. Vinur/vinkona
5. Faðir/móðir
6. Systkin
7. Blóðskyld/ur (aðrir en foreldrar/systkin)
8. Tengd/ur (s.s. fósturfaðir/móðir, stjúpfaðir/móðir, mágur/mágkona)
9. Kærasti/a
10. Maki (eiginmaður/kona, sambýlismaður/kona)
11. Fyrrverandi maki
12. Yfirboðari (s.s. kennari, læknir, prestur, yfirmaður)
13. Samstarfsmaður/kona
14. Skólafélagi
15. Upplýsingar vantar

Um geranda

26. Kyn	**27. Þjóðerni**	**28. Framdi gerandi sjálfsvíg?**	**29. Fjöldi gerenda**	**a. Virkir gerendur**	**b. Áhorfendur**
1. Karl	1. Íslenskt	1. Já 2. Nei	1. 1	1. 1	1. 1
2. Kona	2. Erlent		2. 2	2. 2	2. 2
3. Upplýsingar vantar	**a. Ef erlent, skrá land:** _____		3. 3-4	3. 3-4	3. 3-4
	3. Upplýsingar vantar		4. 5 eða fleiri	4. 5 eða fleiri	4. 5 eða fleiri
			5. Ekki vitað	5. Ekki vitað	5. Ekki vitað

Um árásina

30. Hvar var brotið framið?
1. Á Íslandi
2. Erlendis

a. Ef Ísland, hvar á landinu?
1. Höfuðborgarsvæðinu
2. Reykjanesinu
3. Vesturlandi
4. Vestfjörðum
5. Suðurlandi
6. Austurlandi
7. Norðurlandi
8. Upplýsingar vantar

i. Ef á Höfuðborgarsvæðinu, þá nánar hvar?
1. Miðbæ Reykjavíkur
2. Annars staðar í Reykjavík
3. Seltjarnarnesi
4. Kópavogi
5. Garðabæ
6. Hafnarfirði
7. Álftanesi
8. Mosfellsbæ
9. Kjalarnesi
10. Upplýsingar vantar

b. Ef erlendis, hver var ástæða dvalar erlendis?
1. Ferðamaður
2. Námsmaður
3. Au-pair
4. Skiptinemi
5. Atvinna
6. Annað

i. Hvað: _____

31. Vettvangur árásar
1. Heima hjá þolanda
2. Heima hjá geranda
3. Á öðru heimili
4. Á vinnustað
5. Í bíl
6. Á götu í miðbæ Reykjavíkur
7. Á víðavangi
8. Á útihátíð
9. Á skemmtistað
10. Fyrir utan skemmtistað
11. Annars staðar
a. Hvar: _____
12. Upplýsingar vantar

32. Aðdragandi árásar
1. Óvænt árás
2. Innbrot
3. Stefnumót
4. Tengdist skemmtun
5. Samskipti á undan önnur en skemmtun
6. Annað
a. Hvað:_____
7. Óvíst

Ef 5, hvernig samskipti?
32.b Í persónu
1. Já 2. Nei 3.Ekki vitað
32.c Netsamskipti (e-mail, msn)
1. Já 2. Nei 3.Ekki vitað
32.d Símasamskipti (símtöl, sms)
1. Já 2. Nei 3.Ekki vitað

33. Myndataka af þolanda
1. Já
2. Nei
3. Upplýsingar vantar

Hvers konar kynferðisofbeldi varð þolandi fyrir?

34. Kynmök um leggöng
1. Já 2. Nei 3. Upplýsingar vantar

35. Kynmök um endaþarm
1. Já 2. Nei 3. Upplýsingar vantar

36. Kynfæri þolanda sogin
1. Já 2. Nei 3. Upplýsingar vantar

37. Þolandi neydd/ur til að sjúga kynfæri geranda
1. Já 2. Nei 3. Upplýsingar vantar

38. Sáðlát
1. Já 2. Nei 3. Ekki vitað

39. Aðskotahlutur í leggöng eða endaþarm
1. Já 2. Nei 3. Upplýsingar vantar

40. Fingur settur í leggöng eða endaþarm
1. Já 2. Nei 3. Upplýsingar vantar

41. Snerting með getnaðarlim án innþrengingar
1. Já 2. Nei 3. Upplýsingar vantar

42. Káfað á kynfærum
1. Já 2. Nei 3. Upplýsingar vantar

43. Káfað á brjóstum
1. Já 2. Nei 3. Upplýsingar vantar

44. Káfað á rassi
1. Já 2. Nei 3. Upplýsingar vantar

45. Smokkur notaður
1. Já 2. Nei 3. Upplýsingar vantar

45.a Nauðgunartilraun
1. Já 2. Nei 3. Upplýsingar vantar

46. Annað
1. Já 2. Nei 3. Upplýsingar vantar
a. Ef já, hvað: _____

47. Alvarleiki kynferðisofbeldis (skv. NorVold)
1. Vægt – engin kynfærasnerting
2. Vægt – tilfinningalegt eða kynferðislegt
3. Miðlungs - kynfærasnerting
4. Alvarlegt – innþrenging
5. Upplýsingar vantar

48. Líkamlegt ofbeldi
1. Já 2. Nei 3. Upplýsingar vantar

49a. Haldið
1. Já 2. Nei 3. Upplýsingar vantar

49b. Hindruð för
1. Já 2. Nei 3. Upplýsingar vantar

50. Bundið/handjárn
1. Já 2. Nei 3. Upplýsingar vantar

51. Lokað inni
1. Já 2. Nei 3. Upplýsingar vantar

52. Föt rifin, skemmd
1. Já 2. Nei 3. Upplýsingar vantar

53. Rispað, klórað (með nöglum)
1. Já 2. Nei 3. Upplýsingar vantar

54. Slegið með flötum lófa
1. Já 2. Nei 3. Upplýsingar vantar

55. Hnefahögg
1. Já 2. Nei 3. Upplýsingar vantar

56. Hrint
1. Já 2. Nei 3. Upplýsingar vantar

57. Sparkað
1. Já 2. Nei 3. Upplýsingar vantar

58. Notar vopn/áhald
1. Já 2. Nei 3. Upplýsingar vantar
a. Ef já, hvað: _____

59. Bitið, rispað, stungið (m. áhaldi/vopni)
1. Já 2. Nei 3. Upplýsingar vantar

60. Kverkatak
1. Já 2. Nei 3. Upplýsingar vantar

61. Beinbrot
1. Já 2. Nei 3. Upplýsingar vantar

62. Bruni
1. Já 2. Nei 3. Upplýsingar vantar

63. Annað
1. Já 2. Nei 3. Upplýsingar vantar
a. Ef já, hvað: _____

64. Líkamlegir áverkar
1. Engir áverkar
2. Minniháttar áverkar (ekki þörf á frekari læknisaðstoð, t.d., mar, roði, eymsli, rispur)
3. Meðal áverkar (þörf fyrir læknisaðstoð en ekki þörf á innlögn, t.d., grunur um beinbrot, grunnir skurðir, víðtæk eymsli á kynfærum)
4. Alvarlegir áverkar (innlögn á sjúkrahús, ekki þörf á skurðaðgerð, t.d. alvarlegir áverkar á kynfærum, beinbrot, höfuðáverkar, útbreitt mar)
5. Mjög alvarlegir áverkar (þörf á skurðaðgerð)
6. Upplýsingar vantar

a. Lýsing: _____

65. Hótun
1. Já
2. Nei
3. Upplýsingar vantar

Ef já, hvernig hótun?

66. Hótun með sms
1. Já 2. Nei

67. Hótun með síma
1. Já 2. Nei

68. Hótun gegnum netið (e-mail, msn)
1. Já 2. Nei

69. Hótun í eigin persónu
1. Já 2. Nei

70. Annað
1. Já 2. Nei
a. Ef já, hvað: _____

Ef hótun í eigin persónu, hvernig?

71. Hótun með líkamlegu látbragði
1. Já 2. Nei

72. Hótun með vopnum
1. Já 2. Nei

73. Hótun með orðum
1. Já 2. Nei

74. Annað
1. Já 2. Nei
a. Ef já, hvað: _____

75. Áfengisneysla þolanda
1. Já
2. Nei
3. Upplýsingar vantar

a. Ef já, hvert var vitundarástand þolanda?
1. Áfengisdá
2. Of drukkin/n til að vita hvað var að gerast
3. Of drukkin/n til að stjórna eigin hegðun
4. Undir áhrifum en með fulla vitund
5. Ekkert af ofangreindu
6. Upplýsingar vantar

76. Ef misneyting vegna áfengisneyslu, eðli neyslu?
1. Sjálfviljug áfengisneysla
2. Þvinguð áfengisneysla
3. Áfengi haldið að viðkomandi
4. Upplýsingar vantar

77. Misneyting vegna fötlunar
1. Misneyting v/líkamlegs sjúkdóms
2. Misneyting v/andlegs sjúkdóms
3. Á ekki við
4. Upplýsingar vantar

78. Vímuefnaneysla þolanda
1. Já
2. Nei
3. Upplýsingar vantar

a. Ef já, vitundarástand þolanda
1. Vímuefnadá
2. Of mikil víma til að vita hvað hún/hann væri að gera
3. Of mikil víma til að stjórna eigin hegðun
4. Undir áhrifum en með fulla vitund
5. Ekkert af ofangreindu
6. Upplýsingar vantar

79. Ef misneyting vegna vímuefnaneyslu, hvers eðlis var neyslan?
1. Sjálfviljug vímuefnaneysla
2. Þvinguð vímuefnaneysla
3. Vímuefnum haldið að viðkomandi
4. Upplýsingar vantar

80. Grunur um lyfjabyrlun
1. Já 2. Nei

81. Þungun í kjölfar nauðgunar
1. Já 2. Nei 3. Upplýsingar vantar

a. Ef já, fóstureyðing í kjölfar nauðgunar
1. Já 2. Nei 3. Upplýsingar vantar

Andleg og líkamleg viðbrögð þolanda

Viðbrögð þolanda við árás	*Tilfinningalegt ástand við komu á NM*	*Líkamleg kreppuviðbrögð þolanda*
82. Frjósa 1. Já 2. Nei 3. Upplýsingar vantar	**92. Í losti** 1. Já 2. Nei	**107. Skjálfti** 1. Já 2. Nei
83. Berjast líkamlega á móti 1. Já 2. Nei 3. Upplýsingar vantar	**93. Fjarræn/n** 1. Já 2. Nei	**108. Hrollur** 1. Já 2. Nei
	94. Óraunveruleikatengd/ur 1. Já 2. Nei	**109. Vöðvaspenna/stíf/ur** 1. Já 2. Nei
84. Berjast á móti með orðum (reyna að tala til) 1. Já 2. Nei 3. Upplýsingar vantar	**95. Tilfinningalegt jafnvægi** 1. Já 2. Nei	**110. Kaldur sviti** 1. Já 2. Nei
	96. Yfirveguð/aður 1. Já 2. Nei	**111. Föl/ur** 1. Já 2. Nei
85. Annað 1. Já 2. Nei 3. Upplýsingar vantar **a. Ef já, hvað:** _____	**97. Eirðarlaus/óróleg/ur** 1. Já 2. Nei	**112. Stækkuð sjáöldur** 1. Já 2. Nei
	98.a Grætur 1. Já 2. Nei **98.b Tárast** 1. Já 2. Nei	**113. Öndunarerfiðleikar (köfnunartilfinning)** 1. Já 2. Nei
Vitundarástand við komu á NM	**99. Óttaslegin/n eða kvíðin/n** 1. Já 2. Nei	**114. Of hröð öndun** 1. Já 2. Nei
86. Vímuáhrif 1. Já 2. Nei 3. Upplýsingar vantar	**100. Endurlifun árásar** 1. Já 2. Nei	**115. Hraður hjartsláttur** 1. Já 2. Nei
87. Man lítið/ekkert 1. Já 2. Nei 3. Upplýsingar vantar	**101. Hvumpin/n** 1. Já 2. Nei	**116. Svimi** 1. Já 2. Nei
87.a Tjáir sig um smáatriði árásar 1. Já 2. Nei 3. Upplýsingar vantar	**102. Árásargjörn/gjarn** 1. Já 2. Nei	**117. Ógleði/uppköst** 1. Já 2. Nei
88. Skýr frásögn 1. Já 2. Nei 3. Upplýsingar vantar	**103. Í hnipri** 1. Já 2. Nei	**118. Magaverkir** 1. Já 2. Nei
89. Samhengislaus frásögn 1. Já 2. Nei 3. Upplýsingar vantar	**104. Þolir ekki snertingu** 1. Já 2. Nei	**119. Tíð þvaglát** 1. Já 2. Nei
90. Í sjálfsvígshugleiðingum 1. Já 2. Nei 3. Upplýsingar vantar	**105. Þreytt/ur eða uppgefin/n** 1. Já 2. Nei	**120. Niðurgangur** 1. Já 2. Nei
91. Annað 1. Já 2. Nei 3. Upplýsingar vantar **a. Ef já, hvað:** _____	**106. Annað** 1. Já 2. Nei **a. Ef já, hvað:** _____	**121. Annað** 1. Já 2. Nei **a. Ef já, hvað:** _____

Þjónusta á Neyðarmóttöku

Þjónustunýting á NM	*Til hvaða aðila kom viðkomandi?*	*Kærur/Málsmeðferð*
122. Læknisskoðun/meðferð 1. Já 2. Nei 3. Upplýsingar vantar	**134. Hjúkrunarfræðings** 1. Já 2. Nei 3. Upplýsingar vantar	**145. Kærði þolandi?** 1. Já 2. Nei 3. Upplýsingar vantar
123. Réttarlæknisskoðun 1. Já 2. Nei 3. Upplýsingar vantar	**135. Læknis** 1. Já 2. Nei 3. Upplýsingar vantar	
124. Áverkaskýrsla/komuskýrsla á slysa- og bráðamóttöku 1. Já 2. Nei 3. Upplýsingar vantar	**136. Ráðgjafa (sálfræðingur/ félagsráðgjafi/ hjúkrunarfræðingur)** 1. Já 2. Nei 3. Upplýsingar vantar	**146. Ef já, hver var meðferð málsins hjá lögreglu?** 1. Kæra afturkölluð 2. Mál fellt niður hjá lögreglu 3. Mál sent frá lögreglu 4. Mál enn í vinnslu 5. Upplýsingar vantar
125. Innlögn á gæsludeild/sjúkradeild 1. Já 2. Nei 3. Upplýsingar vantar	**137. Sálfræðileg meðferð** 1. Já 2. Nei 3. Upplýsingar vantar	
	Ef já, hjá hverjum?	
126. Samtal við hjúkrunarfræðing 1. Já 2. Nei 3. Upplýsingar vantar	**138. Innan NM-teymis** 1. Já 2. Nei **a. Ef já, fjöldi viðtala**: _____	**147. Ef mál sent frá lögreglu, ákærði saksóknari?** 1. Já 2. Nei – mál fellt niður 3. Mál enn í vinnslu 4. Upplýsingar vantar
127. Vísað til ráðgjafa (sálfræðingur/ félagsráðgjafi/ hjúkrunarfræðingur) 1. Já 2. Nei 3. Upplýsingar vantar	**139. Utan NM-teymis** 1. Já 2. Nei	
128. Samtal við réttargæslumann (lögfræðing) 1. Já 2. Nei 3. Upplýsingar vantar	**140. Þolanda vísað til annarra fagaðila:** 1. Já 2. Nei 3. Upplýsingar vantar	**148. Hver var dómur Héraðsdóms?** 1. Sakfelling 2. Sýkna 3. Dómur ekki fallinn 4. Upplýsingar vantar
Endurkomur	**140.a Ef já, hvert?** 1. Geðdeild LSH **i. Ef já, bráðainnlögn?** 1. Já 2. Nei 3.Ekki vitað 2. Stígamót 3. Kvennaathvarf 4. SÁÁ/Teigur LSH/Stuðlar 5. Barnahús 6. Annar aðili **a. Ef já, hvaða: _____** 7. Upplýsingar vantar	**149. Hver var dómur Hæstaréttar?** 1. Sakfelling 2. Sýkna 3. Dómur ekki fallinn 4. Upplýsingar vantar
129. Kom í fyrstu endurkomu (1 mán.) 1. Já 2. Nei 3. Upplýsingar vantar		
130. Kom í aðra endurkomu (3 mán) 1. Já 2. Nei 3. Upplýsingar vantar		**150. Fékk þolandi miskabætur?** 1. Já 2. Nei 3. Mál enn í vinnslu 4. Upplýsingar vantar
131. Kom í þriðju endurkomu (6 mán) 1. Já 2. Nei 3. Upplýsingar vantar		
132. Kom oftar 1. Já 2. Nei 3. Upplýsingar vantar **a. Ef já, fjöldi endurkoma: _____**		
133. Haft samband símleiðis 1. Já 2. Nei 3. Upplýsingar vantar	**141. Mál tilkynnt Barnaverndarnefnd?** 1. Já 2. Nei 3. Á ekki við 4. Upplýsingar vantar	***151. Aukalega um kærur:*** a. Sakargögn sótt dags: _____ b. Sakargögnum hent dags: _____ c. Mál sent frá RLR dags: _____ d. Læknir kom fyrir rétt dags: _____ e. Hjúkrunarfræðingur kom fyrir rétt dags: _____ f. Ráðgjafi kom fyrir rétt dags: _____
	142. Sjálfsvígshugsanir eftir atburð 1. Já 2. Nei 3. Ekki vitað	
	143. Sjálfsskaði eftir atburð 1. Já 2. Nei 3. Ekki vitað	
	144. Sjálfsvígstilraun/ir eftir atburð 1. Já 2. Nei 3. Ekki vitað	