Tampere University

PIRJO KETTUNEN

# Postpartum Depression

*Time of onset, severity, symptoms, risk factors and treatment*

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## *Time of onset, severity, symptoms, risk factors and treatment*

ACADEMIC DISSERTATION
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ACADEMIC DISSERTATION
Tampere University, Faculty of Medicine and Health Technology
North Karelia Central Hospital, Department of General Hospital Psychiatry
Finland

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To all mothers

# Abstract

Depression after childbirth is common, the global prevalence being 10–15%. It is important to be aware of this depression because without care it may cause considerable problems for the mother herself, the infant and the whole family.

The postpartum period differs in many respects from other life situations. The bond between mother and infant is strong. Mother's own attachment style, which is based on early interactions, is easily activated. Recovery from pregnancy and delivery causes many physiological changes. Moreover, pregnancy and childbirth with potential complications, child care and current life events are sources of various types of stress. Mothers' psychosocial resources vary. The socioeconomic situation is often precarious and support networks including the treatment system likewise vary.

The aim of the present study was to assess time of onset, severity, symptoms, risk factors and treatment of postpartum depression (PPD), specifically in relation to the course of depression. The study design was cross-sectional case-control study. The study group consisted of 104 mothers with major depressive disorder and a control group of 104 non-depressed mothers. Structured Clinical Interview for the DSM-IV Axis I Disorders (SCID-I) was used to diagnose depression and a self-report questionnaire, partly structured and partly not structured, was used for data collection. The severity of depression and other mental symptoms was assessed using several validated rating scales.

Nearly half of mothers (46%) were depressed within ten days, and 84% of mothers within six weeks after the delivery. Eighty-two per cent (82%) of depressed mothers suffered from recurrent depression. Recurrent depression was more symptomatic and serious than new onset depression, and mothers were more hopeless. In recurrent depression increased or decreased appetite, sleep disturbance and suicidal ideation were more common, and somatization, interpersonal sensitivity, hostility and psychoticism were higher than in new onset depression. Depressed mood, diminished pleasure/interest, psychomotor agitation/retardation, decreased energy, feelings of worthlessness and poor ability to concentrate were equally common, and obsessive-compulsive symptoms, anxiety, phobic anxiety and

paranoid ideation equally severe in new onset and recurrent depression. In general, all these symptoms were more usual among depressed than among non-depressed mothers.

Compared to non-depressed mothers, depressed mothers had more stress factors and psychosocial difficulties. Their pregnancy was more often unwanted, they were more often suffering from hyperemesis, and they had had more depression, fears and other mental symptoms during pregnancy. Their delivery had been more complicated and pain during delivery had been more significant. These mothers' infants had more commonly symptoms and illnesses, especially infantile colic, and they were less likely to be breastfed. The mothers had also experienced more negative life events during the preceding 12 months, especially problematic human relationships. Depressed mothers had suffered more harsh corporal punishment and sexual abuse in childhood and relationships with their own parents and between their parents had been poor. Similarly, among depressed mothers low level of support from spouse and significant others and physical family violence were more common, likewise poor basic and professional education, poor economic and housing situation.

According to the age-adjusted multivariate logistic regression model mental and physical difficulties during pregnancy and delivery, poor present support in close relationships and low socioeconomic status (SES) were associated with PPD. Specifically, difficulties during pregnancy and delivery and adverce experiences in childhood were associated with new onset and recurrent depression. For recurrent depression, poor present support and low SES were also risk factors. In contrast, negative life events during the previous 12 months and infant's difficulties and breastfeeding cessation were not associated with PPD.

Depressed mothers reported more often than non-depressed mother that the support and empathy from professional maternity caregivers (antenatal clinic and maternity hospital) were poor. Only a quarter of depressed mothers made use of psychiatric and a quarter of social services. The respective proportions were only 5% and 10% among mothers with new onset depression.

In conclusion, PPD is usually recurrent depression, which is more symptomatic and serious than new onset depression. Adverse childhood experiences and problems with pregnancy and delivery are emerged as risk factors for new onset depression. In addition to these, recurrent depression is associated with more psychosocial risk factors. Support from maternity care services is insufficient to prevent depression. It is important to be aware of symptoms, course and risk factors in order to detect, prevent and care depression. In addition to needing supportive care, depressed mothers should be offered both psychiatric and social services.

# Tiivistelmä

Masennus synnytyksen jälkeen on yleistä. Sen globaali esiintyvyys on 10–15 %. Masennuksen tunnistaminen on tärkeää, koska masennuksella on hoitamattomana laajoja haitallisia vaikutuksia – äidin lisäksi lapseen ja koko perheeseen.

Synnytyksen jälkeinen ajanjakso eroaa monessa suhteessa muista elämänvaiheista. Sidos äidin ja imeväisen välillä on vahva, ja äidin oma, varhaiseen vuorovaikutukseen perustuva kiintymyssuhde aktivoituu herkästi. Palautuminen raskaudesta ja synnytyksestä aiheuttaa paljon fysiologisia muutoksia. Lisäksi raskaus ja synnytys mahdollisine komplikaatioineen, lapsen hoitaminen ja muut ajankohtaiset elämäntapahtumat saattavat aiheuttaa stressiä. Äitien psykososiaaliset voimavarat ovat erilaisia ja sosioekonominen tilanne on usein vakiintumaton. Läheisten ja hoitavien tahojen antama tuki on vaihtelevaa.

Tämän tutkimuksen tarkoituksena oli arvioida synnytyksen jälkeisen masennuksen alkamisajankohtaa, vakavuutta, oireita, riskitekijöitä ja hoitoa sekä selvittää, onko masennuksen kulussa eroavaisuuksia. Tutkimus tehtiin tapaus-verrokkitutkimuksena poikkileikkausasetelmassa. Tutkittava ryhmä koostui 104 vakavaa masennusta sairastavasta äidistä ja vertailuryhmä 104 äidistä, joilla ei ollut masennusta. Masennuksen diagnosoinnissa käytettiin SCID-I-haastattelua (Structured Clinical Interview for the DSM-IV Axis I Disorders). Aineiston kokoamisessa käytettiin puolistrukturoitua ja osittain strukturoitua haastattelulomaketta. Masennuksen vakavuuden ja muiden psyykkisten oireiden arvioinnissa käytettiin useita validoituja arviointiasteikkoja.

Lähes puolet (46 %) äideistä masentui kymmenen päivän ja 84 % kuuden viikon sisällä synnytyksestä. Toistuvasta masennuksesta kärsi 82 % äideistä. Se oli monioireisempi ja vakavampi kuin elämän ensimmäinen masennus, ja äidit olivat usein toivottomampia. Toistuvassa masennuksessa ruokahalun muutokset, unihäiriöt ja itsetuhoinen ajattelu olivat yleisempiä ja somatisaatio, ihmisten välisiin suhteisiin liittyvä herkkyys, vihamielisyys ja psykoottisuus voimakkaampia kuin ensimmäisessä masennuksessa. Masentunut mieliala, vähentynyt mielihyvä ja mielenkiinto, psykomotorinen kiihtyneisyys tai hidastuneisuus, vähentyneet voimavarat, arvottomuuden tunteet ja huono keskittymiskyky olivat yhtä ylei-

siä – samoin pakkoajatukset ja -toiminnot, ahdistus, pelokkuus ja vainoharhaisuus olivat yhtä voimakkaita. Kaikki nämä oireet olivat tavallisempia masentuneilla kuin niillä, joilla ei ollut masennusta.

Masentuneilla äideillä oli enemmän stressitekijöitä ja psykososiaalisia vaikeuksia kuin ei-masentuneilla. Heidän raskautensa oli useammin ei-toivottu, he kärsivät useammin raskauspahoinvoinnista ja heillä oli enemmän masennusta, pelkoja ja muita psyykkisiä oireita raskausaikana. Heidän synnytyksissään oli enemmän komplikaatioita, erityisesti kipua. Masentuneiden äitien lapsilla oli useammin oireita ja sairauksia, etenkin koliikkia. Masentuneet äidit eivät imettäneet yhtä usein kuin ei-masentuneet. Masentuneilla äideillä oli myös enemmän kielteisiä elämäntapahtumia kuluneen vuoden aikana, erityisesti vaikeuksia ihmissuhteissa. He olivat kärsineet enemmän ruumiillisesta rankaisusta ja seksuaalisesta hyväksikäytöstä lapsena, samoin huonoista suhteista vanhempiin ja vanhempien välillä. Lisäksi he saivat heikosti tukea puolisolta ja muilta läheisiltä, ja he kärsivät useammin fyysisestä perheväkivallasta. Masentuneilla äideillä oli myös heikompi perus- ja ammatillinen koulutus sekä huonompi taloudellinen ja asumistilanne kuin ei-masentuneilla.

Ikävakioidun, monimuuttujaisen logistisen regressiomallin mukaan psyykkiset ja fyysiset ongelmat raskauden ja synnytyksen aikana, läheisten antama heikko tuki ja huono sosioekonominen tilanne liittyivät synnytyksen jälkeiseen masennukseen. Raskauden ja synnytyksen aikaiset ongelmat sekä ikävät lapsuuden kokemukset liittyivät sekä ensimmäiseen että toistuvan masennukseen. Lisäksi läheisten antaman heikko tuki ja huono sosioekonominen tilanne liittyivät toistuvaan masennukseen. Sitä vastoin kielteiset elämäntapahtumat kuluneen vuoden aikana sekä lapsen vaikeudet ja imetyksen puuttuminen eivät olleet yhteydessä synnytyksen jälkeiseen masennukseen.

Masentuneet äidit kokivat äitiyshuollon (äitiysneuvola ja synnytyssairaala) antaman tuen heikkona useammin kuin ei-masentuneet. Neljännes masentuneista äideistä käytti psykiatrian ja neljännes sosiaalitoimen palveluita. Vastaavat luvut olivat vain 5 % ja 10 % ensikertaa masentuneilla.

Johtopäätöksenä todetaan, että synnytyksen jälkeinen masennus on usein toistuva masennus, ja se on monioireisempi ja vakavampi kuin ensimmäinen masennus. Ikävät lapsuuden kokemukset sekä raskauteen ja synnytykseen liittyvät ongelmat korostuvat elämän ensimmäisen masennuksen riskitekijöinä. Toistuvaan masennukseen liittyy näiden lisäksi enemmän psykososiaalisia riskitekijöitä. Äitiyshuollon tuki ei riitä ehkäisemään masennusta. Oireiden, taudinkulun ja riskitekijöiden tunteminen on keskeistä sekä masennuksen tunnistamisen, ehkäisyn että hoidon näkökulmasta. Masentuneet äidit tarvitsevat tukevan hoito-otteen sekä psykiatrian ja sosiaalitoimen palveluita.

# Contents

# List of Original Publications

I Kettunen P, Koistinen E, Hintikka J. 2014. Is postpartum depression a homogenous disorder: time of onset, severity, symptoms and hopelessness in relation to the course of depression. BMC Pregnancy Childbirth 14:402.

II Kettunen P, Koistinen E, Hintikka J. 2016. The connections of pregnancy-, delivery-, and infant-related risk factors and negative life events on postpartum depression and their role in first and recurrent depression. Depress Res Treat ID 2514317:1-7.

III Kettunen P, Hintikka J. 2017. Psychosocial risk factors and treatment of new onset and recurrent depression during the postpartum period. Nord J Psychiatry 71(5):355-361.

# Abbreviations

| | |
|---|---|
| 5-HTT | 5-hydroxytryptamine transporter |
| 5-HTTLPR | 5-HTT-linked polymorphic region |
| APA | American Psychiatric Association |
| ACTH | Adrenocorticotropic hormone |
| BDI | Beck Depression Inventory |
| BHS-20 | 20-item Beck Hopelessness Scale |
| CBG | Corticosterone binding globulin |
| CHR | Corticotrophin releasing hormone |
| CI | Confidence interval |
| COMT | Catechol-O-methyl transferase |
| CRP | C-reactive protein |
| DDP | Depression during pregnancy |
| DNA | Deoxyribonucleic acid |
| DSM-IV-TR | Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision |
| DSM-V | Diagnostic and Statistical Manual of Mental Disorders, fifth edition |
| ECT | Electroconvulsive therapy |
| EPDS | Edinburgh Postnatal Depression Scale |
| HPA | Hypothalamus–pituitary–adrenal |
| HPG | Hypothalamus–pituitary–gonadal |

| | |
|---|---|
| ICD-10 | International Statistical Classification of Diseases and Related Health Problems, tenth revision |
| IL | Interleukin |
| IPV | Intimate partner violence |
| MAO-A | Monoamine oxidase-A |
| MDE | Major Depressive Episode |
| MDD | Major Depressive Disorder |
| OR | Odds ratio |
| PPD | Postpartum depression |
| SCID-I | Structured Clinical Interview for the DSM-IV Axis I Disorders |
| SCL-90 | 90-item Symptom Check List |
| SD | Standard deviation |
| SES | Socioeconomic status |
| SPSS | Statistical Package for the Social Sciences |
| $T_3$ | Triiodothyronine |
| $T_4$ | Thyroxin |
| TNF | Tumour necrosis factor |
| TPH | Tryptophan hydroxylase |
| TSH | Thyrotropin |
| WHO | World Health Organization |

# 1 Introduction

PPD is a common illness, the global prevalence being 10–15%. The prevention, detection and treatment of postpartum depression (PPD) are of great importance because PPD without care may cause many problems. Consequences reported in numerous studies include being distorted emotional and social interaction between infant and mother, insecure attachment and negative consequences to the emotional, cognitive, social and physical development of the child, reportedly persisting up to adolescence. Furthermore, distorted interactions may be detrimental to the whole family.

PPD seems to arise in the same psychosocial contexts as do depressions that develop at other times in a woman's life, but psychosocial stressors and interpersonal events are triggered by specific neurophysiological changes. The postpartum period differs in many respects from other life situations. Recovery from pregnancy and delivery causes a wide range physiological changes. In addition, pregnancy and childbirth with potential complications, child care and current life events may cause various stresses. The early life events may be activated, causing a mental response. Mothers' psychosocial resources are different. The socioeconomic situation is often unstable and support networks, including the treatment system may vary.

It is interesting to ascertain whether PPD is an illness in its own right or an episode of depression triggered by the numerous physical, mental and social changes when having a baby. There may be subgroups of PPD. PPD may be recurrent or surprising new onset depression, the first experience of depression a mother's whole life.

It is generally supposed that childbirth means joy and hope. Recognizing depression is not always easy for the mother herself or the caring professionals. It is important to know more about the time of onset and the course of the depression. Recognizing symptoms and knowing about risk factors are also critical in the detection of PPD. Moreover, awareness of these helps in prevention and treatment.

Planning corrective interventions entails knowledge of mothers' experiences of maternity care support. It is likewise essential to know about the use made of psychiatric and social services.

However, only few studies on PPD have been presented in Finland and further studies are needed in order to evaluate the present situation. Furthermore, political decision-makers should be aware of these issues when planning programmes to help families.

# 2 Review of the Literature

## 2.1 Depression during the postpartum period

### 2.1.1 Definition and diagnosis

In research and clinical practice is no consensus about what the term PPD means. The definition of PPD based on classifications of diseases or several rating scales.

The diagnostic criteria for a Major Depressive Episode (MDE) as defined by the Diagnostic and Statistical Manual of Mental Disorders (4th edition, text revision) (DSM-IV-TR) are similar after childbirth and at other times, and include five (or more) of the following symptoms: at least two weeks of persistent depressed mood and/or loss of interest/pleasure, increased or decreased appetite, sleep disturbance, psychomotor agitation or retardation, decreased energy, feelings of worthlessness or guilt, low concentration and suicidal ideation (American Psychiatric Association (APA) 2000). At least one of these must be either depressed mood or loss of interest/pleasure. Each of the symptoms required must express a change in relation to previous activity. The DSM-IV-TR uses the term "postpartum onset" as a specifier applicable to major depressive disorder (MDD), bipolar disorder or brief psychotic disorder occurring during the first four weeks after childbirth (APA 2000).

The Diagnostic and Statistical Manual of Mental Disorders (5th edition) (DSM-V) uses "peripartum onset" as the specifier for MDD occurring during pregnancy or within the first four weeks postpartum (APA 2013). It recognizes that the beginning of PPD may also be during pregnancy.

According to the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) (World Health Organization (WHO) 2016) the criteria for postpartum depressive episodes are comparable to those in the DSM-IV-TR and

DSM-V, but it recognizes symptom onset within the first six weeks postpartum, during the puerperium period.

Clinical interview is the gold standard for diagnosing PPD. The Structured Clinical Interview for the DSM-IV Axis I Disorders (SCID-I) (First et al. 2002) is well known and widely utilized. However, several studies have used self-report measures. The Edinburgh Postnatal Depression Scale (EPDS) is usually used in research and screening because it is well validated, its sensitivity and specificity are good enough at different cut-off values for different purposes (Cox et al. 1987, Murray & Carothers 1990). The original publication on the EPDS reported a sensitivity of 86% and a specificity of 78% for a threshold score of 12/13 (Cox et al. 1987). Their data suggest that failure to detected cases can be reduced to under 10% with a cut-off score of 9/10, and a threshold of 9/10 may be appropriate for routine use by primary care workers (Cox et al. 1987). The second most commonly used instrument for definition of PPD is the self-report Beck Depression Inventory (BDI) (Beck et al. 1961). The specificity of the BDI is questionable because some symptoms, especially somatic symptoms (appetite, sleep, fatigue), reflect normal postpartum adjustment and may inflate scores (Affonso et al. 2000, Campbell & Cohn 1991, Halbreich & Karkun 2006). In any case the moderate concordance between the EPDS and BDI suggests that the measures have complementary uses for screening and assessment (Affonso et al. 2000).

The length of the postpartum period is also considered to vary across studies, from the first few hours after delivery up to one year (Halbreich 2005, Stuart-Parrigon & Stuart 2014). Halbreich (2005) suggests that postpartum phenomena, symptoms and complaints are associated with biological and psychosocial processes and may thus be considered to be postpartum only as long as they persist. The exact individualized time period differs across individuals (Halbreich 2005).

### 2.1.2 Prevalence and incidence

Depression after childbirth is common; most publications estimate that PPD affects 10–15% of women (Halbreich 2005) or even 13–19% (O'Hara & McCabe 2013). Prevalence and incidence have been much studied, the most comprehensive contributions being those by O'Hara and Swain (1996), Gavin et al. (2005), Halbreich and Karkun (2006), Norhayati et al. (2015) and Shorey et al. (2018) (Table 1).

Table 1. Summary of meta-analyses and reviews of prevalence and incidence studies on postpartum depression

| Author (year) | Number of studies (year) | Diagnosis | Assessment time from childbirth | Prevalence/incidence |
|---|---|---|---|---|
| O'Hara & Swain (1996) | Meta-analysis of 59 studies | Clinical interview, self-reported questionnaire | After at least 2 weeks | Prevalence, average: 13%<br>Prevalence, self-report assessment: 14%<br>Prevalence, Interview assessment: 12% |
| Gavin et al. (2005) | Systematic review of 28 studies, developed countries (1980–2004) | Structured clinical interviews | Up to one year | Period prevalence during the first 3 months after delivery is for major/minor depression 19.2%, for major depression 7.1%. Point prevalence for major/minor depression is highest at 3th month 12.9%, 4th–7th month 9.9–10.6%, 8th–12th month 6.5%. Point prevalence for major depression is at 2 months 5.7%, at 3 months 4.7% and 6 months 5.6%.<br>Incidence during the first 3 months for major/minor depression is 14.5% and major depression 6.5%. |
| Halbreich & Karkun (2006) | Literature review of 143 studies, developed and developing countries (1980–2005) | Structured clinical interviews, rating scales | Up to one year | Global prevalence:<br>Estimated by the EPDS: 0.5–60.8%<br>Estimated by structured clinical interview: 0–34% |
| Norhayati et al. (2015) | Literature review of 203 studies, developed and developing countries (2005–2014) | Structured clinical interview, self-reported questionnaire | Up to one year | Prevalence:<br>Self-reported questionnaire: developed countries: 5.2–74.0%, developing countries 1.9–82.1%<br>Structured clinical interview: 0.1–26.3%<br>Timing and self-report questionnaire (EPDS):<br>(developed/developing):<br>< 4 weeks: 5.5–34.4%/12.9–50.7%<br>4–8 weeks: 2.6–35.0%/4.9–50.8%<br>6 months: 0.9–25.5%/8.2–38.2%<br>One year :6.0–29.0%/21.0–33.2% |
| Shorey et al. (2018) | Systematic review and meta-analysis of 58 studies, healthy mothers without prior history of depression (1988–2016) | Structured clinical interview, self-reported questionnaire | Up to four year | Prevalence: Overall: 17%<br>Self-reported questionnaire: 18%<br>Structured clinical interviews: 17%<br>Assessment time period after childbirth:<br>0–3 months: 14%, 4–6 months: 16%, 7–12 months: 20%, >12 months: 25%.<br>Asia 16%, Africa 11%, Australia 19%, Europe 8%, Middle East 26%, South America 19%, North America 16%.<br>Incidence: 12 % |

These researchers identified some subgroups for PPD. Gavin et al. (2005) found no differences between developed countries, but suggest that prevalence of major depression is similar among women with different socioeconomic status (SES) and minor depression is

more prevalent among those mothers with lower SES. According to Halbreich and Karkun (2006), depressive symptoms were very prevalent in both certain developed and developing countries (Brazil, Guyana, Costa Rica, Italy, Chile, South Africa, Taiwan and Korea). Norhayati et al. (2015) found that subgroups known to experience PPD are immigrants in Western and non-Western countries and women with low SES. Shorey et al. (2018) studied mothers without prior history of depression and documented the highest prevalence, 26%, in the Middle-East and the lowest, 8%, in Europe. They concluded that differences in cultural practices may contribute to this difference.

The reviewers have presented some critical comments on the methodology of these studies. O'Hara and Swain (1996) note that there is variation depending on the methods of assessment (larger estimates in studies using self-report measures) and the length of the postpartum period under evaluation (longer periods predict high prevalence). Gavin et al. (2005) point out that there were the wide confidence intervals (CI) in their estimates and that the results should be interpreted with caution. Furthermore, most (but not all) episodes began after delivery. According to Halbreich and Karkun (2006) global prevalence is difficult to ascertain because of cross-cultural and social diversity, the variability of the underlying processes and the manifestations of symptoms. Furthermore, Halbreich (2005) found that studies varied in their use of clinical concepts, sampling and assessment methods, as well as in the definitions and time periods. Many studies comprised relatively small samples, did not include a control group, were based on self-reports of symptoms – mostly with a short dimensional screening instrument (e.g. EPDS) and were not based on structured clinical interviews for diagnoses (Halbreich 2005). Norhayati et al. (2015) for their part reviewed studies comprehensively, irrespective of the methodological quality. Prevalence estimates have been found to be greater in studies using self-reports than in studies based on structured interviews (O'Hara & Swain 1996, Halbreich & Karkun 2006, Norhayati et al. 2015).

Prevalence and incidence vary depending on the time or the period under evaluation. According to the review by Gavin et al. (2005) the point prevalence of major and minor depression in the first trimester of pregnancy is 11.0% but drops to 8.5% in the second and third trimesters. After delivery the prevalence of major and minor depression begins to rise and peaks (12.9%) in the third month, then declines slightly to 6.5% at end of the first year (Gavin et al. 2005). Furthermore, Norhayati et al. (2015) found in their review that the prevalence of PPD was at its highest eight weeks after childbirth and thereafter decreased. Indeed, depressive symptoms are not common immediately after delivery, possibly because not all the physiological changes have yet occurred, or childcare stress is yet to come. For example, according to the study by Pawar et al. (2011) only 2.5% of women acknowledged symptoms of major depression within the first two days after delivery. The review of studies on incidence by Gavin et al. (2005) showed that 14.5% of pregnant women have a new episode of major/minor depression, and 14.5% have a new episode during the first three months postpartum. Specifically, according to Kumar and Robson (1984), the incidence of

depressive neurosis rose significantly in early pregnancy and in the first three months after delivery (10% vs. 14%), and incidence fell at six months and at one year. Furthermore, Cox et al. (1993) found that the highest, threefold incidence of depression was within five weeks of childbirth. At six months no differences in point prevalence nor in the six-month period prevalence were found between postpartum women and those in general population.

In 2002–2010 among the total Finnish population of women delivering singleton births, 0.3% experienced major physician-diagnosed depression measured by ICD-10 codes during any medical visit in the six weeks following delivery (Räisänen et al. 2013). This data was gathered from national health registers. The prevalence was 0.1% in women without and 5.3% in women with a history of depression (Räisänen et al. 2013).

### 2.1.3 Course and severity

The question arises in studies on PPD as to whether PPD is a distinct disorder in its own right linked to childbirth or an episode of MDD that manifests in the postpartum period. However, there is no exact answer to this question (O'Hara & McCabe 2013, Vliegen et al. 2014). There is some evidence for PPD being a specific entity. For example, Cooper and Murray (1995) compared first-time mothers whose PPD was a recurrence of a prior non-PPD with a group of mothers for whom PPD was their first experience of depression. The former group had a greater risk for subsequent non-PPD, whereas the latter group had a greater risk for subsequent PPD. However, numerous studies show that the PPD risk is high if mother has had previous depression during the postpartum period or even at other times (Cooper & Murray 1995, O'Hara & Swain 1996, Beck 2001, Robertson et al. 2004, Viguera et al. 2011, Norhayati et al. 2015). Specifically, Viguera et al. (2011) in their large study in the USA found that among women with unipolar depression, 4.6% had illness episodes during pregnancy and 30% during the postpartum period. A history of depression is probably associated with longer persistence of depressive symptoms (Howell et al. 2009).

The time of onset of depression varies across studies. In a large US study on postpartum mothers with depressive symptoms, 40% of mothers reported the episode onset postpartum, 33.4% reported antenatal onset and 26.5% reported onset before pregnancy (Wisner et al. 2013). Yonkers et al. (2001) likewise found that 50% of postpartum depressed mothers reported depression onset following delivery, 25% during pregnancy and 25% before pregnancy. Stowe et al. (2005) studied mothers during the peripartum period and reported that 88.5% of mothers were depressed following delivery and 11.5% during pregnancy.

Many researchers have shown that increased susceptibility to depression and other psychiatric illnesses may persist for several years. For example, according to the review by Vliegen et al. (2014) of longitudinal studies of community samples at any time point (3–4 months, 6 months, 9 months 12 months, 18 months, 2 years, 3–3.5 years) about 30% of mothers diagnosed with PPD still met the criteria for depression. In clinical samples this proportion was higher, about 50% remain depressed throughout and beyond the first

postpartum year. For a subgroup of women PPD is probably an extension of a previous episode of depression (Vliegen 2014). Later, in a Swedish longitudinal cohort study (Josefsson & Sydsjö 2007) women with postpartum depressive symptoms were found to be six times more likely to experience depressive symptoms after four years than were women who did not suffer from depressive symptoms after childbirth. Horowitz and Goodman (2004) found that among mothers who had elevated depression scores at two to four weeks after delivery 31% had depression two years after delivery.

Increased severity of depressive symptoms seems to be associated with a history of depression (Horovitz & Goodman 2004). Additionally, an international perinatal psychiatry consortium from seven developed countries (Putnam et al. 2015) showed that the most severe symptoms of PPD were significantly associated with onset of symptoms during pregnancy. Moreover, analysis found increased rates of a history of anxiety and mood disorders among these women. Later Putnam et al. (2017) showed that women with onset of moderate to severe symptoms in their first trimester of pregnancy remained highly symptomatic in the postpartum period. Furthermore, women who reported onset of symptoms during the first trimester and who continued to be symptomatic, might be more chronically depressed and may have had depressive symptoms before pregnancy. Also, onset of symptoms of depression in the postpartum period, especially within eight weeks of delivery, was associated with severe depression (Putnam et al. 2017). They claim that this is in line with fact that enormous hormonal fluctuations occur in the transition from pregnancy to postpartum. The severity of PPD usually decreases over time, but depressed mothers cannot be considered a homogenous group (Vliegen et al. 2014). Moreover, Horowitz and Goodman (2004) found that although depression scores decreased over time, the significant change in mean scores occurred from four to eight weeks to ten to fourteen weeks postpartum, and mean scores did not change after this time in the following two years.

### 2.1.4 Symptoms

Many studies report that symptoms of PPD are variable. Rapid changes in several hormonal levels following delivery affect the symptoms and the type of depression (Kammerer et al. 2006). Pitt (1968) in her pioneering study suggests that PPD is atypical because of the prominence of neurotic symptoms, such as anxiety, phobias, irritability, somatic symptoms and fatigue, and because some symptoms are different from those of classic depression. For example, insomnia may be more severe in the evening than in the morning, and suicidal ideas are rare. Later Goyal et al. (2009) also showed that postpartum depressive symptoms were associated with difficulties in falling or staying asleep.

Miller et al. (2013, 2015) found many more obsessive-compulsive symptoms among patients in the postpartum period than in population (11% vs. 2–3%), and these were often comorbid with depression. Specifically, women with postpartum major depression

experienced disturbing aggressive obsessive thoughts more commonly than did women with major depression outside the postpartum period (Wisner et al. 1999). Furthermore, Miller et al. (2015) found that anxiety and obsessive-compulsive symptoms were comorbid with depression immediately postpartum. Anxiety symptoms declined for up to six months but obsessive-compulsive symptoms improved only slightly and remained persistent (Miller et al. 2015). Some degree of obsessive and compulsive symptoms may be beneficial in the care of an infant, for example thoughts of avoiding harm and accidents or compulsion manifests in avoidance of dangerous situations (for example cleaning things and doublechecking) (Miller et al. 2013). The maladaptive form of those with PPD may be destructive.

Moreover, postpartum anxiety symptoms including somatic and social anxiety are fairly common, affecting up to 10–50% (Farr et al. 2014, Wenzel et al. 2005, Miller et al. 2015). Bernstein et al. (2008) found that psychomotor symptoms (restlessness/agitation) and impaired concentration/decision-making were prominent in major PPD while women with major depression outside the postpartum period reported more often sad mood, suicidal ideation and diminished interest.

Thoughts of self-harm and suicidal ideation during the postpartum period range between 3% and 14% (Lindahl et al. 2005, Howard et al. 2011), and according to Howard et al. (2011) postpartum women are more likely to experience suicidal ideation if they have more depressive symptoms. This concurs with the study by Wisner et al. (2013) in which 19.3% of depressed mothers with EPDS score ≥10 had self-harm ideation, and respectively 30% with EPDS score ≥13. Pope et al. (2013) found that women with a diagnosed mood disorder (MDD or bipolar II disorder) experienced thoughts of self-harm (17%) and suicidal ideation (6.2%) during one year postpartum. According to the review by Lindahl et al. (2005) suicidality (deaths from suicide, attempted suicide, suicidal ideation, thoughts of self-harm) is significantly elevated among depressed women during the peripartum period. Deaths by suicide and attempted suicides are lower during pregnancy and the postpartum than in the general population of women, but when deaths do occur, suicides account for up to 20% of postpartum deaths (Lindahl et al. 2005).

Non-psychotic or psychotic depression of the mothers prior to infanticide has been reported in several studies, but non-psychotic depressed mothers are unlikely to kill (Spinelli 2004, Friedman et al. 2005, Kauppi et al. 2008). If they do so, the purpose in their estimation is usually altruistic. Non-psychotic depressed mothers may feel guilty, they may believe that they are bad mothers and they may experience obsessive thoughts about harming their infant (Spinelli 2004). Kauppi et al. (2008) recognized that those depressed mothers usually experience depressed mood, anxiety, insomnia, suicidal thoughts, they had worries about the baby's well-being and their own ability to be a mother.

Putnam et al. (2017) in their analysis of data from an international consortium identified five distinct subtypes of PPD: severe anxious depression, moderate anxious depression, anxious anhedonia, pure anhedonia and resolved depression. These subtypes have differences in symptom quality and time of onset. Onset in the first trimester of

pregnancy was most usual in the subtype with anxious depression, and onset up to eight weeks postpartum with anxious anhedonia.

Postpartum depressed mothers also experience such feelings as loneliness, anxiety, hopelessness, and loss of control (Leahy-Warren & McCarthy 2007). According to Beck et al. (1974) a common constellation in depression is a pattern of negative expectations of the future and hopelessness has been identified as one of the core characteristics of depression.

### 2.1.5 Differential diagnosis and psychiatric co-morbidities

It is not always easy to differentiate postpartum depressed mothers from healthy mothers and mothers with other psychiatric or non-psychiatric disorders.

Patterns of appetite, especially loss of appetite (Kammerer et al. 2009), fatigue and disrupted sleep related to physical status after childbirth and infant care may be difficult to distinguish from the symptoms of depression. Pereira et al. (2014) found that women with vs. without depression in the postpartum period were very similar and both presented with higher rates than women outside the perinatal period of loss of energy and sleep changes. According to Williamson et al. (2014) irritability, insomnia and appetite loss indicate depressed mood only at higher levels than outside the postpartum period, but are still valid indicators for PPD (Williamson et al. 2014). Sleep disturbances can also lead to negative consequences, such as dysphoric mood and impaired cognitive function. Persistent cognitive impairment is indicative of depressive disorders (Swain et al. 1997).

The "baby blues" is a common, transient mood disturbance that can affect about 70% of new mothers for up to ten days following delivery (APA 2000). Its symptoms consist of tearfulness, irritability, anxiety, emotional lability, interpersonal hypersensitivity, insomnia and sometimes elation but does not impair functioning (APA 2000, O'Hara 2009). Symptoms of postpartum psychosis are usually rapid onset of intense mood disturbance, confusion, strange or delusional beliefs, and disorganised behaviours, and underlying disorder is most commonly a bipolar illness (Sit et al. 2006). Diverse forms of bipolar I-II disorder are also possible and should be considered (Sharma et al. 2010).

Substance abuse and thyroid disorders in particular should be taken into account as non-psychiatric disorders (Fitelson et al. 2011).

According co-morbidity studies PPD is associated with generalized anxiety disorders, panic disorders, post-traumatic stress disorders and obsessive-compulsive disorders (Ross & McLean 2006, Sharma et al. 2008, Yelland et al. 2010, Chaudron & Nirodi 2010, Miller et al. 2013). The incidence of personality disorders among postpartum depressed mothers is greater than among non-depressed mothers (Apter et al. 2012). Wisner et al. (2013) found in their large study in the USA that the most common primary diagnoses among mothers whose EPDS score was 10 or higher were unipolar depressive disorders (68.5%), second was bipolar disorders (22.6%), then anxiety disorders (5.6%) and substance use disorders (0.5%). Secondary diagnoses in women with primary depressive disorders were more

often generalized anxiety disorder (52.3%), then panic disorder, social phobia, obsessive-compulsive disorders, substance use disorders (each 10.5-13.8%) and eating disorders (5.2%) (Wisner et al. 2013).

### 2.1.6 Consequences

PPD has various adverse consequences for the family system as a whole, especially for marital satisfaction and parenting tasks (Barnes 2006). Reviews of the literature have established a prevalence of depressed fathers from 2% to 25%, with an increase up to 50% when mothers were experiencing PPD (Yogman & Garfield 2016). According the review by Goodman (2004), maternal depression is the strongest predictor of paternal depression during the postpartum period. Goodman (2004) found that depression in one partner was significantly correlated with depression in the other, and that fathers were significantly more likely to be depressed if their partners were experiencing PPD. Others have found a moderate positive correlation but the causality remained obscure (Paulson & Bazemore 2010).

As a consequence of PPD emotional and social interaction between the infant and the mother may be distorted, and negative impact to the child's health and social, emotional, cognitive and physical development have been reported up to adolescence (Weinberg & Tronick 1998, Brand & Brennan 2009, Field 2010, Goodman et al. 2011, Murray et al. 2011, Korhonen et al. 2012). Goodman et al.'s (2011) extensive meta-analysis was conducted to examine the mechanism and the strength of the association between mother's depression and child's behavioural problems or emotional functioning. The mean age of the children in these studies ranged from nine days to 20 years, with an overall mean of 7.1 years. Maternal depression was significantly related to higher levels of internalizing, externalizing and general psychopathology and negative affect/behaviour and to lower levels of positive affect/behaviour (Goodman et al. 2011). However, this meta-analysis highlights the importance of numerous other factors that are relevant to child problems (e.g. sex, age, SES). Specifically, PPD predicts poorer intelligence development, and this effect is found across childhood and adolescence, and is more pronounced in boys than girls (Brand & Brennan 2009, O'Hara & McCabe 2013). Both severity and chronicity of depression may play a critical role in child outcomes (O'Hara & McCabe 2013). For example, Josefsson and Sydsjö (2007) found that although postpartum depressive symptoms in the mothers were implicated in explaining the likelihood of behavioural problems in their four-year-old children, mothers with current depressive symptoms were most likely to have a child with behavioural problems. Recently a large study in the UK (Netsi et al. 2018) showed that whether persistent or not, PPD doubled the risk of child behaviour disturbance at 3.5 years old. Persistence of severe PPD was particularly important to child development, substantially increasing the risk for behavioural problems at 3.5 years of age, lower mathematics grades at 16 years of age and higher prevalence of depression at 18 years of age.

## 2.2 Aetiology and risk factors of postpartum depression

Current view is that aetiology and risk factors of PPD are multidimensional and may be biological, psychological and social.

### 2.2.1 Models of postpartum depression

The integrative models of PPD are currently most discussed and promising. The well-known researcher O'Hara (2009) summarized, that PPD seems to arise in the same psychosocial contexts as do depressions that develop at other times in a woman's life, but psychosocial stressors and interpersonal events are triggered by specific neurophysiological changes. This concurs with Halbreich´s (2005) bio-psycho-socio-cultural model of the processes leading to postpartum disorders. These factors are (Halbreich 2005):

1. Genetic predisposition.
2. Dynamically evolving vulnerability to hormonal and psychosocial inputs. Cumulative hormonal inputs include past hormonal destabilizing situations e.g. specific oral contraceptives, pregnancies, premenstrual syndrome and other hormonal withdrawals. Cumulative psychosocial inputs include early life experiences, past episodes of disorders, adverse socioeconomic events and poor immediate support. The dynamically evolving vulnerability may also increase due to the kindling effect (Post 1992) of repeated dysphoric states or episodes of disorders and adverse socioeconomic events.
3. Peripartum biological and social trigger(s), including withdrawal of gonad and stress hormones and abrupt psychosocial change from pregnancy to motherhood.
4. Peripartum and postpartum environment, including destructive family support system and cultural aspects.
5. Perception and coping mechanism, which can lead to healthiness or to symptoms or disorders.

Yim et al. (2015) later described the integrative model of PPD, according which biological vulnerability is conceptualized as a genetically derived hypersensitivity to hormonal changes, and to dysregulation or impaired adaptation mechanisms in the central nervous system. This vulnerability is thought to interact reciprocally with the environment, both shaping the organism's responses to environmental challenges and being shaped by stressors and positive experiences over the life span (Yim et al. 2015).

Evolutionary psychiatry affords an interesting view of PPD (Rantala et al. 2018): The survival of the child is of the greatest importance to human survival and mother´s feelings respond to this knowing the importance of passing on one's own genes to the next generation. If the survival is threatened due to environmental mismatch or other reasons, the mother may be depressed. For example, if the mother does not get adequate support from the father and kin, she may feel that she cannot cope with her parental duties. Child´s

sickness affects chance of survival, and complications during pregnancy or delivery may be a threat to the infant's health. Numerous stresses of modern lifestyle may be pivotal and affect biological processes.

In summary, biological factors, high level of stress and poor psychosocial resources are thought to be connected to PPD.

## 2.2.2 Biological risk factors

Among biological processes the main risk predictors for PPD are genetic vulnerabilities, hormonal dysregulations and inflammatory processes.

### *2.2.2.1 Genetic predisposition*

Several studies have suggested that postpartum depressive symptoms have a partly genetic aetiology, although how different polymorphisms lead to different neurobiological processes and further to depression remains unknown (O'Hara & McCabe 2013, Yim et al. 2015, Serati et al. 2016). Several genes are implicated in major depression, such as those linked to 5-hydroxytryptamine (serotonin) transporter (5-HTT), tryptophan hydroxylase (TPH), monoamine oxidase-A (MAO-A), catechol-O-methyl transferase (COMT), and have also been extensively examined in the context of PPD (Couto et al. 2015, Yim et al. 2015). The findings point to the possible effects of polymorphic variations in genes within the monoaminergic system, but also within the estrogen receptor, the oxytocin peptide, the glucocorticoid receptor and the corticotrophin releasing hormone (CRH) receptor 1 genes (Yim et al. 2015). There was no definitive answer to the question whether the short or long allele of the 5-HTTLPR (5-HTT-linked polymorphic region) is associated with PPD and under what conditions (Yim et al. 2015).

The study of epigenetics consists of factors that are heritable but environmentally modifiable by mechanisms that are not deoxyribonucleic acid (DNA) encoded and help us to understand the incorporation of complex life experiences (Couto et al. 2015, Yim et al. 2015). For example, the model of Garfield et al. (2016) suggests that early life adversity entails a proinflammatory epigenetic signature (altered DNA methylation), that predisposes vulnerable women to PPD.

### *2.2.2.2 Reproductive hormones*

Pregnancy is accompanied by a rise in estradiol, progesterone and cortisol, but after delivery the level of these decreases drastically, prolactin and oxytocin increase and changes in thyroid hormones are possible. Most well-known theories about hormonal effects on PPD include theories about changes in the levels of hormones, the withdrawal theory and theories about interaction among the hypothalamic–pituitary–gonadal system (HPG) and the hypothalamic–pituitary–adrenal system (HPA) (Harris 1994, Bloch et al. 2000,

Brummelte & Galea 2010, O'Hara & McGabe 2013, Yim et al. 2015, Serati et al. 2016). Serati et al. (2016) conducted an extensive review of perinatal major depression biomarkers. Their suggestions are in line with the conclusion of the review by Schiller et al. (2015) that reproductive hormones may exert influence especially in a subgroup of a "hormone sensitive" PPD phenotype, as estrogen is closely tied to the HPA-axis and inflammation.

Although all women experience a dramatic decrease in hormone levels after delivery, only a small subset of women develop PPD (O'Hara & McGabe 2013). The hormone withdrawal theories of PPD suggest that withdrawal of estrogens and progesterone are proximate causes of depression in some vulnerable women (O'Hara & McGabe 2013, Yim et al. 2015). Due to the interaction of the HPG–axis and HPA–axis the fluctuations in ovarian hormone levels contribute to the increased stress sensitivity and vulnerability to depression (Brummelte & Galea 2010), but the exact effects of these endocrinological changes are not yet known. Also, according to the review by Yim et al. (2015) studies have not tested enough moderators of biological vulnerability such as a history of depression or life stress.

Estrogens have neurotrophic and neuroprotective effects. Moses-Kolko et al. (2009) summarized that estrogens promote neuronal growth and survival in hypothalamus, amygdala, hippocampus, dopaminergic neurons and cortex (Lee & McEwen 2001, Amantea et al. 2005). Estrogens also act against oxidative stress, glutamate excitotoxicity, and β-amyloid toxicity (Lee & McEwen 2001, Amantea et al. 2005), and modulate neurotransmitter systems (Lee & McEwen 2001, Amantea et al. 2005), including serotonin (Biegon et al. 1983, Fink et al. 1996, Joffe & Cohen 1998), dopamine (Wieck et al. 1991, Fink et al. 1996), norepinephrine (Biegon et al. 1983), and cholinergic systems (Gibbs & Aggarwal 1998). A massive drop in estrogen concentration during the postpartum period may result in a rise in the sensitivity of dopaminergic receptors, which would then cause psychotic disorder (Wieck et al. 1991, Fink et al. 1996).

Progesterone may be protective against depression because of its anxiolytic and anaesthetic (sedative) properties, and because it modulates serotonergic receptors (Biegon et al. 1983, Harris 1994, Yim et al. 2015). According to the review by Yim et al. (2015) there is little evidence to suggest that low progesterone in late pregnancy or postpartum predicts PPD symptoms, but the studies are small and moderators associated with vulnerability to hormone changes remain untested.

Some clinical studies and trials have reported evidence for hormonal theories of PPD (Moses-Kolko et al. 2009). According to the well-known double-blind pregnancy stimulation study by Bloch et al. (2000), in which estradiol and progesterone were administered, withdrawal depression symptoms began in women with a history of PPD but not in women without a history of PPD. However, there were no group differences in estradiol or progesterone levels in the addback or withdrawal phase. In a double-blind placebo-controlled study Gregoire et al. (1996) found that transdermal estradiol treatment was significantly more effective than placebo in treating PPD. Ahokas et al. (1998) used

sublingual estradiol in a pilot study of two mothers suffering from PPD. The symptoms of depression disappeared in the mothers after two weeks' treatment. After that trial Ahokas et al. (2001) treated a further 23 mothers with postpartum major depression with sublingual estradiol, and by two weeks 83% of subjects achieved remission. However, Ahokas et al. (1998, 2001) did not use a control group.

Prolactin increases over the course of pregnancy. In breastfeeding women prolactin remains elevated (Yim et al. 2015), while estrogen and progesterone levels are supressed during lactation amenorrhea (Yim et al. 2015). Higher basal levels of prolactin may be protective against PPD onset because prolactin has anxiolytic properties and is thought to contribute to the stress-buffering effects of lactation (Torner & Neumann 2002, Yim et al. 2015). However, studies have yielded mixed findings for an association between PPD and prolactin (Yim et al. 2015).

Oxytocin increases just before parturition and breastfeeding sessions trigger increases in oxytocin (Yim et al. 2015). There is a small amount of research to suggest that lower levels of oxytocin in pregnancy or postpartum may be a risk factor for PPD (Skrundz et al. 2011, Stuebe et al. 2013, Yim et al. 2015).

Testosterone shows modest increases during pregnancy compared to prepregnancy levels (Yim et al. 2015). A correlational study suggests a positive association between testosterone and PPD symptoms within the first three postpartum days (Hohlagschwandtner et al. 2001), but conclusions about testosterone are limited due to the paucity of studies presented (Yim et al. 2015).

#### *2.2.2.3 Stress hormones*

Numerous studies on stress hormones and PPD have been presented. Stresses affect the HPA-axis in several ways: the hypothalamus releases CRH, the pituitary releases adrenocorticotropic hormone (ACTH), and the adrenal cortex releases cortisol, a glucocorticoid (Brummelte & Galea 2010). Depressed patients show abnormal HPA-axis function such as hypo- or hypersecretion of stress hormones, but the exact mechanism of a dysregulation of the HPA-axis and depression is not very well understood (Brummelte & Galea 2010). Prolonged stress, which can precipitate or exacerbate depression, also disrupts neuroplasticity, a mechanism of neuronal adaptation (Pittenger & Duman 2008).

Stress hormones follow a pattern similar to that of reproductive hormones; they increase over the course of pregnancy and then drop after delivery (Yim et al. 2015). During the third trimester of pregnancy the HPA-axis functions hyperactively inducing hypersecretion of ACTH and cortisol, mainly because of the high serum concentrations of placental CHR (Brummelte & Galea 2010). Moreover, corticosterone binding globulin (CBG) levels are higher during pregnancy and drop with parturition (Brummelte & Galea 2010). CBG is a carrier protein and may play important role in mediating hormone availability during pregnancy and postpartum (Brummelte & Galea 2010). Furthermore, a rise in the estradiol level of serum during pregnancy may stimulate the HPA-axis (Cizza et al. 1997). After

delivery, the estradiol level in serum decreases and the concentration of CRH decreases dramatically (Cizza et al. 1997). Some research has proved that women who suffer from postpartum blues or depression have a more severe and longer suppression of HPA-axis than emotionally stable mothers (Cizza et al. 1997). Estrogen may act as a psychotropic by modulating feedback regulation of the HPA-axis (Cizza et al. 1997). Vamvakupoulos and Chrousos (1993) suggested that the promoter of the CRH gene contains estrogen receptor-binding estrogen-responsive elements and responds positively to estrogens by normalization of CRH secretion.

There is some evidence that patients with melancholic depression (clinically characterized by hypophagia and hyposomnia) have a hyperfunctional and patients with atypical depression (irritability, hyperphagia, hypersomnia) a hypofunctional HPA-axis (Cizza et al. 1997, Kammerer et al. 2006).

Some studies measuring cortisol and ACTH levels in relation to PPD have found an association, however, some did not (Yim et al. 2015, Serati et al. 2016). Stress reactivity may be more important in the pathophysiology leading to PPD than baseline hormone levels (Yim et al. 2015). Emerging evidence, however, indicates that higher levels of CRH in mid-to-late pregnancy may be predictive of PPD symptoms during the first few postpartum months (Yim et al. 2009, Yim et al. 2015).

#### *2.2.2.4 Thyroid hormones*

Abnormal thyroid function is raised in the postpartum period. In the six months following delivery up to 7% of women experience thyroid dysfunction, but only 3–4% in the general population (Hendrick et al. 1998). Yim et al. (2015) summarized that pregnancy-related changes in the thyroid system may impact on the serotonin system (Hendrick et al. 1998) or alter estrogen receptor sensitivity (Vasudevan et al. 2002). Some studies on biomarkers suggest links between thyroid antibodies, higher thyrotropin (TSH), lower triiodothyronine ($T_3$) or thyroxin ($T_4$) levels with PPD symptoms, but some studies do not (Yim et al. 2015, Serati et al. 2016).

#### *2.2.2.5 Inflammation*

The immune system's function is to protect the body from pathogenic organisms and foreign substances by attacking what it identifies as foreign (Yim et al. 2015). This task is complicated during pregnancy by the genetically distinct foetus, which carries paternal antigens (Zenclussen 2013, Yim et al. 2015). The exact mechanism by which the developing foetus is tolerated by the maternal immune system is not completely understood (Yim et al. 2015). The immune system is activated and proinflammatory cytokines increase during pregnancy and delivery (Maes et al. 2000, Kendall-Tackett 2007, Kronborg et al. 2011, Yim et al. 2015). When the elevations of proinflammatory cytokines are within the normal

range, inflammation is protective. Prolonged or excessive immune system activation is one of the mechanisms involved in depression (Serati et al. 2016, Rantala et al. 2018).

However, inflammation may also explain why psychosocial, behavioural, mental and physical risk factors (stressors) increase the risk of depression (Kendall-Tackett 2007, Rantala et al. 2018). The immune system responds to stress by increasing the production of proinflammatory cytokines, which increases inflammation (Kendall-Tackett 2007). Furthermore, inflammation influences levels of serotonin and catecholamines (Kendall-Tackett 2007). Once inflammation starts, it triggers the HPA-axis to release cortisol (Joynt et al. 2003, Kendall-Tackett 2007). Cortisol is anti-inflammatory and is generally secreted when inflammation levels become too high (Kendall-Tackett 2007). Depressed people may either have abnormally low levels of cortisol or they become less sensitive to cortisol, which then fails to restrain the inflammatory response (Miller et al. 2005). Women with stressful life events or a history of depression are often more vulnerable to PPD, one way that this vulnerability manifests is a more rapid inflammatory response (Kendall-Tackett 2007, Johnson et al. 2002).

The immune system is regulated by an intricate balance of proinflammatory cytokines (e.g., interleukin (IL)-6, IL-1β, tumour necrosis factor-alpha (TNF-α)) that initiate the inflammatory response and anti-inflammatory cytokines (e.g., IL-10) counteracting these effects (Yim et al. 2015). Many studies have assessed increased proinflammatory cytokines around the time of delivery and associations has been found, for example, between IL-6, IL-6 receptor, IL-1β, TNF-α and depression (Maes et al. 2000, Yim et al. 2015, Serati et al. 2016). In general, the findings of numerous studies have yielded inconsistent results but most provide evidence for an exaggerated proinflammatory response in women with postpartum depressive symptoms (Yim et al. 2015). Some studies have assessed C-reactive protein (CRP) as an overall marker of systemic inflammation, but the findings are inconclusive (Yim et al. 2015, Serati et al. 2016).

### 2.2.3 Risk factors: Stress factors and psychosocial resources

Different stress factors around the time of having a baby are connected with depression. Specifically, level of stress is connected with unwanted pregnancy, mental problems and complications during pregnancy and delivery, the infant, breastfeeding and stressful life events. Lack of psychosocial resources is a risk factor for depression. The main components are poor relationships and abuse in childhood, poor present support, violence and socioeconomic difficulties.

#### *2.2.3.1 Sociodemographic factors and obstetric history*

Norhayati et al. (2015) summarized in their review that in developed and developing countries research showed mixed findings of PPD as regards mother's age, most often

young maternal age was associated with PPD. For example, Milgrom et al. (2008), Sword et al. (2011) and Lanes et al. (2011) have reported younger maternal age to be a risk factor for PPD. By contrast, according to Räisänen et al. (2013), maternal age was associated with PPD in a group 30–39 years old, specifically in older women with previous depression.

According some studies (Beck 2001) marital status, especially single status is predictor of PPD. This is also in line with Halbreich's (2005) discussion, according which being a single mother is associated with PPD. In Finland single marital status was associated only with recurrent depression after childbirth, not new onset, and not when these groups were combined (Räisänen et al. 2013).

Lower occupational status has traditionally been associated with increased risk of PPD (O'Hara & Swain 1996, Robertson et al. 2004) and low occupational status may be associated with poor SES. In Finland Räisänen et al. (2013) found that low occupational status was associated with recurrent depression after childbirth, not with new onset depression and not when new onset and recurrent groups were summarized. Norhayati et al. (2015) found in their review that unemployment was specifically associated with PPD in both developed and developing countries, although some studies have reported opposite findings.

In both developed and developing countries, contradictory findings were related to number of births (parity) (Norhayati et al. 2015). For example, according to Nielsen et al. (2000), Milgrom et al. (2008) and Sword et al. (2011) multiparity was associated with depression, but according to Josefsson et al. (2002) and Söderquist et al. (2009) it was not. In Finland nulliparity (no prior births) was associated with PPD in groups with and without previous depression (Räisänen et al. 2013).

According to Giannandrea et al. (2013), women with prior pregnancy loss, including miscarriage, stillbirth and induced abortion, were more likely to be diagnosed with postpartum major depression than were women without a history of loss. Furthermore, women with multiple losses were more likely to be diagnosed with major depression than women with a history of one pregnancy loss. Loss types were not related to depression (Giannandrea et al. 2013). Robertson-Blackmore et al. (2011) found that the number of previous miscarriages/stillbirths significantly predicted symptoms of depression during the pre- and postpartum periods, and the impact of a previous prenatal loss did not diminish following the birth of a healthy child. By contrast, Chojenta et al. (2014) found in their Australian study that history of pregnancy loss increases the risk of sadness, low mood and excessive worry in subsequent pregnancies but not postpartum. Specifically, according to the study by Räisänen et al. (2013) not miscarriages but prior terminations were associated with both new onset and recurrent depression in the postpartum period and stillbirths with recurrent depression.

#### 2.2.3.2 Unwanted pregnancy

Unplanned or unwanted pregnancy is a well-known risk factor for PPD (Beck 2001, Robertson et al. 2004, Norhayati et al. 2015). In developed countries studies on unplanned pregnancy have yielded mixed findings on this as a risk factor for PPD (Norhayati et al. 2015). Specifically, according to a large study in the USA women with mistimed or unwanted pregnancies were more likely to experience symptoms of PPD (Gauthreaux et al. 2017). In developing countries women with unplanned or unintended pregnancies were likely to experience PPD (Norhayati et al. 2015). An unwelcome pregnancy may change the mother's life drastically and be a very stressful experience. There may be social and economic implications, and further influence on problems in adjustment to motherhood (Warner et al. 1996, Beck 2001, Saleh et al. 2013).

#### 2.2.3.3 Mental symptoms during pregnancy

The risk of PPD is greater if the mother has experienced mental difficulties or psychiatric disorders during pregnancy. Research has consistently shown that experiencing depressed mood or anxiety during pregnancy are significant predictors of PPD (O'Hara & Swain 1996, Beck 2001, Robertson et al. 2004, Mohammad et al. 2011), in both developed and developing countries (Norhayati et al. 2015). Feelings of stress (Söderquist et al. 2009, Mohammad et al. 2011, Giri et al. 2015), and other psychological disorders and distresses (O'Hara & Swain 1996, Nielsen et al. 2000) during pregnancy are also connected to PPD. Furthermore, Milgrom et al. (2008) found that antenatal emotional problems including anxiety, depression, eating disorder, difficulty accepting pregnancy and others (unspecified) are separately and in combination significant risk factors for PPD. Fear of childbirth (Söderquist et al. 2009, Räisänen et al. 2013) is also connected to PPD, according to Räisänen et al. (2013) both in first lifetime and recurrent depression.

#### 2.2.3.4 Pregnancy and delivery -related complications

Pregnancy and delivery-related (obstetric) complications may also be a cause of several physical and mental stresses for the mother and predict PPD (O'Hara & Swain 1996, Robertson et al. 2004, Norhayati et al. 2015). They are also important risk factors from an evolutionary perspective because they are threat to the infant's survival (Rantala et al. 2018). Obstetric factors, including pregnancy-related complications such as hyperemesis, pre-eclampsia, premature contractions and labour, hypertension, headache, pain, anaemia, gestational diabetes, diabetes mellitus and amniocentesis (Josefsson et al. 2002, Robertson et al. 2004, Kozhimannil et al. 2009, Räisänen et al. 2013, Giri et al. 2015, Meltzer-Brody et al. 2017, Ruohomäki et al. 2018), as well as caesarean section and delivery-related complications, such as difficult and painful labour, instrumental delivery, premature delivery, and complicated puerperium such as excessive bleeding (Robertson et al. 2004, Räisänen et al. 2013, Saleh et al. 2013, Norhayati et al. 2015), have been suggested, with

mixed findings to be potential risk factors for PPD. In vitro fertilization does not increase the risk of PPD (Räisänen et al. 2013, Lynch & Prasad 2014); according to Räisänen et al. (2013) it is negatively associated with recurrent depression.

Some researchers have studied new onset and recurrent depression in the postpartum period separately. Räisänen et al. (2013) found that preterm birth was associated with first lifetime depression, and anaemia and gestational diabetes with recurrent depression. According to Kozhimannil et al. (2009) pre-pregnancy or gestational diabetes was associated with perinatal depression and also with new onset PPD. Melzer-Brody et al. (2017) found that the following predictors were identified as constituting increased risk among new onset depressed mothers: hyperemesis, gestational hypertension, pre-eclampsia and cesarean section (Melzer-Brody et al. 2017).

However, interpreting the results of research on obstetric factors is not simple because some variables may not be truly independent (Robertson et al. 2004). There are numerous biological and psychosocial mechanisms that could explain associations between these and PPD. For example, hyperemesis is linked to increased risk of depression, anxiety and mental health difficulties (McCarthy et al. 2014). Explanatory models for these symptoms may be somatization of pregnancy-related anxiety and depression but may also be an effect of hormonal changes (Josefsson et al. 2002). According to the discussion in Kozhimannil et al. (2009) diabetes affects thyroid function and the HPA-axis. Moreover, diabetes is also associated with both maternal and neonatal risks and complications. Managing a chronic disease may deplete mental resources and contribute to the occurrence of depression (Kozhimannil et al. 2009). This is in line with Josefsson et al. (2002), who found that the main risk factors for postpartum depressive symptoms were sick leave during pregnancy and frequent visits to the antenatal clinic. Moreover, Nielsen et al. (2000) showed that admission to hospital due to pregnancy complications was a risk factor.

There is little evidence supporting an association between PPD and delivery by caesarean section, in developed and developing countries mode of delivery showed mixed findings (Norhayati et al. 2015). However, in a recent Finnish study, caesarean section was found to be a predisposing factor for PPD, specifically among those suffering first lifetime depression (Räisänen et al. 2013). It has been reported that women undergoing emergency caesarean section were more likely to develop PPD (Robertson et al. 2004), but it is unclear if delivery complications or the long and painful labour necessitating emergency procedures affect the association (Robertson et al. 2004). Eisenach et al. (2008) found that severity of acute pain after childbirth, but not type of delivery predicts persistent pain and PPD. Caesarean delivery may not increase the risk of persistent pain and PPD. Moreover, women with a marked antepartum preference for vaginal delivery who deliver by caesarean may be at increased risk for depression postpartum (Houston et al. 2015). One must take into account that women diagnosed with depression were significantly more likely to have caesarean delivery and preterm labour compared to women without depression (Bansil et al. 2010).

#### 2.2.3.5 *Infant-related problems*

Infant-related problems may be very stressful experiences for the mother. Mothers of premature infants (Vigod et al. 2010, Norhayati et al. 2015), mothers of infants with illnesses/disabilities/distresses (Vigod et al. 2010, Nielsen et al. 2000, Räisänen et al. 2013, Norhayati et al. 2015), mothers of infants that are temperamentally demanding (McGrath et al. 2008, Britton 2011, Norhayati et al. 2015), and mothers who experience stress in childcare (Thome 2000, Beck 2001, Yim et al. 2015) and lack childcare knowledge (Norhayati et al. 2015) are at risk of developing PPD. Specifically, in developed countries medical illnesses and difficult temperament are problems, and in developing countries medical illnesses and lack of childcare knowledge (Norhayati et al. 2015). Worries about infant's health are suggested to be a powerful predictor of postpartum depressive symptoms (Thome 2000). The understanding of this is also easy from an evolutionary perspective: the survival of the infant is most important to mother (Rantala et al. 2018).

The relationship between problems with the infant and mother's depression is likely to be complex; for example, the interrelationship between preterm birth and PPD may be explained by an interaction of multiple alterations in the labour and delivery processes (Bradon et al. 2011), the poorer-than-expected infant health outcomes (Bradon et al. 2011), early parental stress (Gulamani et al. 2013) and dysfunctional mother-infant interaction (Gulamani et al. 2013). Moreover, admission to a neonatal intensive care unit associated with PPD, specifically with recurrent depression (Räisänen et al. 2013).

Specifically, excessive and prolonged crying with or without infantile colic is a well-known risk factor for depression (Howell et al. 2005, 2006, Vik et al. 2009, Kurth et al. 2011, Radesky et al. 2013). According to the review by Kurt et al. (2011) amount of infant crying is associated with tiredness and fatigue, further diminishes the mother's ability to concentrate, burdens mother-child interaction, and triggers depressive symptoms. In cultures that provide the new mother with a high level of family support and pampering during the first month postpartum, reported rates of depression are low and may be delayed until the pampering period ends (Halbreich 2005, Howell et al. 2005).

#### 2.2.3.6 *Breastfeeding*

Women who do not breastfeed or have difficulties with breastfeeding are at risk of developing PPD (Warner et al. 1996, Figueiredo et al. 2013, Saleh et al. 2013, Dias & Figueiredo 2015, Norhayati et al. 2015, Pope & Mazmanian 2016). Studies in developed countries have yielded mixed findings in relation to absence or non-initiation of breastfeeding, in developing countries these are risks for developing PPD (Norhayat et al. 2015). The relationship between breastfeeding and PPD seems to be bidirectional. Breastfeeding may protect against depression or assist in a speedier recovery from symptoms and conversely, PPD may reduce the rates of breastfeeding (Hamdan & Tamim 2012, Figueiredo et al. 2013, Figueiredo et al. 2014, Pope & Mazmanian 2016). Moreover, Ystrom (2012) found

that mothers with high levels of anxiety and depression during pregnancy and who stop breastfeeding early are at an additional multiplicative risk for postpartum anxiety and depression.

Researchers have extensively examined the relationships between PPD and breastfeeding intention, initiation, duration and dose (partial vs. exclusively) (Pope & Mazmanian 2016). Risk for depression is associated with shorter breastfeeding duration (Dias & Figueiredo 2015, Pope & Mazmanian 2016) or partial breastfeeding (Pope & Mazmanian 2016). The risk of PPD may be higher among women who had planned to breastfeed and failed to do so (Borra et al. 2015). Moreover, depressive symptoms may influence breastfeeding outcomes, especially as regards intention or discontinuation (Pope & Mazmanian 2016).

Although the direction and precise nature of relationships between depression and breastfeeding are not exactly known, the literature consistently shows that breastfeeding provides a wide range of benefits for both the child and the mother (Figueiredo et al. 2013, Pope & Mazmanian 2016). It can reduce the risk of PPD by helping the regulation of sleep and wake patterns for mother and child, improving mother's self-efficacy and her emotional involvement with the child, reducing the child's temperamental difficulties and promoting a better interaction between mother and child (Figueiredo et al. 2013, Pope & Mazmanian 2016).

The mechanism between breastfeeding and PPD may also be biological. Breastfeeding can promote hormonal processes that protect mothers against depression by reducing especially HPA-axis response to stress and by the soothing effects of oxytonin (Groër et al. 2002, Kendall-Tackett 2007, Figueiredo et al. 2013, Pope & Mazmanian 2016). Breastfeeding also appears to be protective because it modulates the inflammation response (Kendall-Tackett 2007).

#### *2.2.3.7 Life events*

The relationship between stressful life events and PPD is obviously documented in developed and developing countries (O'Hara & Swain 1996, Beck 2001, Robertson et al. 2004, Norhayati et al. 2015, Yim et al. 2015). Number of life events and stressors are associated with PPD (Rubertsson et al. 2005, Yelland et al. 2010, Saleh et al. 2013, Lynch & Prasad 2014, Stone et al. 2015). Moreover, it appears that the type and severity of life events are relevant (Yim et al. 2015). However, there is contradictory evidence that symptoms or diagnoses of PPD are preceded by stressful life events in controlled analyses (Yim et al. 2015). Confounding factors may be a notable problem. Relatively few studies have examined interactions of events with predispositions to test a stress in diathesis perspective (Yim et al. 2015).

Several studies have found that death, own or significant others' sicknesses, relationship and socioeconomic problems are the most stressful factors, although measurements are variable. According to Rubertsson et al. (2005) two or more stressful life events during the year prior to pregnancy were associated with depressive symptoms in early pregnancy, two

months and one year postpartum. Their stressful life event scale was derived from a more extensive life event scale (Rosengren et al. 1993) and included ten items relating to close relatives' serious illness, divorce, economic and employment problems, unemployment, any events that involved legal consequences and death among relatives. In the study by Rubertsson et al. (2005) a question about own serious illness was added to the life event scale. Yelland et al. (2010) studied life events during six months after delivery and grouped stressful life events or social health issues into emotional (own or significant others' sicknesses, death), relationships, traumatic and financial events. In the study by Saleh et al. (2013) at one month after delivery the number of stressors during the preceding 12 months was found to be higher among depressed than among heathy mothers, and positively and highly correlated with severity of depression. Their measurement of stressful life events was based on the life event questionnaire for measuring presumptive stress (Horowitz et al. 1977). Moreover, according to Lynch and Prasad (2014) having experienced a greater number of stressors in the 12 months before delivery was associated with an increased likelihood of having symptoms of PPD. According to Stone et al. (2015) women who reported peripartum common stressors – particularly partner-related stressors – during the 12 months before delivery, had an increased prevalence of postpartum depressive symptoms. They grouped stressful events into four categories (partner-related, traumatic, financial, emotional including family members' sickness or close relative's death) based on the work of Ahluwalia et al. (2001).

#### *2.2.3.8 Relationships in childhood*

Parental caregiving during a mother's own childhood has been studied as a precursor to PPD. In these studies recall bias may be problem. Poor maternal and/or paternal care and emotional support during childhood have been fairly consistently associated with PPD symptoms (Yim et al. 2015). Unhappy childhood is also a predictor (Ramchandani et al. 2009). For example, Milgrom et al. (2008) showed a connection between depressive symptoms and low emotional support from own mother. Furthermore, according to McMahon et al. (2005) early adverse family relationship experiences such as poor maternal care were predictors of PPD. Similarly, poor improvement and exacerbation of PPD appears to be associated with poor maternal care of the mother in her childhood (Choi et al. 2013). Specifically, Kauppi et al. (2008) found that depressed mothers (N = 10) committing infanticide had had traumatic experiences in their childhood or in adulthood. The majority of those mothers had felt that their own parents, especially their mothers, were very demanding, rejecting and emotionally unsupportive (Kauppi et al. 2008).

Matthey et al. (2000) found that early adjustment to parenthood among depressed mothers seems to relate to relationships with own mothers in childhood, later adjustment to the couple's functioning and relationship.

#### 2.2.3.9 *Attachment and support from spouse, significant others and society in general*

Adult attachment style is based on early attachment and insecure attachment style may mediate the effect of poor maternal care in childhood to PPD. The original attachment theory is concerned with infant–caregiver bonds, but it has been elaborated and extended to other attachment relationships over the life span, especially between romantic partners (Mikulincer & Shaver 2007, Pietromonaco et al. 2013). During early attachment "an internal working model" develops consisting of expectations about worthiness of self in relation to significant others and the availability and responsiveness of attachment figures (Bretherton 1985, Main et al. 1985). This internalization integrates into the personality and regulates cognitions and emotions such as depression and also directs and motivates behaviours in relationships later in adulthood. It is plausible that the psychosocial changes and stresses in conjunction with the rapid physical shifts of the postpartum period may make women who have experienced childhood unresponsiveness particularly vulnerable to activation of insecure attachment (Vigod & Stewart 2009, Pietromonaco et al. 2013). Insecure attachment styles may contribute to personality vulnerabilities and to lower levels of partner and social support (Kuscu et al. 2008, Wilkinson & Mulcahy 2010, Gauthier et al. 2010, Iles et al. 2011). Adult attachment style may affect PPD both directly, perhaps due to underlying negative cognitions, and via contemporaneous relationship functioning (Yim et al. 2015). According to the review by Yim et al. (2015) a woman's spouse and her own mother emerge as most critical with respect to PPD, whereas evidence is mixed for the roles of friends and other family.

Several studies have reported a connection between insecure attachment, poor support from significant others and PPD. Kuscu et al. (2008) found positive correlations between depressive symptoms and ambivalent and avoidant attachment style. In addition, the lower level of perceived family support and absence of a wider social network predicted depression. Moreover, according to the study by Wilkinson and Mulcahy's (2010), mothers with clinical depression had more insecure adult attachment styles and attachment styles characterized by a negative model of self were associated with more severe depression and poorer quality of relationship with baby and spouse and the perception of less social support. Furthermore, according to the study by Iles et al. (2011), less secure attachment and greater dissatisfaction with partner support were associated with higher levels of PPD. The findings of Gauthier et al. (2010) reveal that self-reported anxious attachment to partner two months after the child's birth is associated with depression three months later. Conversely, self-reported depression two months after the child's birth predicts more anxious attachment to a partner three months later.

Specifically, according to Phillips et al. (2010) depressed mothers (PPD) with a previous depression have more personality vulnerabilities and maternal-specific negative attitudes than mothers with new onset depression (PPD), and non-depressed postpartum mothers with a previous depression have elevated general depression vulnerabilities and lower maternal-specific negative attitude. Furthermore, Asselmann et al. (2016) found

that women with depressive (and comorbid anxiety) disorders prior to pregnancy have unfavourable partnership development during the peripartum period.

Well-known meta-analyses (O'Hara & Swain 1996, Beck 2001) and reviews (Robertson et al. 2004) highlight the importance of poor marital relationship and low social support as a risk factor for PPD. Norhayati et al. (2015) found that poor marital relationship is an important predisposing factor in both developed and developing countries. Similarly, studies have found that lack of social support is an independent predictor of PPD (Norhayati et al. 2015).

According to the Yim et al. (2015), the strongest evidence of the articles reviewed suggests that the quality of a woman's relationships in the perinatal period is associated with her risk of PPD. However, significant effects may diminish after controlling for relevant confounding factors, for example stress and need for support. A good relationship with the spouse may improve the mother's and the infant's well-being (Stapleton et al. 2012). The presence of social support may be a protective factor for PPD (Faisal-Gury et al. 2013). By contrast, weak social support and isolation are detrimental factors (Nielsen et al. 2000, Milgrom et al. 2008, Lanes et al. 2011, Sword et al. 2011, Mohammad et al. 2011, Saleh et al. 2013, Jones & Coast 2013, Rantala et al. 2018). For example, according to Nielsen et al. (2000), Milgrom et al. (2008) and Saleh et al. (2013), single marital status and an unsupportive partner relationship are also associated with PPD.

#### *2.2.3.10 Past and present relationship violence*

Numerous studies have shown that past and present emotional and physical interpersonal violence, including domestic violence, impact on PPD. The associations between PPD and sexual, physical and psychological abuse were reportedly significant in developed countries, in developing countries domestic violence is also a risk factor (Norhayati et al. 2015). According to a systematic review by Ross and Dennis (2009) both substance use and current or past experiences of abuse are associated with an increased risk for PPD. Dennis and Vigod (2013) found in their epidemiological study that significant depressive symptomatology at eight weeks postpartum is associated with childhood physical and sexual abuse, physical and emotional abuse by a partner, a lifetime history of forced sex as well as personal and partner substance use problems. Specifically, according to a meta-analysis by Beydoun et al. (2012) there is a 1.5–2.0-fold increased risk for PPD among women exposed to intimate partner violence (IPV) in adulthood compared to non-exposed women. Moreover, a meta-analysis by Howard et al. (2013) shows that women with probable depression in the postnatal period have experienced partner violence during their lifetime, during the past year and during pregnancy. Also, in their prospective cohort study Ludemir et al. (2010) found that psychological violence during pregnancy perpetrated by an intimate partner is strongly associated with PPD. Even when physical or sexual violence in pregnancy was more likely associated with PPD, this association was substantially reduced after adjustment for psychological violence and confounding factors including age, race,

marital status, years of schooling, employment status, social support, controlling behaviour of partner, communication with partner and a history of mental illness (Ludemir et al. 2010). A multivariate analysis by Faisal-Cury et al. (2013) shows that PPD is strongly associated with present psychological and physical or sexual violence, and less so with past (prenatal or lifetime) IPV.

Experiences of violence seem to predispose the victim to further experiences of violence. Thompson et al. (2006) found that exposure to physical and/or sexual abuse or witnessing IPV as a child was associated with an increased risk of IPV as an adult. Garabedian et al. (2011) suggest that the number of abuse types during childhood (sexual or physical) and in adulthood (IPV and sexual violence by an individual other than an intimate partner) cumulatively increase the risk of PPD. Moreover, Abramsky et al. (2011) found that high SES, secondary education and formal marriage may offer protection against recent IPV.

#### *2.2.3.11 Socioeconomic factors*

According to well-known meta-analyses (O'Hara & Swain 1996, Beck 2001) and a systematic review (Robertson et al. 2004) low SES is tenuously related to PPD. Specifically, family income and the mother's occupation are weak predictors (O'Hara & Swain 1996, Robertson et al. 2004). According to the review by Norhayati et al. (2015) low SES, with its determinants of low education level, low income and unemployment, are related to PPD in developed and developing countries, but many studies have reported opposite findings. Nielsen et al. (2000), Rubertsson et al. (2005), Lanes et al. (2011), Sword et al. (2011), and Saleh et al. (2013) found that socioeconomic factors such as low income, low level of education, unemployment and poor housing are associated with PPD. This corroborates Halbreich's (2005) view according which low SES and poverty are associated with risk of PPD.

Some researchers have studied new onset and recurrent depression in the postpartum period separately. Meltzer-Brody et al. (2017) found that Danish mothers with a low income and little formal education are at an increased risk among new onset postpartum depressed mothers. Moreover, Räisänen et al. (2013) found that low SES and its determinant low occupational status were associated with recurrent depression. Gotlib et al. (1989) differentiate new onset cases of PPD from cases of depression continuing from pregnancy. Women who were depressed during pregnancy were younger and less well-educated than were new onset depressed women, and they had a greater number of children. Moreover, housewives were overrepresented in both groups (Gotlib et al. 1989).

## 2.3 Detection, prevention and treatment of postpartum depression

PPD is often underdiagnosed and it is important to know the reasons of this in order to find better methods. Prevention and treatment should be based on adequate study findings.

### 2.3.1 Detection

Although PPD is common, it is often missed by primary care and obstetric teams, despite the fact that simple reliable detection procedures have been developed (Cooper & Murray 1998, Dennis & Chung-Lee 2006). Up to 80% of women with PPD do not report it and are not diagnosed (Halbreich 2005).

There are many possible reasons why most mothers with PPD remain without diagnosis. Depressed mothers may not feel able to freely disclose their feelings or recognize the symptoms of depression, and they may also lack knowledge about PPD (Dennis & Chung-Lee 2006). Depression itself (e.g. a lack of energy and poor motivation) may prevent the mother from seeking help. Some mothers may face barriers in seeking help (Dennis & Chung-Lee 2006), for example, due to the stigma of mental health problems. They may be afraid that their capacity for motherhood will be doubted. In Finland delays in seeking help and discontinuation of treatment seem to create a barrier to care among young adults such as these mothers (Kasteenpohja et al. 2015). Moreover, there may be a lack of knowledge in maternity care services about the antenatal risks of PPD, and clinically useful screening tools may be poor (Austin & Lumley 2003). It may also be that mothers are not given opportunities and encouragement to talk about their mental health (Mohammad et al. 2011). Finally, mental health services for the treatment of depression may not function efficiently (Kasteenpohja et al. 2015), and the mother may not know enough about the mental health services available. When PPD is the first episode of depression in the mother's life, it may be unexpected and especially difficult for her and the maternity care professionals to identify.

### 2.3.2 Prevention

There is a growing consensus that screening for PPD with adequate support and care has benefits for women and their families (O'Hara & McCabe 2013, Ko et al. 2017). Prevention and treatment should be a part of the care offered by ante- and postnatal clinics and suited to women's varied situations. Collaboration between primary care, obstetric and pediatric clinics is recommended, especially for symptomatic women (Ko et al. 2017).

Preventive programmes can be divided into three categories, universal (all pregnant women), selective (presence of potential risk factors such as primiparity or low SES) and indicated (presence of depressive symptoms but no diagnosis) prevention (O'Hara & McCabe 2013).

Austin et al. (2008) in a Cochrane systematic review concluded that antenatal psychosocial assessment (screening) may increase clinicians' awareness of psychosocial risk, and the routine antenatal psychosocial assessment may by itself lead to improved perinatal mental health. Also, according to a Cochrane systematic review (Dennis & Dowswell 2013) psychosocial and psychological interventions for preventing PPD significantly reduce

the number of women who develop it. Promising interventions include the provision of intensive, professionally-based postpartum home visits and telephone-based peer support (Dennis & Dowswell 2013).

Women with a history of PPD have about a 50% chance of relapse (Kim et al. 2014). Kim et al. (2014) found only one randomized, placebo-controlled trial (N = 22) among pharmacotherapy studies with positive results for prevention of PPD. Recurrence rates were 7% (sertraline group) vs. 50% (placebo group). Kim et al. (2014) suggest that, depending on the severity of the previous depressive episode prevention with antidepressant medication may be indicated. Kim et al. (2014) recommend starting immediately after the delivery. The role of estrogen in the prevention of recurrent PPD has not been rigorously evaluated (Dennis et al. 2008).

### 2.3.3 Treatment

Treatment of PPD consists psychological treatment and pharmacotherapy. Mothers are not always able to make a decision and the role of clinicians is important. According to a survey by Patel and Wisner (2011) 65% of postpartum depressed women themselves decided to seek treatment, of these 55% preferred treatment with medications and counselling, followed by counselling (22%), no treatment (8%), medications (8%), and some were unsure about their preferences (7%).

There are four major approaches to the psychological treatment of PPD: general counselling, interpersonal psychotherapy, cognitive behavioural therapy and psychodynamic therapy (O'Hara & McCabe 2013). These interventions may be individual therapies or group therapies. PPD responds to a variety of treatment modalities, and there is no evidence that one approach to treatment is better than any other (O'Hara & McCabe 2013). Furthermore, there may be an added value in keeping interventions as brief and as focused as possible because depressed mothers of young infants have many demands on their time and energy (O'Hara & McCabe 2013).

Munk-Olsen et al. (2012) in their large Danish study found that women one year after birth received less treatment with antidepressants than women of reproductive age in general population. According to a review by Sharma and Sommerdyk (2013) placebo-controlled randomized data of three trials do not support the notion that antidepressants are efficacious in PPD, although it is possible that they are effective in a subgroup of mothers with narrowly defined unipolar depression. Furthermore, in a Cochrane systematic review (Molyneaux et al. 2014) covering antidepressant treatment in six trials, pooled estimates for response and remission were more promising, and selective serotonin reuptake inhibitors (SSRI) were significantly more effective than placebo for women with PPD. However, the quality of the evidence was assessed to be very low. The conclusion was that more randomized controlled trials are needed with larger sample sizes and longer follow-up, including assessment of the impact on the child and safety of breastfeeding (Molyneaux et

al. 2014). Kim et al. (2014) also suggest that antidepressants are the first line of treatment for women with moderate to severe PPD. Moreover, according to the general treatment guidelines, adjuvant therapy with benzodiazepines, antipsychotics and mood stabilizers may be possible in complicated or treatment resistant cases (Kim et al. 2014).

Opinions about estrogen treatment are mixed. According to a study by Gregoire et al. (1996) estrogen therapy was associated with a greater improvement in depression than placebo among women with severe depression. However, a Cochrane systematic review (Dennis et al. 2008) found that estrogen therapy may be of modest value for the treatment of severe PPD.

Electroconvulsive therapy (ECT) is a treatment of choice in severe PPD. Gressier et al. (2015) reviewed eight studies and eight case reports demonstrated benefits of using ECT in postpartum disorders, especially in depression. It was well tolerated, gave a fast response and was good for breastfeeding. Also, according to a recent Swedish study (Rundgren et al. 2018) in patients with depression (N = 99) with a matched control group the response rate to ECT was higher during the postpartum period than outside it. The most important predictor of response was severity of symptoms.

## 2.4 Conclusions

Identifying PPD is not always easy for mothers or for healthcare professionals (Cooper & Murray 1998, Austin & Lumley 2003, Halbreich 2005, Dennis & Chung-Lee 2006, Mohammad et al. 2011, Kasteenpohja et al. 2015). An extensive variation in the course of depression, symptoms and underlying processes (Halbreich & Karkun 2006) may be a decisive reason why identification is difficult.

Current view is that aetiology and risk factors of PPD are multidimensional and may be biological, psychological and social. The most important biological bases of PPD are genetic vulnerabilities, hormonal dysregulations and inflammatory processes (O'Hara & McCabe 2013, Yim et al. 2015, Serati et al. 2016). There are numerous studies about other risk factors of PPD; the best known are the meta-analyses by O'Hara and Swain (1996) and Beck (2001) and the review by Robertson et al. (2004). The reviews by Norhayati et al. (2015) and Yim et al. (2015) have covered more recent studies comprehensively. According to those meta-analyses and reviews, the risk of PPD is especially high if the mother has had a history of depression or lack of marital and social support. Difficulties and stresses related to pregnancy, delivery, the infant and breastfeeding are also risk factors, but with less convincing evidence. Furthermore, mothers' own adverse childhood experiences, present domestic violence, negative life-events and poor SES are known to be risk factors with mixed findings. Likewise, mother's age and number of births have resulted in contradictory findings about an association with PPD.

Women's vulnerability to PPD is different, some women suffer their first and possibly only depression after childbirth, but for most women depression is recurrent (O'Hara

& Swain 1996, Beck 2001, Robertson et al. 2004, Norhayati et al. 2015). Some studies have found occasional differences between new onset and recurrent depression in the postpartum period. In Finland the only notable study is that by Räisänen et al. (2013), but most have investigated PPD without making a distinction in relation to the course of the depression. Further studies are needed about the course, symptoms and risk factors of depression after childbirth in order to identify women at risk.

Planning corrective interventions entails knowledge of mothers' experiences of maternity care support. It is likewise essential to know about the use made of psychiatric and social services.

# 3 Aims of the Study

1. The first aim of this study was to assess the course of depression, severity of symptoms, the symptom profile including the level of hopelessness and risk factors in order to find out if there are differences between postpartum depressed and non-depressed mothers.
2. The second aim was to assess time of onset, severity of symptoms and symptom profile of PPD in order to find whether new onset depression differs from recurrent depression and whether PPD with depression during pregnancy (DDP) is different from PPD without DDP.
3. The third aim was to assess stress factors and psychosocial resources in order to find out, how mental and physical difficulties during pregnancy and delivery, issues relating to the infant and breastfeeding cessation, negative life events during the previous 12 months, childhood experiences, support in close relationships and SES are associated with PPD, specifically with new onset and recurrent depression.
4 The fourth aim was to assess how emotional support for mothers from maternity care and use of psychiatric and social services are connected with PPD, specifically with new onset and recurrent depression.

# 4 Materials and Methods

The study design was a cross-sectional case-control study. The study protocol was approved by the Ethics Committee of the North Karelian Hospital District Federation of Municipalities (09.06.2003, number 11/253/2003). All participants gave their informed consent to participate in this study prior data collection. The data were treated in confidence and without personal data.

## 4.1 Participants

The study group (depressed mothers) and the control group (non-depressed mothers) each consisted of 104 subjects. Mothers were recruited by primary healthcare nurses at antenatal clinics in the town of Joensuu, eastern Finland during postpartum check-ups. Postpartum check-ups are offered approximately 6–8 weeks after childbirth, in every case within 12 weeks as a condition for being granted the parenthood allowance from the Social Insurance Institution. If depressive symptoms began later (i.e. up to six months after delivery), the mothers could again contact their antenatal clinic nurses. The mothers attended the Obstetric Department of North Karelia Central Hospital, Joensuu, Finland (approximately 1,550 deliveries annually) during pregnancy and for delivery. The antenatal clinics and community-based hospital serve a socioeconomically diverse population. Physicians and nurses working in the antenatal clinics were informed about the study by letter.

If the EPDS score (range: 0–30) (Cox et al. 1987) was ≥10 or there was clinical suspicion of depression, the nurse offered the mother a psychiatric assessment by a psychiatrist at the nearby General Hospital Psychiatric Unit of North Karelia Central Hospital. If the EPDS score was <10 and there was no clinical suspicion of depression, primary healthcare nurses asked whether the mothers would be willing to participate in the study, which included a psychiatric assessment at antenatal clinics, as part of a control group. The nurses gave the mothers the patient information letter about the study and organized for them to attend for psychiatric assessment within approximately two weeks, at times convenient

to the mothers. The mothers had ample time to consider participating in the study. The mothers were evaluated consecutively by a psychiatrist between six weeks and six months after delivery. The psychiatrist also provided information about the study and answered questions if necessary. Attendees with psychotic, addictive and thyroid disorders were excluded from the study. Women aged 18–40 years were included. The study group was collected between 2003 and 2013 and the control group between 2008 and 2010.

## 4.2 Measures

### 4.2.1 Definition of postpartum depression

In this study diagnoses of PPD based on DSM-IV, and the diagnosis of MDE were made by means of the SCID-I (APA 2000, First et al. 2002). For this study all nine symptoms (the entry criteria "depressed mood" and/or "loss of interest" and seven associated symptoms) were assessed in the depressed and non-depressed group. This procedure (i.e. an adaptation of the usual SCID procedure) allows comparisons of all symptoms between groups.

### 4.2.2 Course, time of onset, severity and symptoms of postpartum depression

Previous depressive episodes were assessed by asking if the mothers had had depression lasting for at least two weeks (i) without connection to pregnancy or the postpartum period, (ii) during pregnancy, (iii) during previous pregnancies and (iv) whether they had had previous PPD in the period up to six months after a previous delivery. The time period of depression was in line with DSM-IV (APA 2000).

Onset of PPD was elicited by asking how long after the delivery the depression began. This was reported in weeks after the delivery.

Severity of depression was evaluated with number of MDE-positive symptoms in the SCID-I interview (APA 2000, First et al. 2002), with self-report measurements the 10-item EPDS (range: 0–30) (Cox et al. 1987) and the 21-item BDI-21 (range: 0–63) (Beck et al. 1961). Specifically, the level of hopelessness was assessed with self-report inventory, the 20-item Beck Hopelessness Scale (BHS-20, range: 0–20) (Beck et al. 1974). This scale is sensitive to changes in the patient's state of depression (Beck et al. 1974).

Mental symptoms were assessed with symptoms of the SCID-I interview for MDE (depressed mood and/or loss of interest/pleasure, increased or decreased appetite, sleep disturbance, psychomotor agitation or retardation, decreased energy, feelings of worthlessness or guilt, low concentration and suicidal ideation) (APA 2000, First et al. 2002), and with a psychiatric self-report inventory, the 90-item Symptoms Checklist 90 (SCL-90) (Derogatis et al. 1973). This 90-item scale is scored using a 5-point scale from never to extremely, and measures symptom intensity on nine different subscales, including

somatization, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism. The SCL-90 is capable of differentiating healthy and mentally ill subjects and its discriminant validity has been shown to be good in Finnish population (Holi et al. 1998). High intercorrelations were found between the nine original subscales. However, the checklist is not capable of distinguishing between different diagnostic groups (Derogatis et al. 1973, Holi et al. 1998).

### 4.2.3 Sociodemographic factors, obstetric history and risk factors

The mothers were evaluated by the psychiatrist using a semi-structured and partly structured interview designed to identify risk factors relating to pregnancy, delivery, the infant, breastfeeding, negative life events during the previous 12 months from psychiatrist's assessment, childhood experiences, level of support and SES (Table 2). The age of the infant was taken to be the time from date of birth to date of the examination.

Table 2. Questionnaire and categorizations of sociodemographic variables, obstetric history and risk factors

| Questions | Responses | Categorization |
|---|---|---|
| How old are you? | number | continuous |
| How many children you have? | number | continuous |
| How many (i) gestations, (ii) births (iii) spontaneous abortions, (iv) induced abortions, and (v) stillbirths have you had? | number | continuous |
| What is your marital status? | single, divorced, widowed, married, cohabiting | single: single, widowed, divorced;<br>intimate relationship: married, cohabiting |
| What is your employment status? | housewife, unemployed, farmer, blue-collar worker, white-collar worker, executive, self-employed person, student or pensioner | housewife: housewife;<br>unemployed: unemployed;<br>employed: farmer, blue-collar worker, white-collar worker, executive, self-employed person;<br>student: student;<br>pensioner: pensioner |
| Was your pregnancy wanted or unwanted? | yes, cannot say, no | wanted: yes;<br>unwanted: cannot say, no |
| Have you had other mental symptoms than depression during pregnancy and what were these symptoms? | yes; no<br>if yes: what | yes: i) fears, ii) miscellaneous;<br>no |
| Have you had a complicated pregnancy and what were the complications? | yes; no<br>if yes: what | yes: i) hyperemesis, ii) pregnancy complications, iii) infertility treatment;<br>no |

| | | |
|---|---|---|
| Did you have a complicated delivery and what were the complications? | yes; no<br>if yes: what | yes: i) pain, ii) miscellaneous;<br>no |
| What was method of the delivery? | vaginal delivery, elective section, emergency section | vaginal delivery;<br>elective section;<br>emergency section |
| Did the infant have symptoms or illnesses, and what were they? | yes; no<br>if yes: what | yes: i) infantile colic, ii) foetal abnormalities, iii) miscellaneous;<br>no |
| Are you breastfeeding? | yes; no | yes; no |
| Have you experienced negative life events during the last 12 months and what were they? | yes; no<br>if yes; what | yes; i) death of significant others, ii) sickness (own or significant others), iii) relationship problems, iv) socioeconomic problems;<br>no |
| How was your relationship (i) with your mother, and (ii) your father, and (iii) how was the relationship between your parents during your childhood? | good, fairly good, fairly poor, poor | good: good, fairly good;<br>poor: poor, fairly poor |
| Have you experienced (i) sexual abuse, (ii) physical family violence in childhood? | yes; no | yes; no |
| Did you experience corporal punishment during your childhood? | none, fairly little, quite a lot, a lot | not harsh: none, fairly little;<br>harsh: quite a lot, a lot |
| How is the support and empathy from (i) your spouse, (ii) significant others? | good, fairly good, fairly poor, poor | good: good, fairly good;<br>poor: poor, fairly poor |
| Have you experienced physical violence in your current family or intimate relationship? | yes; no | yes; no |
| What is your basic education? | no primary education, comprehensive school, upper secondary school | no upper secondary school: no primary education, comprehensive school;<br>upper secondary school |
| What is your professional education? | none, short courses, vocational school, university of applied sciences, university | no professional education: none, short courses;<br>professional education: vocational school, university of applied sciences, university |
| How is your (i) economic situation, and (ii) how are your housing conditions | good, fairly good, fairly poor, poor | good: good, fairly good;<br>poor: poor, fairly poor |

Other mental symptoms than depression during pregnancy were classified into two groups (Table 2). Fears were classified into one group, and other mental symptoms were classified into a second, miscellaneous group. This is because fears, especially a fear of childbirth, are specific contributors to PPD (Söderquist et al. 2009, Räisänen et al. 2013).

The pregnancy complications were classified as hyperemesis, miscellaneous and infertility treatment groups (Table 2). Classification was based on the different nature

of these difficulties. Hyperemesis is linked the broad spectrum of mental symptoms and disorders (McCarthy et al. 2014), and infertility treatment (Räisänen et al. 2013, Lynch & Prasad 2014) associates with distress before and during early pregnancy.

Delivery complications were classified as painful labour and miscellaneous complications (Table 2). Categorization was based on the fact that pain is an especially common discomfort during delivery (Norhayati et al. 2015, Eisenach et al. 2008).

The infant symptoms and illnesses were classified as colic, foetal abnormalities and others. Infantile colic is a common burden for mothers (Vik et al. 2009, Kurth et al. 2011) (Table 2). Foetal abnormalities are much rarer and seem to be specific problems for some mothers (Räisänen et al. 2013).

Negative life events were classified as a death of a significant other (own or partner's parents, grandparents, siblings or friends), own or significant other's sickness (husband, parents or siblings), socioeconomic problems (unemployment, problems at work, housing problems, economic hardship or academic difficulties) and problems in close relationships (breakdown of relationship or own or parents' divorce) (Table 2). This categorization loosely resembles that used by Ahluwalia et al. (2001).

### 4.2.4 Emotional support from maternity care professionals, use of psychiatric and social services

Emotional support from maternity care and use of psychiatric and social services were also evaluated using a structured interview (Table 3).

Table 3. Questionnaire and categorizations of professional help

| Question | Responses | Categorization |
|---|---|---|
| What kind of support and empathy have you received from (i) the antenatal clinic, (ii) the maternity hospital? | good, fairly good, fairly poor, poor | good: good, fairly good<br>poor: poor, fairly poor<br>good maternity care support: antenatal clinic and maternity hospital support was good<br>poor maternity care support: antenatal clinic and/or maternity hospital support was poor |
| Have you previously received psychiatric treatment? | yes; no | yes; no |
| Are you currently receiving (i) psychiatric treatment, (ii) help from a social worker? | yes; no | yes; no |

## 4.3 Statistical methods

The data analysis was made using IBM Statistical Package for the Social Sciences (SPSS) statistics (Version 24; Study 1: version 21; Study 3: version 23). The differences between the depressed and non-depressed groups and between subgroups (DDP vs. non-DDP; never depressed, new onset and recurrent depressed) were examined using Pearson's chi-squared test and Fisher's exact test for the categorical variables. A non-parametric Mann–Whitney U test was used for continuous variables when continuous variables were not normally distributed. A p-value of less than 0.05 denoted statistical significance.

The relationships between risk factors and PPD, also in relation to the course of depression, were investigated using logistic regression. The final age-adjusted logistic regression model included six continuous sum variables. The sum variable "pregnancy and delivery issues" (range: 0–4) was based on four questions (each no = 0, yes = 1) about unwanted pregnancy, depression and/or other mental symptoms during pregnancy, complicated pregnancy and complicated delivery including both vaginal delivery and complicated caesarean section. The sum variable "issues relating to the infant and breastfeeding cessation" was assigned values of 0–2. Infant's symptoms and illnesses and breastfeeding cessation were classified as no (0) or yes (1). Negative life events during the previous 12 months were classified as a binary variable (no = 0; yes = 1). "Childhood adverse experiences" (range: 0–6) was based on six questions (each no = 0, yes = 1) about relationships with and between the participant's parents, experiences of violence, sexual abuse and harsh corporal punishment in childhood. The sum variable "poor present support in close relationships" was assigned values of 0–3. Low levels of support from spouse and significant others and current family violence were classified as no (0) or yes (1). Finally, the sum variable "poor SES" had values of 0–4. Questions about secondary-level basic education, professional education, poor housing and economic hardship were classified as no (0) or yes (1).

# 5 Results

## 5.1 Severity of depression, symptoms, sociodemographic factors, obstetric history and risk factors among depressed and non-depressed mothers

The interviews were conducted 82.9 days (standard deviation (SD) 33.5) after delivery in the depressed group and 80.2 days (SD 19.3) in the non-depressed group ($p = 0.36$).

Table 4 shows the comparisons between the depressed and non-depressed groups according to the severity of symptoms and symptom profile (Table 4; in Article 1 Table 1). In the depressed group all nine symptoms of major depression in the SCID interview were significantly more common than in the non-depressed group. Moreover, all nine subscales of the SCL-90 were more symptomatic in the depressed group. The depressed group reported significantly more symptoms of depression in the SCID interview and had higher EPDS and BDI scores than the non-depressed group. In addition, the BHS score was higher in the depressed group.

Table 4. Severity of depression and symptoms in the depressed and non-depressed group

| | Depressed group N = 104 | | Non-depressed group N = 104 | | |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | p-value |
| Severity of depressive symptoms: | | | | | |
| Number of symptoms[1] | 6.54 | 1.29 | 0.29 | 0.72 | <0.001[2] |
| EPDS score | 17.59 | 4.08 | 3.53 | 3.20 | <0.001[2] |
| BDI score | 22.22 | 7.95 | 4.08 | 3.17 | <0.001[2] |
| BHS score | 7.69 | 4.50 | 1.98 | 1.91 | <0.001[2] |
| SCL-90 subscales: | | | | | |
| Somatization | 2.18 | 0.71 | 1.38 | 0.36 | <0.001[2] |
| Obsessive-compulsive | 2.75 | 0.63 | 1.46 | 0.41 | <0.001[2] |
| Interpersonal sensitivity | 2.38 | 0.73 | 1.23 | 0.30 | <0.001[2] |
| Depression | 3.21 | 0.60 | 1.43 | 0.40 | <0.001[2] |
| Anxiety | 2.35 | 0.73 | 1.17 | 0.24 | <0.001[2] |
| Hostility | 2.36 | 0.73 | 1.34 | 0.36 | <0.001[2] |
| Phobic anxiety | 1.91 | 0.76 | 1.08 | 0.18 | <0.001[2] |
| Paranoid ideation | 1.86 | 0.67 | 1.16 | 0.26 | <0.001[2] |
| Psychoticism | 1.68 | 0.52 | 1.06 | 0.14 | <0.001[2] |
| Symptoms of major depressive episode in SCID interview: | n | % | n | % | p-value |
| Depressed mood | 93 | 89.4 | 5 | 4.8 | <0.001[3] |
| Loss of interest/pleasure | 86 | 82.7 | 4 | 3.8 | <0.001[3] |
| Increased or decreased appetite | 34 | 32.7 | 1 | 1.0 | <0.001[3] |
| Sleep disturbance | 68 | 65.4 | 1 | 1.0 | <0.001[3] |
| Psychomotor agitation or retardation | 80 | 76.9 | 4 | 3.8 | <0.001[3] |
| Decreased energy | 97 | 93.3 | 5 | 4.8 | <0.001[3] |
| Worthlessness/feelings of guilt | 90 | 86.5 | 5 | 4.8 | <0.001[3] |
| Poor concentration | 80 | 76.9 | 7 | 6.7 | <0.001[3] |
| Suicidal ideation | 26 | 25.0 | 0 | 0 | <0.001[3] |

[1] Number of symptoms of major depressive episode in SCID interview.

[2] Mann-Whitney U test.

[3] Pearson's chi-squared test. EPDS = Edinburgh Postnatal Depression Scale. BDI = Beck Depression Inventory. BHS = Beck Hopelessness Scale. SCL-90 = 90-item Symptom Checklist. SD = standard deviation.

Sociodemographic factors and obstetric history are presented in Table 5. Mother were significantly younger in depressed than non-depressed group, they were more often single and unemployed.

Risk factors including stress factors and psychosocial resources are also presented in Table 5. Unwanted pregnancy and mental difficulties during pregnancy were more common in the depressed than the non-depressed group. By and large there were no differences between groups with regard to complicated pregnancy. However, hyperemesis was significantly more common in the depressed than the non-depressed group. Furthermore, complicated delivery – specifically pain – was significantly more common.

Infants suffering from symptoms and illnesses, especially from infantile colic, were more common in the depressed than in the non-depressed group, likewise breastfeeding

cessation (Table 5). Furthermore, negative life events during the previous 12 months, – specifically relationship problems – were more common.

Adverse experiences during childhood, except physical violence, were more common in the depressed group than in the control group (Table 5). Likewise, poor support in close relationships, physical family violence and indicators of low SES were more common.

Nevertheless, there were no differences between groups in relation to the method of delivery (depressed/non-depressed: vaginal delivery 87 (83.7%) vs. 90 (86.5%), p = 0.56, elective section 7 (6.7%) vs. 10 (9.6%), p = 0.45, and emergency section 10 (9.6%) vs. 4 (3.8%), p = 0.10).

Table 5. Sociodemographic factors, obstetric history and risk factors in the depressed and non-depressed group

| | **Depressed group N = 104** | | **Non-depressed group N = 104** | | |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | p-value |
| Age of infant (days) | 82.9 | 33.51 | 80.2 | 19.25 | 0.356[6] |
| Age of mother (years) | 27.4 | 5.31 | 29.6 | 4.06 | 0.002[6] |
| Number of children | 1.7 | 0.89 | 1.8 | 0.90 | 0.670[6] |
| Number of gestations | 2.0 | 1.25 | 2.1 | 1.24 | 0.684[6] |
| | n | % | n | % | p-value |
| First child | 53 | 51.0 | 48 | 46.2 | 0.488[7] |
| Previous spontaneous abortion | 23 | 22.1 | 18 | 17.3 | 0.383[7] |
| Previous induced abortions | 7 | 6.7 | 9 | 8.7 | 0.603[7] |
| Previous stillbirth | 0 | | 0 | | |
| Single | 12 | 11.5 | 1 | 1.0 | 0.002[7] |
| Housewife | 14 | 13.5 | 10 | 9.6 | 0.385[7] |
| Employed | 49 | 47.1 | 75 | 72.1 | <0.001[7] |
| Unemployed | 16 | 15.4 | 5 | 4.8 | 0.011[7] |
| Student | 25 | 24.0 | 14 | 13.5 | 0.0517 |
| Unwanted pregnancy | 21 | 20.4 | 6 | 5.8 | 0.002[7] |
| Depression during pregnancy | 44 | 42.3 | 5 | 4.8 | <0.001[7] |
| Mental symptoms during pregnancy excl. depression | 35 | 33.7 | 12 | 11.5 | <0.001[7] |
| (i) Fears | 11 | 10.6 | 3 | 2.9 | 0.027[7] |
| (ii) Miscellaneous[1] | 27 | 26.0 | 9 | 8.7 | 0.001[7] |
| Complicated pregnancy | 50 | 48.1 | 44 | 42.3 | 0.403[7] |
| (i) Hyperemesis | 15 | 14.4 | 4 | 3.8 | 0.008[7] |
| (ii) Pregnancy complications[2] | 42 | 40.4 | 41 | 39.4 | 0.887[7] |
| (iii) Infertility treatment | 1 | 1.0 | 4 | 3.8 | 0.366[8] |

| | | | | | |
|---|---|---|---|---|---|
| Complicated delivery | 46 | 44.7 | 31 | 29.8 | 0.031[7] |
| (i) Pain | 20 | 19.2 | 7 | 6.7 | 0.007[7] |
| (ii) Miscellaneous[3] | 27 | 26.0 | 24 | 23.1 | 0.629[7] |
| Infant's symptoms and illnesses | 32 | 30.8 | 14 | 13.5 | 0.003[7] |
| (i) Infantile colic | 17 | 16.3 | 6 | 5.8 | 0.015[7] |
| (ii) Foetal abnormalities | 5 | 4.8 | 4 | 3.8 | 1.000[8] |
| (iii) Miscellaneous[4] | 10 | 9.6 | 4 | 3.8 | 0.097[7] |
| Breastfeeding cessation | 40 | 38.5 | 18 | 17.3 | 0.001[7] |
| Negative life events during the previous 12 months | 47 | 45.2 | 27 | 26.0 | 0.004[7] |
| (i) Death of significant others | 13 | 12.5 | 12 | 11.5 | 0.831[7] |
| (ii) Sickness (own or significant other's) | 16 | 15.4 | 8 | 7.7 | 0.083[7] |
| (iii) Relationship problems | 17 | 16.3 | 5 | 4.8 | 0.007[7] |
| (iv) Socioeconomic problems | 8 | 7.7 | 4 | 3.8 | 0.234[7] |
| Poor relationship with mother in childhood | 17 | 16.3 | 5 | 4.8 | 0.007[7] |
| Poor relationship with father in childhood | 35 | 33.7 | 14 | 13.5 | 0.001[7] |
| Poor relationship between parents | 56 | 53.8 | 31 | 29.8 | <0.001[7] |
| Sexual abuse in childhood | 13 | 12.5 | 1 | 1.0 | 0.001[7] |
| Harsh corporal punishment in childhood | 16 | 15.4 | 3 | 2.9 | 0.002[7] |
| Physical violence in childhood home | 28[5] | 27.2 | 18 | 17.3 | 0.087[7] |
| Poor spousal support | 21 | 20.2 | 3 | 2.9 | <0.001[7] |
| Poor support from significant others | 16 | 15.4 | 0 | 0 | <0.001[7] |
| Physical family violence | 8[5] | 7.8 | 1 | 1.0 | 0.019[8] |
| No upper secondary school | 49 | 47.1 | 29 | 27.9 | 0.004[7] |
| No professional education | 37 | 35.6 | 6 | 5.8 | <0.001[7] |
| Poor economic situation | 37 | 35.6 | 16 | 15.4 | 0.001[7] |
| Poor housing conditions | 16[5] | 15.5 | 1 | 1.0 | <0.001[7] |

[1] Anxiety, panic, obsessions, insomnia, fatigue, tearfulness, sensitivity, psychosomatic symptoms, headache, and loss of appetite.

[2] Pain, diabetes mellitus, anaemia, toxaemia, pre-eclampsia, hepatogestosis, pruritus, premature contractions, infection, vaginal bleeding, and small-for-date infant.

[3] No contractions, lengthy labour, instrumental delivery, excessive bleeding, infection, emergency section, and fatigue.

[4] Eating problems, breathing problems, infections, and allergy.

[5] n = 103.

[6] Mann-Whitney U test.

[7] Pearson's chi-squared test.

[8] Fisher's exact test. SD = standard deviation.

## 5.2 Time of onset, severity and symptoms of postpartum depression in relation to the course of depression

The depressed mothers had a history of previous depression more frequently than the non-depressed mothers (85/104 (81.7%) vs. 32/104 (30.8%), p < 0.001). The same applies to history of DDP, history of depression during previous pregnancies, history of previous PPD and history of previous depression without any connection to pregnancy or the postpartum period (Table 6). Eighty-five per cent (85.2%; 23/27) of depressed mothers and 42.9% (3/7) of non-depressed mothers had histories of both PPD and depression outside the postpartum period (p = 0.037). Sixty-nine per cent (69.2%: 72/104) of non-depressed mothers had no previous depressions.

Table 6. Previous depression in the depressed and non-depressed group

| History of depression | Depressed group | | Non-depressed group | | |
|---|---|---|---|---|---|
| | n | % | n | % | p-value[1] |
| Depression during pregnancy | 44/104 | 42.3 | 5/104 | 4.8 | <0.001 |
| Depression during previous pregnancy, mothers with previous pregnancies | 13/53 | 24.5 | 3/57 | 5.3 | 0.004 |
| Previous postpartum depression, mothers with previous childbirth | 27/51 | 52.9 | 7/55 | 12.7 | <0.001 |
| Previous depression without connection to pregnancy or delivery | 69/104 | 66.3 | 26/104 | 25.0 | <0.001 |

[1] Pearson's chi-squared test.

### 5.2.1 Time of onset

Forty-six per cent (46.2%) of the depressed mothers were depressed within 1.5 weeks, 74.0% within four weeks, 83.7% within six weeks and 98.1% within three months of childbirth. All the PPD diagnoses were set within 22 weeks of childbirth. Mothers with a history of DDP were more often depressed within 1.5 weeks of childbirth than those without such a history (Table 7). There were no differences between these groups later. No differences were found in the time elapsing between the new onset and recurrent depression (Table 7).

Table 7. Time from childbirth to onset of depression in relation to the course of depression

| Time of onset | New onset depression n = 19 | | Recurrent depression n = 85 | | | No history of depression during pregnancy n = 60 | | Depression during pregnancy n = 44 | | | All depressed mothers N = 104 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | p-value | n | % | n | % | p-value | n | % |
| 0–1.5 weeks | 9 | 47.4 | 39 | 45.9 | 0.906[1] | 22 | 36.7 | 26 | 59.1 | 0.023[1] | 48 | 46.2 |
| 2–4 weeks | 7 | 36.8 | 22 | 25.9 | 0.335[1] | 18 | 30.0 | 11 | 25.0 | 0.574[1] | 29 | 27.9 |
| 4.5–6 weeks | 0 | 0 | 10 | 11.8 | 0.202[2] | 8 | 13.3 | 2 | 4.5 | 0.185[2] | 10 | 9.6 |
| 6.5–13 weeks | 2 | 10.5 | 13 | 15.3 | 0.733[2] | 10 | 16.7 | 5 | 11.4 | 0.447[1] | 15 | 14.4 |
| 3.5–22 weeks | 1 | 5.3 | 1 | 1.2 | 0.333[2] | 2 | 3.3 | 0 | 0 | 0.507[2] | 2 | 1.9 |

[1] Pearson's chi-squared test.

[2] Fisher´s exact test.

### 5.2.2 Severity and symptoms

Table 8 shows the severity of depressive symptoms according to previous episodes of depression.

The mean number of MDE symptoms, the BDI score and the BHS score were higher in a recurrent depressive episode than in the new onset episode, and similarly higher among those with history of DDP than among those without. The EPDS score was statistically significantly lower for the new onset episode.

There is a wide variety in the SCL-90 scores as regards previous episodes of depression (Table 8). Of the SCL-90 subscale scores, somatization, interpersonal sensitivity, hostility and psychoticism were higher in a recurrent depressive episode than in the new onset episode and among those with history of DDP than among those without. The SCL-90 depression and anxiety scores were higher among those with history of DDP than among those without.

Increased or decreased appetite, sleep disturbance and suicidal ideation as symptoms of depression were more common in a recurrent depressive episode than in the new onset episode (Table 8). Worthlessness/feelings of guilt were more common among those with history of DDP than among those without (Table 8).

Table 8. Severity of depressive symptoms, Symptom Checklist -90 scores and prevalence of symptoms of a major depressive episode in relation to the course of depression

| | New onset depression n = 19 | | Recurrent depression n = 85 | | | No history of depression during pregnancy n = 60 | | Depression during pregnancy n = 44 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | p-value | Mean | SD | Mean | SD | p-value |
| Severity of depressive symptoms: | | | | | | | | | | |
| Number of symptoms[1] | 5.58 | 0.61 | 6.75 | 1.31 | <0.001[2] | 6.28 | 1.18 | 6.89 | 1.37 | 0.024[2] |
| EPDS score | 15.32 | 4.22 | 18.09 | 3.90 | 0.012[2] | 17.02 | 3.99 | 18.36 | 4.12 | 0.137[2] |
| BDI score | 17.03 | 6.27 | 23.38 | 7.85 | 0.001[2] | 19.97 | 6.98 | 25.29 | 8.52 | 0.001[2] |
| BHS score | 5.52 | 3.47 | 8.17 | 4.58 | 0.016[2] | 6.42 | 4.13 | 9.42 | 4.45 | 0.001[2] |
| SCL-90 subscales: | | | | | | | | | | |
| Somatization | 1.88 | 0.54 | 2.25 | 0.73 | 0.033[2] | 2.06 | 0.65 | 2.35 | 0.77 | 0.042[2] |
| Obsessive-compulsive | 2.63 | 0.60 | 2.78 | 0.63 | 0.363[2] | 2.65 | 0.65 | 2.89 | 0.56 | 0.099[2] |
| Interpersonal sensitivity | 1.98 | 0.59 | 2.47 | 0.73 | 0.008[2] | 2.18 | 0.64 | 2.65 | 0.78 | 0.002[2] |
| Depression | 2.97 | 0.64 | 3.26 | 0.59 | 0.074[2] | 3.09 | 0.60 | 3.38 | 0.57 | 0.025[2] |
| Anxiety | 2.13 | 0.57 | 2.40 | 0.75 | 0.159[2] | 2.21 | 0.69 | 2.55 | 0.73 | 0.012[2] |
| Hostility | 2.03 | 0.59 | 2.43 | 0.74 | 0.034[2] | 2.22 | 0.69 | 2.54 | 0.75 | 0.028[2] |
| Phobic anxiety | 1.80 | 0.62 | 1.94 | 0.79 | 0.710[2] | 1.80 | 0.70 | 2.07 | 0.84 | 0.080[2] |
| Paranoid ideation | 1.61 | 0.60 | 1.91 | 0.68 | 0.071[2] | 1.77 | 0.65 | 1.98 | 0.69 | 0.096[2] |
| Psychoticism | 1.44 | 0.37 | 1.73 | 0.54 | 0.023[2] | 1.60 | 0.50 | 1.79 | 0.54 | 0.037[2] |
| Symptoms of major depressive episode in SCID interview: | n | % | n | % | p-value | n | % | n | % | p-value |
| Depressed mood | 16 | 84.2 | 77 | 90.6 | 0.418[4] | 54 | 90.0 | 39 | 88.6 | 1.000[4] |
| Loss of interest/ pleasure | 15 | 78.9 | 71 | 83.5 | 0.738[4] | 50 | 83.3 | 36 | 81.8 | 0.840[3] |
| Increased or decreased appetite | 2 | 10.5 | 32 | 37.6 | 0.023[3] | 16 | 26.7 | 18 | 40.9 | 0.126[3] |
| Sleep disturbance | 6 | 31.6 | 62 | 72.9 | 0.001[3] | 35 | 58.3 | 33 | 75.0 | 0.078[3] |
| Psychomotor agitation or retardation | 16 | 84.2 | 64 | 75.3 | 0.552[4] | 32 | 72.7 | 32 | 72.7 | 0.384[3] |
| Decreased energy | 18 | 94.7 | 79 | 92.9 | 1.000[4] | 54 | 90.0 | 43 | 97.7 | 0.234[4] |
| Worthlessness/ feelings of guilt | 14 | 73.7 | 76 | 89.4 | 0.128[4] | 48 | 80.0 | 42 | 95.5 | 0.023[3] |
| Poor concentration | 12 | 63.7 | 68 | 80.0 | 0.136[4] | 43 | 71.7 | 37 | 84.1 | 0.137[3] |
| Suicidal ideation | 1 | 5.3 | 25 | 29.4 | 0.038[4] | 14 | 23.3 | 12 | 27.3 | 0.647[3] |

[1] Number of symptoms of major depressive episode in SCID interview.

[2] Mann-Whitney U test.

[3] Pearson's chi-squared test.

[4] Fisher's exact test. EPDS = Edinburgh Postnatal Depression Scale. BDI = Beck Depression Inventory. BHS = Beck Hopelessness Scale. SCL-90 = 90-item Symptom Checklist. SD = standard deviation.

## 5.3 Risk factors: Stress factors and psychosocial resources in relation to the course of depression

Risk factors in relation to the course of depression are presented in Table 9. Unwanted pregnancy, mental symptoms other than depression during pregnancy, breastfeeding cessation, poor relationship with father, poor relationship between parents in childhood and poor housing conditions were more common among mothers with new onset depression than among never-depressed mothers (Table 9).

Unwanted pregnancy, depression and other mental symptoms during pregnancy, complicated delivery, infant's symptoms and illnesses, breastfeeding cessation and negative life events during previous 12 months were more common among mothers with recurrent depression than among never-depressed mothers (Table 9). Additionally, poor relationship with mother, with father and between parents, sexual abuse and harsh corporal punishment, physical violence in childhood home, poor support from spouse and significant others, low level of education, economic hardship and poor housing were more common. Lack of professional education was more common among recurrently depressed mother than new onset depressed mother.

Table 9. Risk factors among mothers with new onset, recurrent or no depression during the postpartum period

| | Mothers with new onset depression n = 19 | | Mothers with recurrent depression n = 85 | | Never-depressed mothers n = 72 | | New onset depressed vs. newer-depressed mothers | Recurrent depressed vs. never-depressed mothers | New onset depressed vs. recurrent depressed mothers |
|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | p-value | p-value | p-value |
| Unwanted pregnancy | 4 | 21.1 | 18 | 20.2 | 2 | 2.8 | 0.016[4] | 0.001[3] | 1.000[4] |
| Depression during pregnancy | 0 | 0 | 44 | 51.9 | 0 | 0 | - | <0.001[3] | <0.001[3] |
| Mental symptoms during pregnancy excl. depression | 6 | 31.6 | 29 | 34.1 | 6 | 8.3 | 0.016[4] | <0.001[3] | 0.832[3] |
| Complicated pregnancy | 10 | 52.6 | 40 | 47.1 | 30 | 41.7 | 0.392[3] | 0.498[3] | 0.660[3] |
| Complicated delivery | 9 | 47.4 | 37 | 44.0 | 20 | 27.8 | 0.103[3] | 0.035[3] | 0.761[3] |
| Infants symptoms and illnesses | 6 | 31.6 | 26 | 30.6 | 9 | 12.5 | 0.077[4] | 0.007[3] | 0.933[3] |
| Breastfeeding cessation | 8 | 42.1 | 32 | 37.6 | 9 | 12.5 | 0.007[4] | <0.001[3] | 0.718[3] |
| Negative life events | 6 | 31.6 | 41 | 48.2 | 19 | 26.2 | 0.652[3] | 0.005[3] | 0.187[3] |
| Poor relationship with mother in childhood | 1 | 5.3 | 16 | 18.8 | 1 | 1.4 | 0.376[3] | <0.001[3] | 0.188[4] |
| Poor relationship with father in childhood | 9 | 47.4 | 26 | 30.6 | 6 | 8.3 | <0.001[4] | 0.001[3] | 0.162[3] |
| Poor relationship between parents | 13 | 68.4 | 43 | 50.6 | 14 | 19.4 | <0.001[3] | <0.001[3] | 0.159[3] |
| Sexual abuse in childhood | 0 | 0 | 13 | 15.3 | 1 | 1.4 | 1.000[4] | 0.002[3] | 0.119[4] |
| Harsh corporal punishment in childhood | 1 | 5.3 | 15 | 17.6 | 0 | 0 | 0.209[3] | <0.001[3] | 0.293[4] |
| Physical violence in childhood home | 5[1] | 27.8 | 23 | 27.1 | 9 | 12.5 | 0.144[4] | 0.024[3] | 1.000[4] |
| Poor spousal support | 3 | 15.8 | 18 | 21.2 | 2 | 2.8 | 0.060[3] | 0.001[3] | 0.758[4] |
| Poor support from significant others | 1 | 5.3 | 15 | 17.6 | 0 | 0 | 0.209[4] | <0.001[3] | 0.293[4] |
| Physical family violence | 1 | 5.3 | 7[2] | 8.3 | 1 | 1.4 | 0.376[4] | 0.070[4] | 1.000[4] |
| No upper secondary school | 7 | 36.8 | 42 | 49.4 | 17 | 23.6 | 0.244[3] | 0.001[3] | 0.321[3] |
| No professional education | 3 | 15.8 | 34 | 40.0 | 4 | 5.6 | 0.156[4] | <0.001[3] | 0.046[3] |
| Poor economic situation | 4 | 21.1 | 33 | 38.8 | 10 | 13.9 | 0.480[4] | <0.001[3] | 0.144[3] |
| Poor housing conditions | 3 | 15.8 | 13[2] | 15.5 | 1 | 1.4 | 0.028[4] | 0.002[3] | 1.000[4] |

[1] n = 18.

[2] n = 84.

[3] Pearson's chi-squared test.

[4] Fisher's exact test.

According to the age-adjusted multivariate logistic regression model (Table 10), mental and physical problems during pregnancy and delivery, poor present support in close relationships and low SES were associated with PPD. Mental and physical problems during pregnancy and delivery and inadequate relationships including abuse in childhood were associated with both the risk of new onset depression and the risk of recurrent depression when compared to the group with never-depressed mothers. Nevertheless, poor present support and low SES were associated only with the risk for recurrent depression. Among mothers with PPD, low SES was associated with recurrent depression when compared to new onset depression.

Table 10.Risk of having postpartum depression according to multivariate logistic regressions in relation to the course of depression

| | Depressed vs. non-depressed mothers N = 101/N = 104 | | | Mothers with new onset depression vs. never-depressed mothers n = 18/n = 72 | | | Mothers with recurrent depression vs. never-depressed mothers n = 83/n = 72 | | | Mothers with recurrent depression vs. new onset depressed mothers n = 83/n = 18 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | p-value | OR | 95% CI | p-value | OR | 95% CI | p-value | OR | 95%CI | p-value |
| Pregnancy and delivery issues[1] | 2.47 | 1.60-3.82 | <0.001 | 3.57 | 1.37-9.34 | 0.009 | 3.88 | 2.01-7.48 | <0.001 | 1.56 | 0.82-2.95 | 0.173 |
| Issues relating infant and breastfeeding cessation[2] | 1.46 | 0.82-2.61 | 0.200 | 2.33 | 0.84-6.48 | 0.105 | 1,49 | 0.67-3.32 | 0.332 | 0.65 | 0-29-1.48 | 0.306 |
| Negative life events during the previous 12 months (no vs. yes) | 1.40 | 0.65-3.03 | 0.387 | 0.53 | 0.11-2.53 | 0.426 | 1.42 | 0.52-3.90 | 0.491 | 1.66 | 0.51-5.37 | 0.395 |
| Childhood adverse experiences[3] | 1.27 | 0.96-1.70 | 0.099 | 2.56 | 1.41-4.68 | 0.002 | 1.60 | 1.02-2.50 | 0.039 | 0.95 | 0.66-1.34 | 0.755 |
| Poor present support in close relationships[4] | 4.52 | 1.49-13.72 | 0.008 | 1.20 | 0.15-9.34 | 0.864 | 4.19 | 1.09-16.19 | 0.038 | 1.12 | 0.40-3.12 | 0.828 |
| Poor socioeconomic status[5] | 2.83 | 1.66-4.83 | <0.001 | 1.67 | 0.53-5.30 | 0.380 | 4.85 | 2.17-10.87 | <0.001 | 2.39 | 1.15-4.96 | 0.019 |

Model is adjusted for age.

[1] The sum variable (range: 0–4) was based on four questions about unwanted pregnancy, depression and/or other mental symptoms during pregnancy, complicated pregnancy, and complicated delivery.

[2] The sum variable (range: 0–2) was based on two questions about infant's symptoms and illnesses and breastfeeding cessation.

[3] The sum variable (range: 0–6) was based on six questions about relationships with mother, with father and between parents, sexual abuse, corporal punishment and physical violence in the family.

[4] The sum variable (range: 0–3) was based on three questions about spousal support, support from significant others, and current physical family violence.

[5] The sum variable (range: 0–4) was based on four questions about secondary-level basic education, professional education, economic hardship, and housing conditions. OR = odds ratio. CI = confidence interval.

## 5.4 Emotional support from maternity care professionals, use of psychiatric and social services

Table 11 (in Article 3 Table 5) shows emotional support from maternity care professionals and use of psychiatric and social services. In total, 22.1% of mothers with PPD and 9.6% of the non-depressed mothers reported having received poor support from maternity care professionals. Mothers with PPD attended psychiatric and social services more often than mothers in the non-depressed group. They had also made more previous use of attended psychiatric services. Depressed mothers with recurrent depression had more often attended and were currently attending psychiatric services more often than mothers with new onset depression. Thirty-six per cent (36.4%: 20/55) of mothers with PPD who had previously attended psychiatric services had a current contact there. Twenty-three per cent (23.1%: 24/104) of mothers with PPD had a current contact with social services and there were no statistically significant differences according to history of depression.

Table 11. Support from maternity care professionals and attendance at psychiatric and social services in mothers with postpartum depression, specifically new onset and recurrent depression

| | Depressed mothers N = 104 | | Non-depressed mothers N = 104 | | | Mothers with new onset depression n = 19 | | Mothers with recurrent depression n = 85 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | p-value | n | % | n | % | p-value |
| Poor support from maternity care professionals | 23 | 22.1 | 10 | 9.6 | 0.014[1] | 5 | 26.3 | 18 | 21.2 | 0.760[2] |
| Previous attendance at psychiatric services | 55 | 52.9 | 23 | 22.1 | <0.001[1] | 1 | 5.3 | 54 | 63.5 | <0.001[1] |
| Present attendance at psychiatric services | 26 | 25.0 | 3 | 2.9 | <0.001[1] | 1 | 5.3 | 25 | 29.4 | 0.038[2] |
| Present attendance at social services | 24 | 23.1 | 10 | 9.6 | 0.005[1] | 2 | 10.5 | 22 | 25.9 | 0.229[2] |

[1] Pearson's chi-squared test. [2] Fisher's exact test.

Mental and physical difficulties during pregnancy and delivery (OR 2.59, 95%CI 1.27–5.26, p = 0.009) and low SES (OR 2.03, 95%CI 1.07–3.82, p = 0.030) were associated with attendance at social services in mothers with PPD after adjustment for age. Issues relating to the infant and breastfeeding cessation, negative life events during previous 12 months, childhood adverse experiences and poor present support were not associated. There were no association with those variables and with present attendance at psychiatric services in mothers with PPD.

# 6 Discussion

According to this study PPD is not a homogenous disorder. It is usually connected with a history of previous depression, but a subgroup of women suffers from new onset depression during the postpartum period. Over eighty per cent of mothers were depressed within six weeks, during the puerperium period. The time of onset of PPD does not differ between new onset and recurrent depression. It is, however, more common during the first ten days with DDP than without. The severity of PPD and hopelessness are more severe in recurrent depression than in new onset depression, recurrent depression is also more symptomatic. It must be noted that interpretation of differences between subgroups must be made with caution because of the small sample size.

Mental and physical difficulties during pregnancy and delivery, poor present support in close relationships and low SES are associated with PPD. Specifically, of particular importance are unwanted pregnancy, depression, fears and other mental symptoms during pregnancy, hyperemesis, pain during delivery, infantile colic and problematic relationships.

It seems that mental and physical problems during pregnancy and delivery and inadequate relationships including abuse in childhood are associated with both new onset and recurrent depression after childbirth. Furthermore, for recurrent depression, poor present support and low SES also are risk factors. Low SES as a risk factor for recurrent depression is highlighted. Negative life events during previous 12 months and issues relating to infant's symptoms and illnesses and breastfeeding cessation were not associated with PPD, nor with subgroups, in the multivariate model. Their importance as risk factors is less than that of the others. The risk of recurrent depression is independently associated with more risk factors than is the risk of new onset depression. This means that a recurrent episode may result from less severe exposure to stress than the first lifetime episode, which is in line with the kindling hypothesis (Post 1992).

Emotional support from maternity care professionals is insufficient to prevent PPD. However, only a quarter of depressed mothers attended psychiatric services and a quarter attended social services. This is highlighted by the fact that those mothers who had their first lifetime depression were mostly not receiving psychiatric care.

## 6.1 Course, time of onset, severity and symptoms of postpartum depression

This study, like several other studies (O'Hara & Swain 1996, Beck 2001, Robertson et al. 2004, Viguera et al. 2011, Räisänen et al. 2013, Wisner et al. 2013) found that history of depression including DDP and earlier PPD, is common (81.7%) with PPD. In the present study history of PPD is often (23/27; 85.2%) connected with episodes of depression outside the postpartum period. The question of whether the first episode (18.3%) denotes the beginning of a recurrent depressive disorder should be addressed in a follow-up study.

### 6.1.1 Time of onset

In this study 46.2% of the mothers stated that the onset of depression occurred within the first ten days after childbirth. This is the baby blues period (APA 2000, O'Hara 2009). Onset of depression within ten days after childbirth was more common (59.1%) among those mothers who had had DDP than among those who had had no DDP. There may have been a recall bias from some mothers who may have been unable to distinguish between symptoms of the baby blues and the beginning of an MDE. Furthermore, it can be assumed that in some mothers depression continues after pregnancy to the postpartum period, and the exact time of onset is difficult to establish. The new DSM-V may take this in account as it states that PPD commonly begins during pregnancy and uses "peripartum onset" as the specifier for MDD occurring during pregnancy or during the first four weeks postpartum (APA 2013). According to the DSM-IV the onset of PPD occurs within four weeks of childbirth (APA 2000). In this study, 74% of mothers had PPD within four weeks. According to the ICD-10 the onset of PPD occurs within six weeks of childbirth (WHO 2016), which is generally defined as the puerperium period, and 84% of depressed mothers had PPD within this period. Furthermore, nearly all (98%) mothers experienced the onset of PPD within three months of childbirth and all of them within 22 weeks. The results of this study are in line with those of earlier studies; for example, according to the study by Kumar and Robson (1984), the incidence of depressive neurosis rose significantly in the first three months after delivery and according to the study by Cox et al. (1993) the highest, threefold incidence of depression was at five weeks of childbirth. In the present study no differences were found in the time of onset between new onset and recurrent depression.

### 6.1.2 Severity and symptoms

In this study the means of the EPDS, BDI and BHS scores were significantly higher among depressed than among non-depressed mothers. The capacity of these scales to differentiate between depressed and non-depressed mothers seems to be good. Not surprisingly, the

number of MDE symptoms was higher among depressed mothers. The severity of depressive symptoms was greater in recurrent depression than in new onset depression. The number of MDE symptoms, BDI score and level of hopelessness were higher in the recurrent episode of depression than in the first depression and in depression with DDP than without DDP. The EPDS score, the specific measure for PPD, worked similarly, with the exception that there were no significant differences between mothers with and without DDP. The results of severity concur with the finding by Horowitz and Goodman's (2004) according which previous depression increased the severity of depression symptoms and the conclusion of Putnam et al. (2015) that the most severe symptoms of PPD were associated with onset of symptoms during pregnancy and moreover, with history of mood disorders.

A new finding is that MDE symptoms vary in relation to the course of depression. MDE symptoms such as depressed mood, loss of interest/pleasure, psychomotor agitation/retardation and decreased energy were equally common in new onset and recurrent depression and in DDP and without DDP. The diagnostic criteria for MDE include depressed mood or loss of interest (APA 2000), and these may occur more often because of the definition of MDE. Changes in appetite, sleep disturbances and suicidal ideations were less prevalent in new onset depression than in recurrent depression. Mothers' feelings of worthlessness were stronger, if they had had DDP than if they had not. There were no other differences between mothers with and without DDP.

An additional new finding is that all subscales of SCL-90 were more symptomatic among depressed than non-depressed mothers and these symptoms varied according to the course of depression. Of course, there may be intercorrelations (Derogatis et al. 1973, Holi et al. 1998). Obsessive-compulsive symptoms, phobic anxiety and paranoid ideation were equally common in all kinds of depression histories. Somatization, interpersonal sensitivity, hostility and psychoticism were higher in the recurrent depression than in new onset depression, and among those with a history of DDP than among who had not. Anxiety was more severe among those with a history of DDP.

According to this study the symptom profile was wide, as shown in the recent literature (Pitt 1968, Wisner et al. 1999, Lindahl et al. 2005, Wenzel et al. 2005, Bernstein et al. 2008, Goyal et al. 2009, Howard et al. 2011, Pope et al. 2013, Miller et al. 2013, Wisner et al. 2013, Farr et al. 2014, Miller et al. 2015). Increased or decreased appetite, sleep disturbances, decreased energy and irritability, which may be difficult to differentiate from healthy women because of the specific features of postpartum period (Swain et al. 1997, Kammerer et al. 2009, Fitelson et al. 2011, Pereira et al. 2014, Williamson et al. 2014), were also common among depressed mothers. This study suggests that these are valid indicators for PPD.

## 6.2 Risk factors: Stress factors and psychosocial resources

Mothers were younger in the depressed than in the non-depressed group. They were more often single and unemployed. Because of data source in this study mothers were 18-40 years old, and the result is not fully representative. Previous studies have yielded mixed findings in relation to age (Norhayati et al. 2015) as a risk factor. Single marital status was associated in several studies with PPD (Beck 2001, Halbreich 2005), in Finland only with recurrent depression (Räisänen et al. 2013). Unemployment was associated in many studies with PPD, but there are also opposite findings (Norhayati et al. 2015). In this study were no differences in relation to the obstetric history, although some previous studies have reported a connection between prior pregnancy losses and PPD (Giannandrea et al. 2013, Robertson-Blackmore et al. 2011, Chojenta et al. 2014, Räisänen et al. 2013).

### 6.2.1 Mental and physical difficulties during pregnancy and delivery

According to the multivariate model in this study, mental and physical difficulties during pregnancy and delivery associated with PPD, likewise with new onset and recurrent depression.

Unwanted pregnancy and an indifferent attitude to pregnancy were connected significantly to PPD, which concurs with the findings of several studies (Beck 2001, Robertson et al. 2004, Norhayati et al. 2015, Gauthreaux et al. 2017). Specifically, unwanted pregnancy was connected with new onset and recurrent depression. An unwanted pregnancy may change the mother's life substantially due to socioeconomic changes, be a stressful experience and further impact negatively on motherhood (Warner et al. 1996, Beck 2001, Saleh et al. 2013).

Moreover, depression and other mental symptoms during pregnancy were significant risk factors for PPD. Specifically, mental symptoms during pregnancy were connected with new onset and recurrent depression. The association between PPD and psychiatric disorders and distresses during pregnancy has been found in numerous studies (O'Hara & Swain 1996, Nielsen et al. 2000, Beck 2001, Robertson et al. 2004, Milgrom et al. 2008, Söderquist et al. 2009, Mohammad et al. 2011, Giri et al. 2015, Norhayati et al. 2015). In the present study, fears were highlighted and these were connected widely to current life, not only to childbirth as is usual (Söderquist et al. 2009, Räisänen et al. 2013).

Pregnancy-related complications are generally potential risk factors for PPD (O'Hara & Swain 1966, Josefsson et al. 2002, Kozhimannil et al. 2009, Räisänen et al. 2013, Giri et al. 2015, Norhayati et al. 2015, Meltzer-Brody et al. 2017, Ruohomäki et al. 2018), but in this study only hyperemesis was a specific complication connected with PPD. Not surprisingly, hyperemesis has been associated in many other studies with depression, anxiety and other mental health difficulties (Josefsson et al. 2002, Robertson et al. 2004, McCarthy et al.

2014). It may also be an effect of hormonal changes or somatization of pregnancy-related anxiety and depression (Josefsson et al. 2002).

According to the present study complicated delivery, specifically pain during delivery, was connected to PPD. Moreover, complicated delivery was connected to recurrent depression. Other studies (Robertson et al. 2004, Räisänen et al. 2013, Saleh et al. 2013, Norhayati et al. 2015) have reported diverse results regarding the link between delivery complications and PPD. In this study caesarean section (elective or emergency) was equally common among depressed and non-depressed mothers, which concurs with several earlier studies (Robertson et al. 2004, Norhayati et al. 2015). Perhaps pain during delivery is a more plausible explanation for depression than the method of delivery (Robertson et al. 2004, Eisenach et al. 2008, Norhayati et al. 2015). The result is in contrast to the wide register-based study by Räisänen et al. (2013), according which caesarean section was a predisposing factor for PPD, specifically among those with first lifetime depression.

### 6.2.2 Infant's symptoms and illnesses and breastfeeding cessation

According to this study, infant's symptoms and illnesses were significantly connected to PPD like previous studies (McGrath et al. 2008, Vigod et al. 2010, Britton 2011, Räisänen et al. 2013, Norhayati et al. 2015) showed, specifically with recurrent depression. These difficulties may trigger depression in mothers who are predisposed to depression. This may be connected to the fact that mothers who experience stress in childcare (Thome 2000, Beck 2001, Yim et al. 2015) and who lack childcare knowledge (Norhayati et al. 2015) are at risk of developing PPD. Worries about infant's health are suggested to be a powerful predictor of postpartum depressive symptoms (Thome 2000). According to the present study, the main cause of PPD was infantile colic with uncontrolled crying, which has been observed in many other studies (Howell et al. 2005, 2006, Vik et al. 2009, Kurth et al. 2011, Radesky et al. 2013). Infant crying is associated with mother's tiredness and fatigue and may further serve to trigger depressive symptoms (Kurth et al. 2011).

The present study, like many earlier studies (Warner et al. 1996, Hadman & Tamim 2012, Ystrom 2012, Saleh et al. 2013, Figueiredo et al. 2013, Dias & Figueiredo 2015, Norhayati et al. 2015, Pope & Mazmanian 2016), showed that depressed mothers more commonly did not breastfeed. Breastfeeding cessation was connected to both new onset and recurrent depression. This may be because breastfeeding may protect against depression or assist in a speedier recovery from symptoms or conversely, PPD may reduce the rates of breastfeeding (Warner et al. 1996, Hadman & Tamim 2012, Figueiredo et al. 2013, 2014, Pope & Mazmanian 2016). Depressive symptoms may influence breastfeeding outcomes, especially at the point of intention to breastfeed or to discontinue breastfeeding (Pope & Mazmanian 2016). Women who had planned to breastfeed and failed to do so have a higher risk (Borra et al. 2015). The effect of breastfeeding cessation on depression may be mediated

through poor self-esteem due to failed intentions to breastfeed (Warner et al. 1996, Saleh et al. 2013, Borra et al. 2015).

According to the multivariate model in this study, infant's symptoms and illnesses and absence of breastfeeding were not associated with PPD, nor with new onset or recurrent depression. This means that their importance as risk factors is less.

### 6.2.3 Negative life events during previous 12 months

The present study, like several previous studies (O'Hara & Swain 1996, Beck 2001, Robertson et al. 2004, Rubertsson et al. 2005, Yelland et al. 2010, Saleh et al. 2013, Lynch & Prasad 2014, Norhayati et al. 2015, Stone et al. 2015), showed that depressive mothers had had more negative life events during the preceding 12 months than had non-depressed mothers. Specifically, negative life events were connected with recurrent depression. Furthermore, this study emphasized the significance of problematic relationships. Previous problems in relationships may be associated with previous depressions. Furthermore, previous problems in relationships and previous depressions may have a cumulative impact on the risk for PPD. According to the multivariate model in this study negative life events were not associated with PPD, nor with new onset or recurrent depression. This is in line with Yim et al. (2015), who found that this often occurs in controlled multivariate analyses, according Yim et al. (2015) confounding factors may also account for this association. Their importance as a risk factor is in any case less.

### 6.2.4 Experiences in childhood

The present study found that adverse experiences during childhood (poor relationship with mother and/or father, between parents, sexual abuse and harsh corporal punishment) were connected with PPD, as previous studies have extensively suggested (Matthey et al. 2000, Milgrom et al. 2008, Ramchandani et al. 2009, Garabedian et al. 2011, Dennis & Vigod 2013). Moreover, Yim et al. (2015) found in their review that poor maternal and/or paternal care and emotional support during childhood seems to be associated with PPD. Childbirth may act as a trigger for childhood memories and activate insecure attachment and painful emotions like depression (McMahon et al. 2005, Pietromonaco et al. 2013).

According to the multivariate model in this study, childhood adverse experiences associated with new onset and recurrent depression. Specifically, poor relationship with mother's own father and between her parents in childhood were shown to be connected to new onset depression. More adverse experiences in childhood were connected with recurrent depression. In this study harsh corporal punishment and sexual abuse in childhood and physical violence in the childhood home were more common among recurrently depressed mothers than among never depressed mothers. Furthermore,

mothers with recurrent depression had poor relationships with their own mothers – the most significant attachment object during childhood. In line with this Choi et al. (2013) found that poor recovery from PPD was associated with poor maternal care in childhood.

### 6.2.5 Present support in close relationships

In this study poor spousal support, support from significant others and physical family violence associated with PPD and were more common among depressed than among non-depressed mothers which corroborates several previous studies (O'Hara & Swain 1996, Nielsen et al. 2000, Beck 2001, Robertson et al. 2004, Milgrom et al. 2008, Ross & Dennis 2009, Ludemir et al. 2010, Beydoun et al. 2012, Dennis & Vigod 2013, Faisal-Cury et al. 2013, Howard et al. 2013, Saleh et al. 2013, Norhayati et al. 2015). The connection between poor support and PPD may be bidirectional. A low level of support may increase the risk of depression and, conversely, depression may impair the mother's ability to obtain support. Poor support as a risk factor for recurrent depression after childbirth was emphasized. Mothers with recurrent depression had experienced poorer support and empathy from their spouses and significant others than never-depressed mothers, but there were no differences between new onset and never-depressed mothers. Asselmann et al. (2016) likewise found that women with depressive disorders prior to pregnancy had unfavourable partnership development during the peripartum period, and Räisänen et al. (2013) found that single marital status was associated with recurrent depression. Perhaps recurrently depressed mothers have personalities more prone to vulnerabilities (Phillips et al. 2010) or their ability to obtain support is weaker because of their early insecure attachments. Insecure attachment styles may contribute to personality vulnerabilities and to lower levels of partner and social support (Kuscu et al. 2008, Gauthier et al. 2010, Wilkinson & Mulcahy 2010, Iles et al. 2011), and this may lead to depression both directly, perhaps due to underlying negative cognitions, and via contemporaneous relationship functioning (Yim et al. 2015).

### 6.2.6 Socioeconomic status

In the present study low SES was associated with PPD, which concurs with numerous studies (Gotlib et al. 1989, O'Hara & Swain 1996, Nielsen et al. 2000, Beck 2001, Robertson et al. 2004, Rubertsson et al. 2005, Lanes et al. 2011, Sword et al. 2011, Saleh et al. 2013, Norhayati et al. 2015), and with the discussion in Halbreich (2005) according which low SES and poverty are associated with higher risk of PPD. Low SES as a risk factor for recurrent depression after childbirth was highlighted. Depressed mothers seem to have fewer socio-economic resources to cope with the transition to motherhood. They had poor economic situation and poor housing condition more often, and they had less basic education, and

commonly lacked professional education more frequently than did non-depressed mothers. Specifically, these problems were more common in recurrent depression with the exception of housing conditions, which were also poor in new onset depression. Lack of professional education as a specific risk factor for recurrent depression was emphasised. Perhaps the difficulties are cumulative: previous episodes of depression may be an obstacle to education, and later on to a job, good housing and a good financial situation. Gotlib et al. (1989) in their pioneering study found that depressed mothers who were depressed during pregnancy were less well-educated than were new onset depressed mothers. This result concurs with another Finnish study (Räisänen et al. 2013), according to which low occupational status was associated with recurrent depression after childbirth.

## 6.3 Emotional support from maternity care professionals, use of psychiatric and social services

All mothers attended the municipal antenatal clinic and maternity hospital. In spite of these services some mothers were depressed. More often those with PPD (22.1%) than others (9.6%) reported that the support and empathy from the maternity care professionals (antenatal clinic and maternity hospital) was poor. This suggests that emotional caregiving from maternity care professionals is insufficient to prevent PPD. However, only 25.0% of depressed mothers attended psychiatric services and 23.1% used social workers' help. The proportions were only 5.3% and 10.5% of mothers with new onset depression. Among depressed mothers using social services mental and physical problems during pregnancy and delivery and low SES were emphasized. This study found no risk factor for using psychiatric services.

The results of this study are local, but concur with earlier observations; globally PPD is often missed by primary care and obstetric teams and goes untreated (Cooper & Murray 1998, Dennis & Chung-Lee 2006, Halbreich 2005). Those mothers who had their first lifetime depression were mostly not receiving psychiatric care. It may be difficult for health care professionals to identify depressed patients, especially when depression is a patient's first episode. There may be also a lack of knowledge about the antenatal risks of PPD (Austin & Lumley 2003), or psychiatric services may not be functioning efficiently (Kasteenpohja et al. 2015).

## 6.4 Strengths and limitations of the study

The diagnostic interview constitutes a critical strength of the study. The diagnoses of major depressive disorder in the study group and control group were made by the psychiatrist using the Structured Clinical Interview for DSM-IV Axis I Disorders. Using a matched control group is a strength of the study. Furthermore, the depressed group and the control

group represent the same socioeconomically diverse population. Mothers attended the same obstetric clinic, and the health services were stable during the sampling time.

The limitations of this study include the retrospective self-report of previous depressions and childhood. There may be a recall bias in some mothers; for example, reporting depressive episodes seems to diminish with time (Patten et al. 2012). Furthermore, experiences of life events, pregnancy, delivery, support, SES and the infant were reported subjectively. Mothers may downplay or exaggerate their responses according to their beliefs and perceptions, while in the midst of a depressive episode their thoughts may be negative about the self, others and the environment (Beck 1976). Moreover, it is possible that mothers do not recognize their symptoms and disorders. In this study duration and severity of variables were not precisely identified. There may also be intercorrelations between several variables. A threat to internal validity is also the fact that the sampling time was longer in the depressed than in the control group. Furthermore, the use of a convenience sampling method limits the generalizability to the broader population. We could only study mothers who accepted an invitation from the primary health care nurses to attend a psychiatric interview, and we did not evaluate those who did not want to participate. The cross-sectional nature of this study limits the assessment of causality. The small sample size limited the statistical power in the subgroups of mothers. The small number of cases increased the risk for type II statistical error in some analyses, so true differences may not have been detected. In some logistic analyses the results should be interpreted with caution because of the wide confidence intervals. A further limitation is the fact that the psychiatrist conducting the structured/semi-structured interviews was not blind to the mothers' depression status.

However, the results of the study are quite similar to those of previous global studies in relation to the course of depression, symptoms and risk factors, and generalization to broader population in Finland may be possible. The results regarding care are local, but in line with those of previous studies, and may be to some extent generalizable.

# 7 Summary and Conclusions

## 7.1 Main findings

1. PPD is not a homogenous disorder. The course of depression, time of onset, symptoms and severity of depression vary. Recurrent depression was common, over eighty per cent of postpartum depressed mothers had had previous depressions. Nearly half of depressed mothers were depressed within the baby blues period and this was usually connected with depression during pregnancy. Over eighty per cent of mothers were depressed within six weeks, during the puerperium period. The symptom profile includes in addition to MDE symptoms somatization, obsessive-compulsive symptoms, interpersonal sensitivity, anxiety, phobic anxiety, hostility, paranoid ideation and psychoticism. Recurrent depression was more serious and symptomatic than new onset depression and the level of hopelessness was higher.
2. Mental and physical problems during pregnancy and delivery, poor present support in close relationships and low SES were associated with PPD. Specifically, pregnancy and delivery issues and inadequate relationships with parents including abuse in childhood were associated with new onset and recurrent depression during the postpartum period. For recurrent depression, poor present support in close relationships and low SES were also risk factors. Low SES was highlighted as a risk factor for recurrent depression.
3. Some mothers – more often those with PPD (22%) than others (10%) – considered the emotional support from the professional maternity caregivers to be insufficient. Moreover, only a quarter of depressed mothers attended psychiatric and a quarter social services. The corresponding proportions were only 5% and 10% of mothers with new onset depression.

## 7.2 Clinical implications

It is important as regards all maternity care contacts to assess PPD in all mothers, those who have had previous episodes of depression and who have not, and to offer opportunities for extra contacts.

Depression may begin soon after delivery or later, up to five months. All mothers should be screened within approximately six weeks of childbirth. The EPDS score and BDI score are appropriate screening instruments. In addition, it is important to pay attention to feelings of hopelessness and diversity of symptoms. Of course, MDE symptoms are important, but symptoms of SCL-90 (somatization, obsessive-compulsive symptoms, interpersonal sensitivity, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism) should also be taken into account because they may be connected to PPD.

To be able to detect, prevent and care for PPD it is necessary to discuss the mother's actual stresses and difficulties with her. Pregnancy planning, mental symptoms, especially depression and fears and physical complications during pregnancy and delivery should be considered. It is important to handle hyperemesis and delivery pain well. It is especially important to provide support in caring for babies with colic, expert support to women experiencing difficulties with breastfeeding, and to take negative life events, specifically relationship problems, empathically into account.

An awareness of psychosocial risk factors might be of help in detection, prevention and care. It is important to talk empathically with mothers about childhood adversities, specifically about relationships with mother, father and between parents; about sexual abuse and harsh corporal punishment. It is important to take into account a level of support from the spouse and significant others, physical violence in the family, a level of education, economic hardship and poor housing, and organize help suited to mothers' varied situations.

Present support from maternity care services is insufficient to prevent depression in the postpartum period. According to this study most mothers, specifically those with new onset depression did not receive psychiatric treatment. More depressed mothers should be referred to psychiatric services. Furthermore, when there are socioeconomic difficulties, the help of social service should be considered.

Care needs to be well organized for good clinical practice. In addition to health and social care professionals, political decision-makers should be aware of these issues when planning programmes to help families.

## 7.3 Suggestions for further studies

In light of the findings of this study, several suggestions for further studies can be made:

1. Longitudinal research is needed in order to learn more about the course of PPD. This would also yield more information as to whether depression constitutes an entity in its own right, a specific depression only after delivery. For better evidence, diagnostic interviews are needed instead of rating scales. To use multiple measures of depression is useful in order to eliminate biases.
2. It would be useful in future studies to assess co-morbidities of PPD by diagnostic interview. In this study, symptoms were assessed extensively, but not co-morbidity. Co-morbidity may explain different symptoms and be related to aetiology. For example, depression with and without co-morbidities may be valuable to assess. Moreover, a longitudinal study design in relation to the course of depression would yield more information about type and aetiology of depression.
3. More information about present care of PPD is needed when planning the care in specific organizations. A survey study may be a solution. In the antenatal clinic the easiest way is to measure mothers' depressive symptoms with EPDS and ask about received support and other treatments.
4. Moreover, an intervention study based on this study could be carried out in the antenatal clinic. The procedure could be a case-control study with the study group as the intervention group while a control group would be offered normal care. A supportive intervention might consist of 1–2 visits during pregnancy and 1–2 visits after delivery. Mothers' mental status and risk factors should be discussed and the help need should be arranged, for example emotional support, socioeconomic help and psychiatric help. After supportive interventions depression should be evaluated, for example, at a postpartum follow-up examination.

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# 10 Original Publications

# PUBLICATION I

**Is postpartum depression a homogenous disorder: time of onset, severity, symptoms and hopelessness in relation to the course of depression**

Pirjo Kettunen, Eeva Koistinen and Jukka Hintikka

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RESEARCH ARTICLE Open Access

# Is postpartum depression a homogenous disorder: time of onset, severity, symptoms and hopelessness in relation to the course of depression

Pirjo Kettunen[1*], Eeva Koistinen[2] and Jukka Hintikka[3,4]

## Abstract

**Background:** Postpartum depression (PPD) is a common illness, but due to the underlying processes and the diversity of symptoms, some variability is exhibited. The risk of postpartum depression is great if the mother has previously suffered from depression, but there is some evidence that a certain subgroup of women only experience depression during the postpartum period.

**Methods:** The study group consisted of 104 mothers with postpartum major depression and a control group of 104 postpartum mothers without depression. The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) was used for data collection. The severity of depression and other mental symptoms were assessed using several validated rating scales.

**Results:** A history of past depression (82%), including depression during pregnancy (42%) and during the postpartum period (53%), was very common in those with current PPD. Eighteen per cent of mothers with current PPD had previously not had any depressive episodes and four per cent had experienced depression only during the postpartum period. Therefore, pure PPD was rare. The onset of PPD was usually (84%) within six weeks of childbirth. Obsessive-compulsive symptoms, phobic anxiety, paranoid ideation, depressed mood, diminished pleasure/interest, decreased energy, and psychomotor agitation/retardation were common with all kinds of depression histories. Pure PPD was the most similar to the first depressive episode. Nevertheless, the severity of depression, the level of hopelessness, somatisation, interpersonal sensitivity, anxiety, hostility, psychoticism, sleep disturbance, and suicidal ideation were lower, appetite changed less, and concentration was better than in other recurrent depressions.

**Conclusions:** According to this study, PPD is not a homogenous disorder. The time of onset, severity, symptoms, level of hopelessness, and the course of depression vary. Recurrent depression is common. All mothers must be screened during the sixth week postpartum at the latest. Screening alone is not effective; it is also important to give mothers information about PPD and to discuss the symptoms with them in order for them to recognise this disorder and possible new episodes in the future.

**Keywords:** Postpartum depression, Pregnancy, Delivery, Depression, Symptoms, Hopelessness, General population

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## Background

Depressive symptoms are among the most frequent psychiatric manifestations observed in women after childbirth. In their meta-analysis, O Hara and Swain [1] found an average prevalence rate of 13% and a variation depending on the methods of assessment and time of onset after childbirth. A systematic review by Gavin et al. [2] suggested that 19.2% of women suffer from major or minor depression (7.1% for major depression alone) during the first three months postpartum, and the prevalence varies from 6.5% to 12.9% (1.0% to 5.6% for major depression) during the postpartum year. However, Halbreich and Karkun [3] found that an average prevalence of 10  15% for postpartum depression (PPD) is not representative of the actual global prevalence due to the variability of the underlying processes and the diversity of symptoms. The postpartum period is unique with respect to psychosocial adjustment and the degree of neuroendocrine alterations.

Although PPD is common, it is often missed by primary care teams [4]. Moreover, mothers often face barriers to seeking help, such as an inability to disclose their feelings or to recognise the symptoms of depression; they also lack of knowledge about postpartum depression [5].

It is not easy to differentiate PPD from other psychiatric and non-psychiatric disorders or to separate depressed mothers from healthy mothers. Patterns of appetite, especially loss of appetite [6], fatigue, and disrupted sleep related to infant care may be difficult to distinguish from the symptoms of depression. Sleep disturbances can also lead to negative consequences, such as dysphoric mood and impaired cognitive function, while persistent difficulty with concentration or cognitive tasks is indicative of a mood disorder [7]. Substance abuse and medical causes of psychiatric symptoms, such as thyroid disorders, should also be considered [8]. The  baby blues  is a transient mood disturbance that can affect as many as 70% of new mothers within ten days of delivery. It manifests as tearfulness, irritability, anxiety, and emotional liability, as well as interpersonal hypersensitivity, insomnia, and sometimes elation, but it does not impair function [9,10]. Mothers with a rapid onset of intense mood disturbance, confusion, strange or delusional beliefs, hallucinations, and disorganised behaviour have symptoms of postpartum psychosis, which is most commonly a form of bipolar disorder [11]. Other forms of bipolar I  II disorders should also be considered [12]. Co-morbidity studies suggest that PPD is associated with generalised anxiety disorders, panic disorders, post-traumatic stress disorders, and obsessive-compulsive disorders [13-16]. The incidence of personality disorders among PPD patients is greater than among non-PPD patients, and many symptoms are coloured by these disorders [17].

In different meta-analyses, the following risk factors have been found to have a moderate to strong association with PPD: depression and anxiety during pregnancy, a previous history of depression, stressful life events (including child care-related stressors), a poor marital relationship, and poor social support [1,18,19]. Other risk factors, including a low socioeconomic status, unplanned/unwanted pregnancy, obstetric factors, and difficult infant temperament are less strongly related to PPD [18,19]. The risk for depression is greater if the mother has had psychiatric illnesses before, including illnesses during pregnancy. The risk is especially high if the mother has experienced depression during previous postpartum periods or at other times [1,19-21].

There is some evidence that a subgroup of women have depression only during the postpartum period. Cooper and Murray [22] have compared primiparous women whose PPD was a recurrence of a prior non-postpartum mood disorder with a group of women for whom PPD was their first experience of affective disturbance. The former group was found to be at a greater risk for subsequent non-postpartum depression, whereas the latter group was found to be at a greater risk for subsequent PPD.

Rapid changes in hormonal levels following delivery have been suggested to predispose women to PPD. One might expect that these changes would affect the symptoms, incidence, and type of depression over the perinatal period [23-25].

Depressive symptoms are uncommon during the immediate postpartum period. As observed in a recent study, only 2.5% of women acknowledged symptoms of major depression within the first two days of delivery [26]. The low figure may be caused by the fact that not all the physiological changes have occurred yet and the stress of childcare is yet to come. Incidences of depression increase significantly during the first three months after delivery [20,27,28], and the incidence of depression may be threefold higher five weeks after childbirth [29]. Kumar and Robson [27] found that incidences of depression decreased after six months and that there was no increase at a year after delivery. Depression may last for several months [20,27,29]. The prevalence of depression does not increase during pregnancy. Indeed, depressive episodes are 3.5 times more prevalent during the postpartum period than during pregnancy [2,21].

The symptoms of PPD also vary according to many studies. In her pioneer study, Pitt [30] found that PPD is atypical, either because of the prominence of neurotic symptoms such as anxiety, irritability, somatic symptoms, fatigue, and phobias overshadowing the depression, or because some features are the opposite of those of classical depression. For example difficulties in falling or staying asleep may be common instead of early awakening [31]. Only few of patients exhibited the classical picture of depressive illness with suicidal ideas. Miller et al. [32] found much higher rates of obsessive-compulsive symptoms

among those suffering from PPD than among subjects of population-based studies. Women with postpartum-onset major depression experience disturbing aggressive obsessional thoughts more frequently than women with non-postpartum major depression [33]. Postpartum anxiety symptoms, including somatic and social anxiety and comorbid depression symptoms, have been found to be fairly common: 10 50% of mothers exhibit these symptoms [34,35]. According to Bernstein et al. [36], psychomotor symptoms and impaired concentration/decision-making were prominent in PPD, while women who had depression outside the postpartum period more often reported a sad mood, suicidal ideation, and reduced interest. Prevalence of thoughts of self-harm and suicidal ideation during the postpartum period was between 5% and 14% [37,38].

The mood in a major depressive episode is often described by the person as sad, hopeless, and discouraged [10]. Hopelessness has been identified as one of the core characteristics of depression. A common denomination in depression is a pattern of negative expectations of the future [39]. It is generally supposed that childbirth induces hope and positive expectations of the future. However, many mothers with PPD express hopelessness at a time when one would expect to see joy and hope [40]. Due to this contradiction, more studies are needed on hopelessness among depressed mothers.

Although PPD is common, it is often missed by primary care teams. Moreover, mothers often face barriers to seeking help, such as an inability to disclose their feelings or to recognise the symptoms of depression. It is not easy to differentiate PPD from other psychiatric and non-psychiatric disorders or to separate depressed mothers from healthy mothers. The postpartum period is unique with respect to psychosocial adjustments and the degree of neuroendocrine alterations, and there seems to be variability due to the underlying processes and the diversity of symptoms. The course of depression also seems to be different. In the context of our study, we are interested to learn whether PPD is homogenous according to the course of depression. In addition, we wish to learn more about the time of onset of PPD, its severity, its symptoms, and the level of the hopelessness experienced. The results may have clinically important implications for the detection, screening, and further treatment of this disorder.

The study was designed to assess the course of depression, time of onset, severity of symptoms, the symptom profile, and the level of hopelessness in order to find out:

whether mothers with PPD are different from mothers without PPD in relation to the severity of symptoms, symptom profile, and level of hopelessness;
whether mothers with PPD have experienced more incidences of depression than mothers without PPD;
whether recurrent depression differs from the first depressive episode;
whether PPD with depression during pregnancy (DDP) is different from PPD without DDP;
whether pure PPD (mothers who previously have not had episodes of depression or only PPD) is different from other types of postpartum depression.

## Methods

In Finland, a postpartum examination is offered to all mothers at six weeks after childbirth, after the puerperium [41]. Mothers were screened during this examination by primary care nurses at the antenatal clinic in Joensuu, Eastern Finland, using the Edinburg Postnatal Depression Scale (EPDS-10, range 0 30) [42]. The EPDS has been developed to assist primary care health professionals detect mothers suffering from postnatal depression. If the depressive symptoms of the mothers began later (i.e. up to six months after delivery) they contacted their antenatal clinic s nurse, who assessed their depression using the EPDS. If the EPDS score was ≥ 10 or there was a clinical suspicion of depression, the nurse told the mother that she could be assessed by a psychiatrist (PK) at the local General Hospital Psychiatric unit of the North Karelia Central Hospital in Joensuu. This community-based hospital unit serves a socioeconomically diverse population. All mothers who wanted to attend the psychiatric unit were evaluated by a psychiatrist at six weeks to six months after delivery. Mothers with psychotic, addictive and thyroid disorders were excluded from the study.

Diagnoses of major depressive disorder in the study group (depressed mothers) and the control group (non-depressed mothers) were assessed by a psychiatrist (PK) by means of the Structured Clinical Interview for DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders*, fourth edition) Axis I Disorders (SCID-I) [10,43]. DSM-IV uses the term postpartum onset as a specifier applicable to major depressive disorder, bipolar disorder or brief psychotic disorder occurring over the first four weeks following childbirth [10]. The diagnostic criteria for a Major Depressive Episode (MDE), as defined by the DSM-IV, include five (or more) of the following symptoms: at least two weeks of persistent depressed mood, loss of interest/pleasure, increased or decreased appetite, sleep disturbance, psychomotor agitation or retardation, decreased energy, feelings of worthlessness or guilt, poor concentration, and suicidal ideation. At least one of the symptoms must be either depressed mood or loss of interest. For this study, all nine SCID symptoms the entry criteria (depressed mood and/or loss of interest) and seven associated symptoms were assessed in the depressed and non-depressed group. This procedure (i.e. an adaptation of the usual SCID procedure) allows comparisons of all SCID symptoms between groups.

The groups were asked questions about the onset of depression and experiences of previous depressive episodes as a part of the semi-structured SCID interviews. Previous depressive episodes were assessed by asking whether the mothers had had persistent depression (i) for at least two weeks without connection to their pregnancy or postpartum period, (ii) during pregnancy, (iii) and/or during previous pregnancies, and (iv) whether they had had previous postpartum depression in the period up to six months after delivery. The answers were classified as yes or no. The onset of PPD was assessed by asking how soon after childbirth the depression began. This was reported as weeks after delivery. The mothers were also asked if they had given birth to a living infant or not, and how many children they had.

The severity of depression was rated using the number of MDE-positive symptoms found in the SCID interview, the self-administered 21-item Beck Depression Inventory (BDI-21, range 0 63) [44], and the 10-item EPDS. The level of hopelessness was assessed by the 20-item Beck Hopelessness Scale (BHS-20, range: 0 20) [39].

Mental symptoms were assessed by the 90-item Symptoms Checklist 90 (SCL-90) [45]. The SCL-90 measures symptom intensity on nine different subscales, including somatisation, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. The SCL-90 is capable of differentiating healthy and mentally ill subjects, and its discriminant validity is good in the Finnish population [46]. High intercorrelations were found between the nine original subscales. However, the checklist is not capable of distinguishing between different diagnostic groups [45,46].

The study protocol was approved by the Ethical Committee of the North Karelian Hospital District Federation of Municipalities. All participants gave their informed consent prior to data collection.

The final study group consisted of 104 mothers with a major depressive episode, aged 18 40 years. The participants expressed their willingness to participate in this study. Data collection took place from 2003 to 2013. A control group of non-depressed mothers was collected at the antenatal clinic in Joensuu. If the EPDS score was <10 in postpartum examinations, primary care nurses asked if the mothers were willing to participate in the non-depressed group of mothers and then organised psychiatric evaluation. The final control group consisted of 104 non-depressed mothers, evaluated six weeks to six months after delivery and aged 18 40 years. The control group was collected between 2008 and 2010. Mothers with psychotic, addictive and thyroid disorders were again excluded.

Data analysis was conducted with IBM SPSS (version 21). The differences between the study groups were examined with Pearson s chi-square test and Fisher s exact test for the categorical variables, and the independent samples t-test was used for the continuous variables. If a continuous variable was not normally distributed, the non-parametric Mann Whitney U test was used. The statistical significance of the tests was defined as 0.05. The relationship between previous depression and current PPD was investigated using age-adjusted logistic regression.

**Table 1 Comparisons between the non-depressed and depressed groups according to the severity of depression and symptoms**

| | Non-depressed group n = 104 | Depressed group n = 104 | |
|---|---|---|---|
| | Mean (SD) | Mean (SD) | p-value |
| Severity of depressive symptoms: | | | |
| Number of symptoms[3] | 0.29 (0.72) | 6.54 (1.29) | <0.001[1] |
| EPDS score | 3.53 (3.20) | 17.59 (4.08) | <0.001[1] |
| BDI score | 4.08 (3.17) | 22.22 (7.95) | <0.001[1] |
| BHS score | 1.98 (1.91) | 7.69 (4.50) | <0.001[1] |
| SCL-90 subscales: | | | |
| Somatisation | 1.38 (0.36) | 2.18 (0.71) | <0.001[1] |
| Obsessive-compulsive | 1.46 (0.41) | 2.75 (0.63) | <0.001[1] |
| Interpersonal sensitivity | 1.23 (0.30) | 2.38 (0.73) | <0.001[1] |
| Depression | 1.43 (0.40) | 3.21 (0.60) | <0.001[1] |
| Anxiety | 1.17 (0.24) | 2.35 (0.73) | <0.001[1] |
| Hostility | 1.34 (0.36) | 2.36 (0.73) | <0.001[1] |
| Phobic anxiety | 1.08 (0.18) | 1.91 (0.76) | <0.001[1] |
| Paranoid ideation | 1.16 (0.26) | 1.86 (0.67) | <0.001[1] |
| Psychoticism | 1.06 (0.14) | 1.68 (0.52) | <0.001[1] |
| Symptoms of major depressive episode in SCID interview: | n (%) | n (%) | p-value |
| Depressed mood | 5 (4.8 ) | 93 (89.4) | <0.001[2] |
| Loss of interest/pleasure | 4 (3.8) | 86 (82.7) | <0.001[2] |
| Increased or decreased appetite | 1 (1.0) | 34 (32.7) | <0.001[2] |
| Sleep disturbance | 1 (1.0) | 68 (65.4) | <0.001[2] |
| Psychomotor agitation or retardation | 4 (3.8) | 80 (76.9) | <0.001[2] |
| Decreased energy | 5 (4.8) | 97 (93.3) | <0.001[2] |
| Worthlessness/feelings of guilt | 5 (4.8) | 90 (86.5) | <0.001[2] |
| Poor concentration | 7 (6.7) | 80 (76.9) | <0.001[2] |
| Suicidal ideation | 0 (0.0) | 26 (25.0) | <0.001[2] |

[1]Mann Whitney U test.
[2]Pearson s chi-square test.
[3]Number of symptoms of a major depressive episode in the SCID interview
EBDS = Edinburgh Postnatal Depression Scale, BDI = Beck Depression Inventory, BHS = Beck Hopelessness Scale, SD = standard deviation.

## Results

The depressed mothers were younger than the non-depressed controls (mean 27.4 (SD 5.3) years versus 29.6 (SD 4.1), p = 0.001). The frequency of being the mother of a first living infant was similar in both groups (51.0% and 46.2%, respectively, p = 0.49). All the mothers had given birth to a living infant.

Table 1 shows the comparisons between the non-depressed and depressed groups according to the severity of symptoms and symptom profile. Unsurprisingly, the depressed group reported significantly more symptoms of depression in the SCID interview and higher EPDS and BDI scores than the non-depressed group. In addition, the BHS score was higher among depressed mothers. All nine symptoms of the SCID interview were significantly different. Moreover, they were more symptomatic on all nine subscales of the SCL-90.

The depressed mothers had a history of previous depression more frequently than the non-depressed mothers (85/104 (81.7%) versus 32/104 (30.8%), p < 0.001). The same applies to a history of DDP, a history of depression during previous pregnancies, a history of previous PPD, and a history of previous depression without any connection to pregnancy or the postpartum period (Table 2). Eighty-five per cent (85.2%; 23/27) of depressed mothers with a history of previous PPD and 42.9% (3/7) of non-depressed mothers had a history of both PPD and depression outside the postpartum period (p = 0.037). Four of the depressed mothers and four of the non-depressed mothers had not had any previous depression other than PPD. Twenty-two per cent (22.1%; 23/104) of the mothers had pure PPD, meaning mothers who had previously not had depression (18.3%; 19/104) or had only had PPD (3.8%; 4/104). A history of previous depression without any connection to pregnancy or the postpartum period was as common among mothers with a history of DDP as among other mothers (75.0%; 33/44 versus 60.0%; 36/60, p = 0.110).

The age-adjusted risk of PPD associated significantly with DDP, previous PPD, and a history of depression without any connection to pregnancy or the postpartum period (Table 2).

Forty-six per cent (46.2%) of the depressed mothers were depressed within 1.5 weeks, 74.0% within 4 weeks, 83.7% within 6 weeks and 98.1% within three months of childbirth. All the PPD diagnoses were reached within 22 weeks of childbirth. Mothers with a history of DDP were more often depressed within 1.5 weeks of childbirth than other mothers. There were no differences between these groups later. No differences were found in the time of occurrence between the first and recurrent episodes of depression or between pure and other types of postpartum depression (Table 3).

Table 4 shows the severity of depressive symptoms according to previous episodes of depression. The mean number of MDE symptoms, the BDI score and the BHS score were higher in a recurrent depressive episode than in the first episode, and similarly higher among those who had a history of DDP than among those without such a history. Likewise, the scores were lower in pure PPD than in other types of depression. The EPDS score was statistically significantly lower for the first episode and for pure PPD.

There is a great variety in the SCL-90 scores as regards to previous episodes of depression (Table 5). Of the SCL-90 subscale scores, somatisation, interpersonal sensitivity, hostility, and psychoticism were higher in a recurrent depressive episode than in the first episode, among those who had a history of DDP than among those without such a history, and among those who had had other types of depression than pure PPD. The SCL-90 depression and anxiety scores were higher among those with a history of DDP than among those without such a history and those who had had other types of depression than pure PPD. No differences were found in obsessive-compulsive symptoms, phobic anxiety or paranoid ideation.

The prevalence of the symptoms of a major depressive episode classified according to previous depression is presented in Table 6. Increased or decreased appetite, sleep disturbance, and suicidal ideation as symptoms of

**Table 2 Previous depression in the non-depressed and depressed group and age-adjusted associations for postpartum depression**

| | Non-depressed group n (%) | Depressed group n (%) | p-value | OR | 95% CL | p-value |
|---|---|---|---|---|---|---|
| Depression during pregnancy | 5/104 (4.8%) | 44/104 (42.3%) | <0.001[1] | 14.752 | 2.723 79.936 | 0.002 |
| Depression during previous pregnancy, mothers with previous pregnancies | 3/57 (5.3%) | 13/53 (24.5%) | 0.004[1] | 0.856 | 0.146 5.023 | 0.863 |
| Previous postpartum depression, mothers with previous childbirth | 7/55 (12.7%) | 27/51 (52.9%) | <0.001[1] | 6.124 | 1.831 20.478 | 0.003 |
| Previous depression without connection to pregnancy or delivery | 26/104 (25%) | 69/104 (66.3%) | <0.001[1] | 6.712 | 2.183 20.641 | 0.001 |

[1]Pearsons chi-square test.
OR = odds ratio, CL = confidence limits.

**Table 3 Presence of depression from childbirth according to previous depression**

| | History of previous depressive episode | | | History of depression during pregnancy | | | Pure postpartum depression | | | All depressed mothers |
|---|---|---|---|---|---|---|---|---|---|---|
| | No (n = 19) | Yes (n = 85) | | No (n = 60 ) | Yes (n = 44 ) | | No (n = 81) | Yes (n = 23) | | N = 104 |
| | n (%) | n (%) | p-value | n (%) | n (%) | p-value | n (%) | n (%) | p-value | n (%) |
| 0 1.5 weeks | 9 (47.4) | 39 (45.9) | 0.906[1] | 22 (36.7) | 26 (59.1) | 0.023[1] | 37 (45.7) | 11 (47.8) | 0.855[1] | 48 (46.2) |
| 2 4 weeks | 7 (36.8) | 22 (25.9) | 0.335[1] | 18 (30.0) | 11 (25.0) | 0.574[1] | 22 (27.2) | 7 (30.4) | 0.757[1] | 29 (27.9) |
| 4.5 6 weeks | 0 ( 0.0) | 10 (11.8) | 0.202[2] | 8 (13.3) | 2 (4.5) | 0.185[2] | 9 (11.1) | 1 (4.3) | 0.452[2] | 10 (9.6) |
| 6.5 13 weeks | 2 (10.5) | 13 (15.3) | 0.733[2] | 10 (16.7) | 5 (11.4) | 0.447[1] | 12 (14.8) | 3 (13.0) | 1.000[2] | 15 (14.4) |
| 13.5 22 weeks | 1 (5.3) | 1 (1.2) | 0.333[2] | 2 (3.3) | 0 (0.0) | 0.507[2] | 1 (1.2) | 1 (4.3) | 0.395[2] | 2 (1.9) |

[1]Pearson s chi-square test.
[2]Fisher s exact test.

depression were more common in a recurrent depressive episode than in the first episode, and likewise more common in other types of depression than in pure PPD. Worthlessness/feelings of guilt were more common among those who had a history of DDP than among those without such a history. Finally, poor concentration was significantly more common among other types of depression than pure PPD. No differences were found in depressed mood, loss of interest/pleasure, psychomotor agitation/retardation, or decreased energy.

## Discussion

According to this study, PPD is not a homogenous disorder. It is usually connected with a history of previous depression, but it is also possible that a subgroup of women only suffer from depression during the postpartum period. There are many variations in time of onset, severity, symptoms, and level of hopelessness. This may be due to biological vulnerability or because of other childbirth-specific features that may predispose women to PPD and overshadow the postpartum state.

The present study, like numerous other studies [1,18-21], shows that a previous history of depression including DDP and earlier PPD, is common with PPD. A previous history of PPD is usually connected with episodes of depression outside the postpartum period. The incidence of pure PPD where mothers had experienced no previous depression or only previous PPD was fairly small (22.1%), and the episode was often the first one (18.3%). The question of whether the first episode denotes the beginning of a recurrent depressive disorder should be addressed in a follow-up study.

This study also shows that the BDI, EPDS and BHS scores were significantly different between the mothers suffering from major depression and the non-depressed postpartum mothers. The capacity of these scales to differentiate depressed and non-depressed mothers is good. All nine SCID symptoms and all SCL-90 symptoms were different between the mothers suffering from major depression and the non-depressed postpartum mothers. The symptom profile was wide, as shown by numerous studies [6,30-38]. Increased or decreased appetite, sleep disturbances, and decreased energy, each of which may be difficult to differentiate from healthy women because of postpartum status, other medical reasons and child care stress were also different [6-8]. Many of the symptoms are similar to those of generalised anxiety disorders, panic disorders, post-traumatic stress disorders, obsessive-compulsive disorders, and personality disorders, and co-morbidity may be high between these disorders and PPD [10,13-17].

The baby blues is common during the first ten days after delivery [9,10], and 46.2% of the mothers in the present study stated that the onset of depression occurred within

**Table 4 Severity of depressive symptoms according to previous depression**

| | History of previous depressive episode | | | History of depression during pregnancy | | | Pure postpartum depression | | |
|---|---|---|---|---|---|---|---|---|---|
| | No (n = 19) | Yes (n = 85) | | No (n = 60) | Yes (n = 44) | | No (n = 81) | Yes (n = 23) | |
| | Mean (SD) | Mean (SD) | p-value[2] | Mean (SD) | Mean (SD) | p-value[2] | Mean (SD) | Mean (SD) | p-value[2] |
| Number of symptoms[1] | 5.58 (0.61) | 6.75 (1.31) | <0.001 | 6.28 (1.18) | 6.89 (1.37) | 0.024 | 6.77 (1.32) | 5.74 (0.81) | 0.001 |
| EPDS score | 15.32 (4.22) | 18.09 (3.90) | 0.012 | 17.02 (3.99) | 18.36 (4.12) | 0.137 | 18.10 (3.98) | 15.78 (4.00) | 0.028 |
| BDI score | 17.03 (6.27) | 23.38 (7.85) | 0.001 | 19.97 (6.98) | 25.29 (8.52) | 0.001 | 23.35 (7.84) | 18.24 (7.18) | 0.003 |
| BHS score | 5.52 (3.47) | 8.17 (4.58) | 0.016 | 6.42 (4.13) | 9.42 (4.45) | 0.001 | 8.32 (4.56) | 5.45 (3.54) | 0.006 |

[1]Number of symptoms in SCID interview.
[2]P-values are for Mann Whitney U test.
EPDS = Edinburgh Postnatal Depression Scale, BDI = Beck Depression Inventory, BHS = Beck Hopelessness Scale, SD = standard deviation.

**Table 5 Symptom Checklist-90 scores according to previous depression**

| | History of previous depressive episode | | | History of depression during pregnancy | | | Pure postpartum depression | | |
|---|---|---|---|---|---|---|---|---|---|
| | No (n = 19) | Yes (n = 85) | | No (n = 60) | Yes (n = 44) | | No (n = 81) | Yes (n = 23) | |
| SCL-90 subscales | Mean (SD) | Mean (SD) | p-value[1] | Mean (SD) | Mean (SD) | p-value[1] | Mean (SD) | Mean (SD) | p-value[1] |
| Somatisation | 1.88 (0.54) | 2.25 (0.73) | 0.033 | 2.06 (0.65) | 2.35 (0.77) | 0.042 | 2.27 (0.74) | 1.88 (0.52) | 0.020 |
| Obsessive-compulsive symptoms | 2.63 (0.60) | 2.78 (0.63) | 0.363 | 2.65 (0.65) | 2.89 (0.56) | 0.099 | 2.79 (0.63) | 2.60 (0.60) | 0.202 |
| Interpersonal sensitivity | 1.98 (0.59) | 2.47 (0.73) | 0.008 | 2.18 (0.64) | 2.65 (0.78) | 0.002 | 2.49 (0.73) | 1.97 (0.57) | 0.002 |
| Depression | 2.97 (0.64) | 3.26 (0.59) | 0.074 | 3.09 (0.60) | 3.38 (0.57) | 0.025 | 3.27 (0.59) | 3.00 (0.61) | 0.043 |
| Anxiety | 2.13 (0.57) | 2.40 (0.75) | 0.159 | 2.21 (0.69) | 2.55 (0.73) | 0.012 | 2.43 (0.75) | 2.08 (0.57) | 0.042 |
| Hostility | 2.03 (0.59) | 2.43 (0.74) | 0.034 | 2.22 (0.69) | 2.54 (0.75) | 0.028 | 2.44 (0.74) | 2.05 (0.59) | 0.023 |
| Phobic anxiety | 1.80 (0.62) | 1.94 (0.79) | 0.710 | 1.80 (0.70) | 2.07 (0.84) | 0.080 | 1.96 (0.80) | 1.72 (0.59) | 0.276 |
| Paranoid ideation | 1.61 (0.60) | 1.91 (0.68) | 0.071 | 1.77 (0.65) | 1.98 (0.69) | 0.096 | 1.92 (0.69) | 1.65 (0.58) | 0.084 |
| Psychoticism | 1.44 (0.37) | 1.73 (0.54) | 0.023 | 1.60 (0.50) | 1.79 (0.54) | 0.037 | 1.74 (0.54) | 1.45 (0.36) | 0.015 |

[1]P-values are for the Mann Whitney U test.
SCL-90 = 90-item Symptom Checklist, SD = standard deviation.

this period. Pawar et al. [26] found that only 2.5% of women acknowledged major depression symptoms within the first two days following delivery. In our study, depression during the baby blues period was more common among those who had had DDP than among those who had had no DDP. It can be supposed that in some mothers, depression continues after pregnancy into the baby blues period. It must be noted, however, that the method used in this study was retrospective self-report and the period assessed was longer. There may have been a recall bias from some mothers who may have been unable to differentiate between the symptoms of the baby blues and the beginning of a major depressive episode. According to the DSM-IV, postpartum depression occurs within four weeks of delivery. Seventy-four per cent of our depressed mothers had PPD within that period. The puerperium period is six weeks, and eighty-four per cent of depressed mothers had PPD within that period. Moreover, nearly all (98%) mothers experienced a new episode of depression three months of childbirth and all of them within 22 weeks, respectively. Our results are in line with previous studies [20,27-29].

A new finding is that there were differences in the severity of depressive symptoms according to previous depression. The level of hopelessness was greater and the number of SCID symptoms and the BDI score were lower in the first episode of depression, in depression without DDP and in pure PPD than in other types of depressions. The EPDS score, the specific measure to PPD, was significantly lower in the first depression and in pure PPD.

Adding to the current literature, it can be stated that there was a great variety in symptoms with PPD according to previous episodes of depression. Anxiety and obsessive-compulsive symptoms are common with PPD according to earlier studies [30,32-35]. Obsessive-compulsive symptoms,

**Table 6 Prevalence of symptoms of a major depressive episode according to previous history of depression**

| Symptoms of a major depressive episode in the SCID interview | History of previous depressive episode | | | History of depression during pregnancy | | | Pure postpartum depression | | |
|---|---|---|---|---|---|---|---|---|---|
| | No (n = 19) | Yes (n = 85) | | No (n = 60) | Yes (n = 44) | | No (n = 81) | Yes (n = 23) | |
| | n (%) | n (%) | p-value | n (%) | n (%) | p-value | n (%) | n (%) | p-value |
| Depressed mood | 16 (84.2) | 77 (90.6) | 0.418[1] | 54 (90.0) | 39 (88.6) | 1.000[2] | 73 (90.1) | 20 (87.0) | 0.704[1] |
| Loss of interest/pleasure | 15 (78.9) | 71 (83.5) | 0.738[1] | 50 (83.3) | 36 (81.8) | 0.840[1] | 67 (82.7) | 19 (82.6) | 1.000[1] |
| Increased or decreased appetite | 2 (10.5) | 32 (37.6) | 0.023[2] | 16 (26.7) | 18 (40.9) | 0.126[1] | 31 (38.3) | 3 (13.0) | 0.023[2] |
| Sleep disturbance | 6 (31.6) | 62 (72.9) | 0.001[2] | 35 (58.3) | 33 (75.0) | 0.078[1] | 58 (71.6) | 10 (43.5) | 0.012[2] |
| Psychomotor agitation/retardation | 16 (84.2) | 64 (75.3) | 0.552[1] | 32 (72.7) | 32 (72.7) | 0.384[1] | 62 (76.5) | 18 (78.3) | 0.863[2] |
| Decreased energy | 18 (94.7) | 79 (92.9) | 1.000[1] | 54 (90.0) | 43 (97.7) | 0.234[2] | 75 (92.6) | 22 (95.7) | 1.000[1] |
| Worthlessness/feelings of guilt | 14 (73.7) | 76 (89.4) | 0.128[1] | 48 (80.0) | 42 (95.5) | 0.023[1] | 73 (90.1) | 17 (73.9) | 0.077[1] |
| Poor concentration | 12 (63.7) | 68 (80.0) | 0.136[1] | 43 (71.7) | 37 (84.1) | 0.137[1] | 66 (81.5) | 14 (60.9) | 0.038[2] |
| Suicidal ideation | 1 (5.3) | 25 (29.4) | 0.038[1] | 14 (23.3) | 12 (27.3) | 0.647[1] | 24 (29.6) | 2 (8.7) | 0.041[2] |

[1]Fisher s exact test.
[2]Pearson s chi-square test.

phobic anxiety, and paranoid ideation were common with all kinds of depression histories. The symptoms of pure PPD were very similar compared to the first depression episode and to depression without a history of DDP. Somatisation, interpersonal sensitivity, hostility, and psychoticism were lighter in the first episode of depression than in recurrent episodes of depression and among those without a history of DDP compared to those who had. The same applies to those having pure PPD as opposed to those having other types of depression. In this study, anxiety was less severe among those without a history of DDP and in pure PPD.

An additional new finding is that MDE symptoms vary according to previous episodes of depression. According to previous studies, psychomotor symptoms, decreased energy, changes in appetite, sleep disturbances, poor concentration, and mild suicidal ideation are typical of PPD [6,30,31,36]. In this study, symptoms such as depressed mood, loss of interest/pleasure, psychomotor agitation/retardation, and decreased energy were common with all kinds of histories of depression. The diagnostic criteria for MDE include depressed mood or loss of interest [10], and these criteria may be of a greater importance because of the definition of MDE. Furthermore, changes in appetite, sleep disturbances, and suicidal ideations were less prevalent in the first episode of depression than in recurrent episodes and in pure PPD than in other types of depression. Poor concentration was only significantly less prevalent in pure PPD. If mothers had experienced DDP, their feelings of worthlessness were stronger, which may be a result of negative experiences during pregnancy.

One of the limitations of the present study was the use of a retrospective self-report about depression episodes and their severity, duration, and time of onset. Women may have over- or underestimated their responses in self-report questionnaires according to their beliefs and perceptions. Furthermore, the sample was a convenience sample. We could only evaluate mothers who accepted an invitation by the primary care nurses to attend a general hospital unit because of depressive symptoms. Nevertheless, the depression group and the healthy control group represent the same population. The diagnostic interview constitutes a critical strength of the study. The diagnoses of major depressive disorders in the study group and the control group were assessed by a psychiatrist by means of the Structured Clinical Interview for DSM-IV Axis I Disorders. One limitation is the fact that the psychiatrist (PK) conducting the clinical interviews was not blind to the mothers depression status.

## Conclusions

According to the present study, PPD is not a homogenous disorder, and it is usually connected to a previous history of depression. The time of onset, severity, and level of hopelessness vary according to the course of the depression, and symptom profile is wide. Obsessive-compulsive symptoms, phobic anxiety, paranoid ideation, depressed mood, diminished pleasure/interest, decreased energy, and psychomotor agitation/retardation were common with all kinds of depression histories. Pure PPD was the most similar compared to the first depressive episode. Nevertheless, the severity of depression, level of hopelessness, somatisation, interpersonal sensitivity, anxiety, hostility, psychoticism, changed appetite, sleep disturbance, and suicidal ideation were lower and concentration better than in other types of recurrent depression. The results of the study indicate that it is important for health care services to follow up mothers who have had previous episodes of depression, including DDP and PPD, after delivery. If a mother has had DDP, she needs care already during pregnancy and usually also during the baby blues period. As it is possible that a mother will experience her first depression later, all mothers should be screened within six weeks of childbirth at the latest. Screening alone is not effective; it is also important to pay special attention to feelings of hopelessness and the diversity of symptoms with PPD. Furthermore, it is also important to give mothers information about PPD and to discuss the symptoms with them in order to raise their awareness of this disorder and possible new episodes in the future.

#### Abbreviations

BDI: Beck depression inventory; BHS: Beck hopelessness scale; DDP: Depression during pregnancy; DSM-IV: Diagnostic and statistical manual of mental disorders, fourth edition; EPDS: Edinburg postnatal depression scale; MDE: Major depressive episode; PPD: Postpartum depression; SCID-1: Structured clinical interview; SCL-90: Symptoms checklist 90; SD: Standard deviation; OR: Odds ratio; CL: Confidence limits; SPSS: Statistical package for the social sciences.

#### Competing interests

The authors declare that they have no competing interests.

#### Authors contributions

Authors PK and JH designed the study and wrote the manuscript. PK managed and conducted the statistical analyses and interpreted the data. PK collected the data. EK participated in the conception of the study. All authors contributed to and have approved the final manuscript.

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# PUBLICATION II

**The Connections of Pregnancy-, Delivery-, and Infant-Related Risk Factors and Negative Life Events on Postpartum Depression and Their Role in First and Recurrent Depression**

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*Research Article*

# The Connections of Pregnancy-, Delivery-, and Infant-Related Risk Factors and Negative Life Events on Postpartum Depression and Their Role in First and Recurrent Depression

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*Introduction*. The aim of this study is to assess how negative life events and adverse experiences with pregnancy, delivery, the infant(s), and breastfeeding cessation impact on postpartum depression (PPD), specifically in first lifetime and recurrent depression. *Method*. The study group comprised 104 mothers with a current episode of PPD and a control group of 104 mothers who did not have current PPD. The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) was used for data collection. The course of the depression, adverse experiences, and breastfeeding were assessed by self-reports. *Results*. In age-adjusted multivariate analyses, mental and physical problems during pregnancy or delivery, postpartum problems with the infant and breastfeeding cessation, and negative life events during the previous 12 months were associated with postpartum depression. Eighteen percent (18%) of the mothers had first depression and 82% recurrent depression. Mental and physical problems during pregnancy or delivery were associated with both first lifetime and recurrent depression. Nevertheless, negative life events and infant/breastfeeding issues associated only with recurrent depression. *Conclusion*. Factors associated with pregnancy and delivery have an impact on PPD, but in recurrent depression other postnatal and psychosocial factors are also important risk factors.

## 1. Introduction

The postpartum period is unique with respect to the mother's psychosocial adjustment and the degree of physical changes. For most women, these experiences are constructive and mothers are healthy. Depression after childbirth, however, is common. The prevalence of postpartum depression (PPD) is 10–15% [1, 2]. PPD is usually associated with a previous history of depression also in primiparous women, but a subgroup of women may suffer depression only during the postpartum period [3–5]. There is some evidence that the occurrence of the first lifetime episode of depression during the postpartum period is associated with adverse events during the pregnancy or delivery, or with the infant [3]. Recurrent depressive episodes may have more predisposing factors during pregnancy and also psychosocial risk factors [3]. Stressful life events, adverse experiences before pregnancy, stress during pregnancy and delivery, and strain in infant care in general are connected to postpartum depression [2, 6–8]. Pregnancy and childbirth are often regarded as stressful life events in their own right [8], and childbirth procedures may act as a trigger for previous painful memories. Posttraumatic stress and depression after childbirth seem to be positively associated [9] and share the same underlying vulnerability factors, such as fear of childbirth, stress, and psychological problems [9].

Unplanned or unwanted pregnancy is a predictor of PPD [2, 7, 8]. An unexpected pregnancy may change the mother's life extensively and have social and economic implications; furthermore, difficulties in adjustment to parenthood may be greater if the pregnancy is not planned [7, 10, 11].

Depression and anxiety during pregnancy are significant contributors to PPD [2, 6–9]. Fear of childbirth [3, 9], feelings

of stress [9, 12], and other psychological disorders [6] during pregnancy are also connected to PPD.

Pregnancy and delivery-related (obstetric) complications also cause physical and mental troubles for the mother and comprise a single predictor variable for PPD [2, 6, 8]. Obstetric factors, including pregnancy-related complications such as hyperemesis, preeclampsia, premature contractions and labor, hypertension, headache, pain, anemia, gestational diabetes, diabetes mellitus, and amniocentesis [3, 8, 12–15], as well as delivery-related complications, such as difficult and painful labor, cesarean section, instrumental delivery, premature delivery, and complicated puerperium-like excessive bleeding, have been examined as potential risk factors for PPD [2, 3, 8, 11]. In a recent Finnish study, cesarean section was a strong predisposing factor for PPD, specifically among those who had first lifetime depression [3]. The same study found that preterm birth associated with first lifetime depression, and anemia and gestational diabetes associated with recurrent depression in the postpartum period [3]. According to several studies, hyperemesis is linked with an increased risk for depression, anxiety, and mental health difficulties [16]. Infertility treatment does not increase the risk for PPD [3, 17].

The association between cesarean section and PPD is not simple. It is unclear whether delivery complications or long and painful labors leading to emergency procedures account for the association [8, 18]. Women who wanted vaginal delivery but delivered by cesarean section may be at an increased risk for PPD [19]. Conversely, women who had been diagnosed with a depressive disorder at the time of delivery have been shown to be significantly more likely to have a delivery by cesarean section [20].

Infant-related problems are often very stressful experiences for the mother. Mothers of premature infants, mothers of infants with illnesses/disabilities/distress, mothers of infants that are temperamentally difficult, and mothers who experience strain in childcare and have a lack of childcare knowledge are at risk for developing PPD [2, 3, 7, 15]. The relationship between problems with the infant and the mother's depression is likely to be complex; for example, the interrelationship between preterm birth and PPD may be explained by an interaction of multiple alterations in the labor and delivery processes, poorer-than-expected infant health outcomes, early parental stress, and dysfunctional mother-infant interaction [21, 22]. Specifically, infantile colic as a cause of excessive and prolonged crying is a well-known risk factor for depression [23, 24]. The amount of infant crying is associated with the experience of tiredness and fatigue in new mothers. Incremental exhaustion may trigger depressive symptoms, diminish the mother's ability to concentrate, and burden mother-child interaction [24].

Women who do not or fail to initiate breastfeeding are at risk for developing PPD [2, 10, 11, 25, 26]. The effect of breastfeeding on depression may be mediated by intentions to breastfeed. The risk for PPD may be higher among women who had planned to breastfeed and failed to do so [27]. The relationship between breastfeeding and PPD seems to be reciprocal. Breastfeeding reduces the risk for developing PPD and conversely PPD may decrease the rate of breastfeeding [10, 26, 28].

The relationship between stressful life events and postpartum depression is well known [2, 6, 8]. A number of life events and stressors are connected to PPD [11, 17, 29–31]. The mother's own sickness, the sicknesses or death of a significant other, problematic relationships, socioeconomic problems, and other traumatic experiences seem to be associated with depressive symptoms during the postpartum period [30, 31].

The postpartum period seems to be a time of vulnerability to depression. Ante- and postnatal periods present unique challenges in detecting the risk factors for PPD. The onset of depression may be unexpected, and it is useful to know risk factors for prevention and treatment. Little is known about the possible differences in risk factors for first lifetime and recurrent depression after childbirth. The aim of this study is to assess how pregnancy and delivery issues, issues relating to the infant and breastfeeding cessation, and negative life events associate with postpartum depression. In addition, the study seeks to discover if there are differences in their role between first lifetime depression and recurrent depression during the postpartum period.

## 2. Materials and Methods

The nature of this study is cross-sectional. Both the study group (depressed) and the control group (nondepressed) consisted of 104 mothers evaluated six weeks to six months after delivery. Mothers were recruited by primary health care nurses at antenatal clinics in Joensuu, a town in Eastern Finland, using the Edinburgh Postnatal Depression Scale (EPDS, range: 0–30) [32]. If the EPDS score was ≥10 or there was clinical suspicion of depression, the nurses told the mother that she could be assessed by a psychiatrist (Pirjo Kettunen) at the local General Hospital Psychiatric Unit at North Karelia Central Hospital, Joensuu, Finland. This community-based hospital unit serves a socioeconomically diverse population. Mothers were cared for at the Obstetric Department at the same hospital during pregnancy and delivery (approximately 1,550 deliveries per year). Data collection took place from 2003 to 2013. If the EPDS score was <10 and there was no clinical suspicion of depression, primary health care nurses asked mothers if they were willing to participate in the study as part of the control group and then organized a psychiatric assessment at the antenatal clinics. The control group was collected between 2008 and 2010.

The diagnoses of major depressive disorder in the study group (depressed mothers) and the control group (nondepressed mothers) were assessed by a psychiatrist (Pirjo Kettunen) by means of the Structured Clinical Interview for DSM-IV (*Diagnostic and Statistical Manual of Mental Disorders*, fourth edition) Axis I Disorders (SCID-I) [33]. Attendees with psychotic, addictive, and thyroid disorders were excluded. Women aged 18–40 years were included. The mothers were also evaluated by the psychiatrist (Pirjo Kettunen) using a semistructured interview designed to identify risk factors relating to pregnancy, delivery, the infant, breastfeeding, and life events during the previous year.

Previous depressive episodes were assessed by asking whether the mothers had had depression lasting for

at least two weeks; the time period was in line with DSM-IV [33]. Mothers were also asked how old they were and how many children, gestations, deliveries, spontaneous or induced abortions, and stillbirths they had had.

Mothers were asked about possible risk factors:

(i) *If the pregnancy was wanted or unwanted or if the mother could not say.* Answers were classified as wanted ("yes") or unwanted ("no" or "cannot say").

(ii) *If they had had depression lasting for at least two weeks during pregnancy.* Responses were "yes" or "no."

(iii) *If there had been other mental symptoms than depression during pregnancy and what the symptoms were.* Fears were classified into one group, and other mental symptoms (anxiety, panic, obsessions, insomnia, fatigue, tearfulness, sensitivity, psychosomatic symptoms, headache, and loss of appetite) were classified into a second, miscellaneous group. This categorization is based on the fact that fears, especially a fear of childbirth, are specific contributors to PPD [3, 9].

(iv) *If they had had a complicated pregnancy and what the complications were.* The complications were classified as hyperemesis and miscellaneous pregnancy-related complications (pain, diabetes mellitus, anemia, toxemia, preeclampsia, hepatogestosis, pruritus, premature contractions, infection, vaginal bleeding, and small-for-date infant) and infertility treatment. Classification was based on the different nature of these difficulties. For example, hyperemesis is linked with a broad spectrum of mental symptoms and disorders [16], and infertility treatment [3, 17] associates with distress before and during early pregnancy.

(v) *If they had had a complicated delivery and what the complications were.* The complications were classified as painful labor and miscellaneous complications during delivery (no contractions, lengthy labor, instrumental delivery, excessive bleeding, infection, emergency cesarean section, and fatigue). Categorization was based on the fact that pain is an especially common discomfort during delivery [2, 18]. Mode of delivery (vaginal, elective cesarean section, or emergency cesarean section) was also asked.

(vi) *If the infant has had sicknesses or symptoms and what the sicknesses or symptoms were.* The answers were classified as colic, fetal abnormalities, and others (eating problems, breathing problems, infections, and allergy). Infantile colic is a common burden for mothers [23, 24]. Fetal abnormalities are much rarer and seem to be specific problems for some mothers [3].

(vii) *If they were breastfeeding.* Responses were "yes" or "no."

(viii) *If they had experienced negative life events during the previous 12 months and what these events were.* Negative life events were classified as a death of a significant other (own or partner's parents, grandparents, siblings, or friends), own or significant other's sickness (husband, parents, or siblings), socioeconomic problems (unemployment, problems at work, housing problems, economic hardship, or academic difficulties), and problems in close relationships (breakdown of relationship or own or parents' divorce). This categorization loosely resembles that used by Ahluwalia et al. [34].

The study protocol was approved by the Ethical Committee of the North Karelian Hospital District Federation of Municipalities. All participants gave their informed consent to participate in this study prior to data collection.

Data analysis was carried out with IBM SPSS Statistics (version 22). To assess the differences between the study groups, also in relation to the course of depression, Pearson's chi-squared test and Fisher's exact test were used for the categorical variables and independent samples $t$-test was used for the continuous variables. If a continuous variable was not normally distributed, a nonparametric Mann–Whitney $U$ test was used. A $p$ value less than 0.05 denoted statistical significance. The relationships between risk factors and PPD, also in relation to the course of depression, were also investigated using logistic regression. The final age-adjusted logistic regression model included continuous sum variables "pregnancy and delivery issues" (unwanted pregnancy, depression and/or other mental symptoms during pregnancy, complicated pregnancy, and complicated delivery including both vaginal delivery and complicated cesarean section) and "issues relating infant and breastfeeding cessation" (infant's symptoms and illnesses and breastfeeding cessation). Negative life events during the previous 12 months were classified as a binary variable (no = 0; yes = 1).

## 3. Results

The study group consisted of 104 mothers with a major depressive disorder and a control group of 104 nondepressed mothers.

The mean age of the infants was 82.9 days (standard deviation (SD) 33.5) in the depression group and 80.2 days (SD 19.3) in the nondepressed group ($p = 0.36$). Depressed mothers were younger than nondepressed mothers (mean 27.4 years (SD 5.3) versus 29.6 years (SD 4.1), $p = 0.001$). Fifty-three (51.0%) mothers in the depressed group had delivered their first child, as had 48 (46.2%) mothers in the nondepressed group ($p = 0.49$). No difference was found in the mean number of children (mean 1.7 (SD 0.9) versus 1.8 (SD 0.9), $p = 0.67$, resp.). The mean number of gestations was 2.0 (SD 1.3) in the depressed group and 2.1 (SD 1.2) in the nondepressed group ($p = 0.68$). No participant had had a stillbirth. There were no differences between the groups in regard to the number of mothers with previous spontaneous abortion (23 (22.1%) versus 18 (17.3%), $p = 0.383$) or induced abortion (7 (6.7%) versus 9 (8.7%), $p = 0.60$).

Unwanted pregnancy, depression, fears, and other mental symptoms during pregnancy were significantly more common among the depressed than the nondepressed mothers (Table 1). Pregnancy-related problems were as common in

Table 1: Adverse experiences during the antenatal and postnatal period in the nondepressed and depressed group.

| | Nondepressed group $N = 104$ | | Depressed group $N = 104$ | | $p$ value[5] |
|---|---|---|---|---|---|
| | $n$ | % | $n$ | % | |
| Unwanted pregnancy | 6 | 5.8 | 21 | 20.4 | 0.002 |
| Depression during pregnancy | 5 | 4.8 | 44 | 42.3 | <0.001 |
| Mental symptoms during pregnancy excl. depression | 12 | 11.5 | 35 | 33.7 | <0.001 |
| (i) Fears | 3 | 2.9 | 11 | 10.6 | 0.027 |
| (ii) Miscellaneous[1] | 9 | 8.7 | 27 | 26.0 | 0.001 |
| Complicated pregnancy | 44 | 42.3 | 50 | 48.1 | 0.403 |
| (i) Hyperemesis | 4 | 3.8 | 15 | 14.4 | 0.008 |
| (ii) Pregnancy complications[2] | 41 | 39.4 | 42 | 40.4 | 0.887 |
| (iii) Infertility treatment | 4 | 3.8 | 1 | 1.0 | 0.366[6] |
| Complicated delivery | 31 | 29.8 | 46 | 44.7 | 0.031 |
| (i) Pain | 7 | 6.7 | 20 | 19.2 | 0.007 |
| (ii) Miscellaneous[3] | 24 | 23.1 | 27 | 26 | 0.629 |
| Infant's symptoms and illnesses | 14 | 13.5 | 32 | 30.8 | 0.003 |
| (i) Infantile colic | 6 | 5.8 | 17 | 16.3 | 0.015 |
| (ii) Fetal abnormalities | 4 | 3.8 | 5 | 4.8 | 1.000[6] |
| (iii) Miscellaneous[4] | 4 | 3.8 | 10 | 9.6 | 0.097 |
| Breastfeeding cessation | 18 | 17.3 | 40 | 38.5 | 0.001 |
| Negative life events | 27 | 26.0 | 47 | 45.2 | 0.004 |
| (i) Death of significant others | 12 | 11.5 | 13 | 12.5 | 0.831 |
| (ii) Sickness (own or significant others) | 8 | 7.7 | 16 | 15.4 | 0.083 |
| (iii) Relationship problems | 5 | 4.8 | 17 | 16.3 | 0.007 |
| (iv) Socioeconomic problems | 4 | 3.8 | 8 | 7.7 | 0.234 |

[1]Anxiety, panic, obsessions, insomnia, fatigue, tearfulness, sensitivity, psychosomatic symptoms, headache, and loss of appetite. [2]Pain, diabetes mellitus, anemia, toxemia, preeclampsia, hepatogestosis, pruritus, premature contractions, infection, vaginal bleeding, and small-for-date infant. [3]No contractions, lengthy labor, instrumental delivery, excessive bleeding, infection, emergency section, and fatigue. [4]Eating problems, breathing problems, infections, and allergy. [5]Pearson's chi-square test. [6]Fisher's exact test.

both groups (Table 1). Nevertheless, hyperemesis was more common among the depressed than the nondepressed mothers. Complicated delivery—specifically pain—was significantly more common among the depressed than the nondepressed controls (Table 1). There were no differences between groups with regard to method of the delivery (depressed/nondepressed: vaginal delivery 87 (83.7%) versus 90 (86.5%), $p = 0.559$, elective section 7 (6.7%) versus 10 (9.6%), $p = 0.448$, and emergency section 10 (9.6%) versus 4 (3.8%), $p = 0.097$).

Infants suffering from symptoms and illnesses, especially from infantile colic, were more common among depressed than nondepressed mothers (Table 1). Cessation of breastfeeding was more common in depressed mothers.

Negative life events during the previous 12 months were more common among depressed mothers than among the nondepressed controls (Table 1). Specifically, complicated close relationships were more common among depressed mothers.

The number of risk factors was higher in the depressed than in the nondepressed group (Table 2). Eighteen percent (18.2%: 19/104) of the mothers were experiencing their first depression and 81.7% (85/104) recurrent depression. Sixty-nine percent (69.2%: 72/104) of nondepressed mothers had no previous depression. The mean number of risk factors was higher among mothers with first lifetime depression ($n = 19$) than among the never-depressed control group ($n = 72$; mean

Table 2: Number of risk factors in the nondepressed and depressed group.

| Number of risk factors[1] | Nondepressed group $N = 104$ | | Depressed group $N = 104$ | |
|---|---|---|---|---|
| | $n$ | % | $n$ | % |
| 0 | 22 | 21.2 | 4 | 3.8 |
| 1 | 37 | 35.6 | 15 | 14.4 |
| 2 | 28 | 26.9 | 23 | 22.1 |
| 3 | 7 | 6.7 | 26 | 25.0 |
| 4 | 8 | 7.7 | 25 | 24.0 |
| 5 | 2 | 1.9 | 7 | 6.7 |
| 6 | 0 | 0 | 3 | 2.9 |
| 7 | 0 | 0 | 1 | 1.0 |
| | Mean[2] = 1.50 | SD = 1.23 | Mean[2] = 2.87 | SD = 1.44 |

[1]Unwanted pregnancy, depression and/or other mental symptoms during pregnancy, complicated pregnancy, complicated delivery, infant's symptoms and illnesses, breastfeeding cessation, and negative life events during the previous 12 months. [2]Mann–Whitney $U$ test: $p < 0.001$. SD = standard deviation.

Table 3: Age-adjusted risk for having postpartum depression according to multivariate logistic regressions in relation to the course of depression.

| | Depressed ($n$ = 104) versus nondepressed mothers ($n$ = 104) | | | Mothers with first lifetime depression ($n$ = 19) versus never-depressed controls ($n$ = 72) | | | Mothers with recurrent depression ($n$ = 85) versus never-depressed controls ($n$ = 72) | | |
|---|---|---|---|---|---|---|---|---|---|
| | OR[1] | 95% CI[2] | $p$ value | OR[1] | 95% CI[2] | $p$ value | OR[1] | 95% CI[2] | $p$ value |
| Pregnancy and delivery issues ($n$[3] = 4) | 2.31 | 1.59–3.35 | <0.001 | 2.87 | 1.33–6.17 | 0.007 | 2.88 | 1.81–4.59 | <0.001 |
| Issues relating infant and breastfeeding cessation ($n$[4] = 2) | 1.86 | 1.11–3.09 | 0.018 | 2.27 | 0.96–5.35 | 0.062 | 2.17 | 1.14–4.13 | 0.019 |
| Negative life events (no versus yes) | 2.16 | 1.12–4.16 | 0.021 | 1.00 | 0.28–3.58 | 1.000 | 2.51 | 1.15–5.50 | 0.021 |

[1]OR = odds ratio. [2]95% CI = 95% confidence interval. [3]Unwanted pregnancy, depression and/or other mental symptoms during pregnancy, complicated pregnancy, and complicated delivery. [4]Infant's symptoms and illnesses and breastfeeding cessation.

2.58 (SD 1.46) versus mean 1.32 (SD 1.11), $p < 0.001$, resp.). Similarly, mothers with recurrent depression ($n = 85$) had more risk factors than their never-depressed counterparts ($n = 72$; mean 2.94 (SD 1.43) versus 1.32 (SD 1.11), $p < 0.001$, resp.). There was no difference between groups with regard to first lifetime ($n = 19$) and recurrent depression ($n = 85$; mean 2.58 (SD 1.46) versus mean 2.94 (SD 1.43), $p = 0.247$, resp.).

Pregnancy and delivery issues, issues relating to the infant and breastfeeding, and negative life events during previous 12 months were associated with PPD according to age-adjusted logistic regression (Table 3). Pregnancy and delivery issues associated with both the risk of first lifetime depression and the risk of recurrent depression when compared to the never-depressed control group. Nevertheless, issues related to the infant and breastfeeding cessation and negative life events associated only with the risk for recurrent depression (Table 3). In a subgroup of mothers who had had at least one previous depressive episode, negative life events during the previous 12 months were a significant risk factor for PPD (OR 2.60, 95% CI 1.00–6.75, and $p = 0.049$). No differences were found in the nondepressed control group between mothers with no history of depression and a history of previous depressions (data not shown).

## 4. Discussion

In general, mental and physical problems during pregnancy or delivery, postpartum problems with the infant and breastfeeding cessation, and negative life events during the previous 12 months were connected to PPD. Mental and physical problems during pregnancy or delivery were associated with both first lifetime depression and recurrent depression during the postpartum period. Furthermore, for recurrent depression, infant/breastfeeding issues and negative life events were also risk factors. The differences in risk factors between first lifetime and recurrent major depressive episodes during the postpartum period represent a novel finding of this study. The risk of recurrent depression is independently associated with more risk factors of lesser severity for the mother's health compared to the risk of first lifetime depression. This means that during the postpartum period a recurrent episode of depression may result from less severe stress exposure than the first lifetime episode, which is in line with the kindling hypothesis [35]. Among mothers who had experienced a previous depressive episode, recent negative life events were of particular importance.

In our study, unwanted pregnancy and an indifferent attitude to pregnancy were connected to depression. An unwanted pregnancy may change life considerably, be a stressful experience with social and economic changes, and further impact on difficulties with motherhood [2, 7, 8, 10].

According to our study, depression and other mental symptoms during pregnancy are important risk factors for PPD. This association has been found in numerous previous studies [2, 6–9]. In our study, fears were emphasized, and these were linked widely to the present life situation, not only to childbirth, as is usually studied [3, 9]. Findings from other studies suggest that pregnancy-related complications are in general potential risk factors for PPD [2, 3, 8, 12, 14, 15], but in our study only hyperemesis as a specific pregnancy complication associated with PPD. Not surprisingly, hyperemesis has been linked with depression, anxiety, and mental health difficulties in other studies [8, 13, 16].

Our study found that complicated delivery, especially pain during delivery, is connected to depression. Other studies [2, 8, 18] have shown mixed findings regarding the link between delivery complications and PPD.

Cesarean section (elective and emergency) was equally as common among depressed and nondepressed mothers, as several previous studies have suggested [2, 8]. Perhaps the pain and other complications during delivery are more remarkable reasons for depression than the method of delivery [2, 8, 18].

Infant-related problems are well-known risk factors for PPD [2, 3, 7, 15, 22]. We found that infant symptoms and sicknesses were connected to depression. According to our study, the main cause of this is infantile colic with uncontrolled crying [23, 24]. Infant crying is associated with the mother's tiredness and may act as a trigger to depression [24]. Our study, like previous studies [2, 11, 25, 26, 28], shows

that depressed mothers more commonly have breastfeeding cessations. The effect of breastfeeding cessation on depression may be mediated through poor self-esteem by failed intentions to breastfeed [10, 11, 27]. Alternatively, depressed women may give up breastfeeding more readily [10, 26, 28].

We found that negative life events during the previous 12 months were common among depressed mothers, which is in line with several previous studies [2, 6, 8, 11, 17, 29–31]. Our study highlighted the role of problematic relationships. When first lifetime and recurrent depressive episodes were studied separately, an association was found only with recurrent depressions. This suggests that previous problems in relationships might associate with previous depressions. It may even be that previous problems in relationships and previous depressions have an additive impact on the risk for PPD.

Not surprisingly, the number of risk factors was higher among depressed than nondepressed mothers. Furthermore, the number of risk factors was also higher among mothers with first lifetime depression or recurrent depression during the postpartum period than among nondepressed mothers without a history of depression. A number of stressors have also been connected to PPD in other studies [11, 17, 29–31].

The limitations of this study include the retrospective self-report of previous depressions and experiences of life events, pregnancy, delivery, and the infant. Mothers may downplay or exaggerate their responses according to their beliefs and perceptions, and in the midst of a depressive episode their thoughts may be negative about the self and the environment [36]. It is possible that mothers do not recognize their symptoms and disorders. The threat to internal validity is also the fact that the sampling time was longer in the depressed than in the nondepressed group. Nevertheless, the depressed group and the control group represent the same socioeconomically diverse population. Mothers attended the same obstetric clinic, and the health services were stable during the sampling time. Furthermore, the use of a convenience sampling method limits the generalizability to the broader population. We could only evaluate depressed mothers who accepted an invitation from the primary health care nurses to attend a psychiatric interview. The cross-sectional nature of this study limits the assessment of causality. The small number of cases increased the risk for type II statistical error, so true differences may not have been detected. There may also be intercorrelations between variables. A further limitation is the fact that the psychiatrist (Pirjo Kettunen) conducting the semistructured interviews was not blind to the mothers' depression status. The diagnostic interview constitutes a critical strength of the study. The diagnoses of major depressive disorder in the study group and control group were made by the psychiatrist using the Structured Clinical Interview for DSM-IV Axis I Disorders.

## 5. Conclusions

In conclusion, mental and physical problems during pregnancy or delivery have an impact on both first lifetime and recurrent PPD. Nevertheless, in recurrent depression, adverse experiences with the infant and breastfeeding cessation and negative life events around the time of having a baby also have an important impact. Compared to nondepressed mothers, depressed mothers have more adverse experiences. Of particular importance for consideration are problematic relationships, unwanted pregnancy, depression, fears and other mental symptoms during pregnancy, hyperemesis, pain during delivery, and infantile colic. To be able to prevent and care for PPD in clinical practice, it is necessary to discuss the mother's stress factors with her. Pregnancy planning, mental symptoms during pregnancy, and relationship problems should be considered. It is important to handle hyperemesis and delivery pain well, support women in caring for babies with colic, and provide expert support to women who have difficulties with breastfeeding. If a mother has experienced previous depression, it is especially important to take negative life events into account.

## Competing Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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# Publication III

**Psychosocial risk factors and treatment of new onset and recurrent depression during the postpartum period**

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# Psychosocial risk factors and treatment of new onset and recurrent depression during the postpartum period

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## Abstract

**Background**. When developing maternity care services, it is important to know how psychosocial factors affect the course of postpartum depression (PPD) and how depressed mothers are treated.

**Aims**. The aim of this study is to assess how adverse childhood experiences, poor present support and violence, and low socioeconomic status (SES) associate with PPD, specifically in new onset and recurrent postpartum depression. The second aim is to assess the treatment received for PPD.

**Methods**. This is a cross-sectional study. The study group comprises 104 mothers with a current episode of PPD and a control group of 104 mothers without an episode. The Structured Clinical Interview for DSM-IV Axis I Disorders was used for data collection. Psychosocial risk factors, treatment issues, and the course of depression were assessed with a structured self-report questionnaire.

**Results**. In age-adjusted multivariate analyses, adverse childhood experiences, a low level of present support in close relationships, and a poor SES were associated significantly with PPD. Childhood adversity was associated with both new onset and recurrent depression. Nevertheless, a low level of support and a poor SES were also associated with recurrent depression. A quarter of mothers with a major depressive episode in the postpartum period attended psychiatric services. In mothers with new onset depression, the proportion was only five per cent.

**Conclusions**. There is an urgent need to develop the diagnostics of depression in maternity care services. An awareness of psychosocial risk factors might help in this. More depressed mothers should be referred to psychiatric services.



**Keywords**: Postpartum depression, Violence, Risk factor, Maternity care

## Background and aim

The global prevalence of postpartum depression (PPD) is 10–15%[1,2]. Some women may suffer depression only during the postpartum period, but for most it is a recurrent episode of a depressive disorder[3,4]. Emotional and social interaction between the baby and the mother may be distorted due to PPD and insecure attachment may be a consequence[5–7]. Furthermore, PPD may have various adverse consequences for the family as a whole. The aetiology of PPD is multifactorial. However, studies consistently highlight the importance of psychosocial risk factors[2,8–11].

Psychosocial risk factors for PPD have been widely examined in meta-analyses by O'Hara and Swain[8] and Beck[9], and in systematic reviews by Robertson et al.[10] and Norhayati et al.[2]. They indicate that the main risk factors for PPD are a lack of social support, especially a lack of support from the spouse. Marital status[9] and socioeconomic status (SES)[8–10] are related to PPD, but less strongly. Family income and the mother's occupation are also weak predictors[8,10]. In more recent studies, marital status and a poor marital relationship[12,13], weak social support and isolation[12,14–20], and socioeconomic problems[11,12,14–17] such as low income, a low level of education, a low-level occupation, and poor housing have also been suggested as associating with PPD.

Poor relationships with the parents during the mother's own childhood have also been associated with PPD. Past or present experiences of abuse are associated with an increased risk of PPD[13,21–26], specifically childhood physical and sexual abuse[22], physical and emotional abuse by a partner[22–26], a lifetime history of forced sex[22], and domestic violence in adulthood[24]. The importance of these factors to PPD varies among studies. Experiences of violence seem to predispose the sufferer to further experiences of violence. Thompson et al.[27] found that exposure to physical and/or sexual abuse or witnessing intimate partner violence (IPV) as a child was associated with an increased risk of IPV as an adult. Garabedian et al.[28] suggest that the number of abuse types during childhood (sexual or physical) and in adulthood (IPV and sexual violence by an individual other than an intimate partner) cumulatively increase the risk of PPD. Moreover, Abramsky et al.[29] found that a high SES, a secondary education and formal marriage may offer protection against recent IPV.

On the other hand, a good relationship with the spouse may improve the mother's and the infant's well-being[18]. The presence of social support may be a protective factor for PPD[26]. The economic independence of the mother may serve as an additional protective factor against PPD[15].

Little is known about differences in psychosocial risk factors for new onset and recurrent PPD. According to Phillips et al.[30], women with recurrent depression have more personality vulnerabilities and maternal-specific negative attitudes than women with new onset PPD, but no differences were found in relationship insecurity. Asselmann et al.[31] found that women with depressive disorders prior to pregnancy have difficulties with partnership during the peripartum period. A recent Finnish study[32] showed that low occupational status and single marital status associates with recurrent PPD, but not with first onset PPD. Moreover, Meltzer-Brody et al.[33] found that Danish mothers with a low income and less education have an increased risk of new onset PPD.

Although PPD is common, it is often missed by primary care and obstetric teams[34,35]. When PPD remains unidentified in health care, its treatment is inadequate. Moreover, especially when PPD is the first episode of depression in the mother's life, it may be unexpected and difficult for her or others close to her to identify, because times with a new-born are expected to be happy and full of joy. When PPD remains unidentified by the mother and those close to her, they are unable to ask for adequate treatment.

The aim of this study was to assess how childhood experiences, present support from the spouse and significant others, and SES associate with PPD, specifically in new onset and recurrent postpartum depression. The second aim was to assess the emotional support and treatment that mothers receive from maternity care and psychiatric services, specifically in new onset and recurrent PPD.

## Materials and Methods

The nature of this study is cross-sectional. Mothers were recruited consecutively during the postpartum examination by primary healthcare nurses at antenatal clinics in Joensuu, eastern Finland. If depressive symptoms began later (i.e. up to six months after delivery), they again contacted their antenatal clinic nurses. If the Edinburgh Postnatal Depression Scale score (EPDS, range: 0–30) [36] was ≥10 or there was clinical suspicion of depression, the nurse told the mother that she could be assessed by a psychiatrist (PK) at the nearby General Hospital Psychiatric Unit of North Karelia Central Hospital in Joensuu, Finland. A control group of non-depressed mothers was recruited consecutively at the antenatal clinics in Joensuu. If the EPDS score was <10 and there was no clinical suspicion of depression, primary healthcare nurses asked whether the mothers would be willing to participate in the study as part of a control group and then organized a psychiatric assessment (again, by PK). Psychiatric assessments were organized within two weeks. The mothers attended the Obstetric Department of North Karelia Central Hospital (approximately 1,550 deliveries annually) during pregnancy and delivery. The antenatal clinics and community-based hospital serve a socioeconomically diverse population.

Both the consecutively collected study group (depressed mothers) and the control group (non-depressed mothers) consisted of 104 subjects. They were evaluated by a psychiatrist six weeks to six months after delivery. The diagnosis of major depressive disorder was made using the Structured Clinical Interview for DSM-IV Axis I Disorders[37]. Attendees with psychotic, addictive, and thyroid disorders were excluded. Women aged 18–40 years were included. Nobody refused to participate at this stage. The study group was collected between 2003 and 2013, and the control group between 2008 and 2010.

Previous depressive episodes were assessed by asking whether the mothers had suffered from a depressive episode lasting at least two weeks; this time period is in line with DSM-IV[37]. The severity of depression was evaluated by using the EPDS[36] and the self-administered 21-item Beck Depression Inventory (BDI-21, range: 0–63)[38]. Moreover, mothers were asked about their sociodemographic situation, childhood experiences, current relationships, socioeconomic status, and treatment in different settings with a structured questionnaire (Table 1).

The study protocol was approved by the Ethics Committee of the North Karelian Hospital District Federation of Municipalities. All participants gave their informed consent to participate in this study prior to the data collection.

The data analysis was made using IBM SPSS statistics package (version 23). The differences between the groups were examined using Pearson's Chi-squared test and Fisher's exact test for the categorical variables. The independent samples *t*-test was used for continuous variables. If a continuous variable was not normally distributed, a non-parametric Mann–Whitney *U*-test was used. A *p*-value of less than 0.05 denoted statistical significance. Due to multiple comparisons, the false discovery rate was assessed using the Benjamini–Hochberg

Table 1. The questionnaire and categorizations.

| Question | Responses | Categorization |
|---|---|---|
| What is your marital status? | single, divorced, widowed, married, cohabiting | single: single, widowed, divorced;<br>intimate relationship: married, cohabiting |
| What is your employment status? | housewife, unemployed, farmer, blue-collar worker, white-collar worker, executive, self-employed person, student or pensioner. | housewife: housewife;<br>unemployed: unemployed;<br>employed: farmer, blue-collar worker, white-collar worker, executive, self-employed person;<br>student: student;<br>pensioner: pensioner |
| How was your relationship (i) with your mother, and (ii) your father, and (iii) how was the relationship between your parents during your childhood? | good, fairly good, fairly poor, poor | good: good, fairly good;<br>poor: poor, fairly poor |
| Have you experienced (i) sexual abuse, (ii) physical family violence in childhood? | yes; no | yes; no |
| Did you experience corporal punishment during your childhood? | none, fairly little, quite a lot, a lot | not harsh: none, fairly little;<br>harsh: quite a lot, lot |
| How is the support and empathy from (i) your spouse, (ii) significant others? | good, fairly good, fairly poor, poor | good: good, fairly good;<br>poor: poor, fairly poor |
| Have you experienced physical violence in your current family or intimate relationship? | yes; no | yes; no |
| What is your basic education? | no primary education, comprehensive school, upper secondary school | no upper secondary school: no primary education, comprehensive school;<br>upper secondary school |
| What is your professional education? | none, short courses, vocational school, university of applied sciences, university | no professional education: none, short courses; professional education: vocational school, university of applied sciences, university |
| How is your (i) economic situation, and (ii) how are your housing conditions? | good, fairly good, fairly poor, poor | good: good, fairly good;<br>poor: poor, fairly poor |
| What kind of support and empathy have you received from (i) the antenatal clinic, (ii) the maternity hospital? | good, fairly good, fairly poor, poor | good: good, fairly good;<br>poor: poor, fairly poor. Poor maternity care support: antenatal clinic and/or maternity hospital support was poor |
| Have you received previous psychiatric treatment? | yes, no | yes; no |
| Do you currently receive (i) psychiatric treatment, (ii) help from a social worker? | yes, no | yes; no |

correction[39]. The relationships between risk factors, PPD, and received treatment – also in relation to the course of depression – were investigated using logistic regression.

Three sum variables were calculated for the logistic regressions. "Childhood adverse experiences" (range: 0–6) was based on six questions (each no = 0, yes = 1) about relationships with and between the parents in childhood, and experiences of violence and harsh corporal punishment in childhood. The sum variable "poor present support in close relationships" was assigned the values of 0–3. Low levels of support from the spouse and significant others, and current family violence were classified as no (0) or yes (1). Finally, the sum variable "poor socioeconomic status" had values of 0–4. Questions about secondarylevel basic education, professional education, poor housing, and economic hardship were classified as no (0) or yes (1).

## Results

The study group and control group both consisted of 104 mothers. The psychiatrist's interviews were carried out on average 82.9 days after delivery (standard deviation (SD) 33.5) in the depression group and 80.2 days after delivery (SD 19.3) in the non-depressed group (p=0.356). Mothers with PPD were younger than those in the control group (mean 27.4 (SD 5.3) years vs 29.6 (4.1) years, $p$=0.001). They also were more often single (12 (11.5%) vs 1 (1.0%), $p$=0.001) and unemployed (16 (15.4%) vs 5 (4.8%), $p$=0.011). No other differences were found in the sociodemographic variables (data not shown). Not surprisingly, both the EPDS and BDI scores were higher in mothers with PPD than in the control group (mean 17.6 (SD 4.1) vs 3.5 (3.2), $p$<0.001 and 22.2 (8.0) vs 4.1 (3.2), $p$<0.001, respectively).

Negative experiences both during childhood and in current life were more common among mothers with PPD than in the controls (Table 2).

Eighteen per cent (18.3%: 19/104) of the mothers were experiencing their first depression and 81.7% (85/104) were experiencing recurrent depression. Sixty-nine per cent (69.2%: 72/104) of non-depressed mothers had no previous depressions. A poor relationship with the father and a poor relationship between the parents in childhood were more common among mothers with new onset depression than among never-depressed mothers (Table 3).

A poor relationship with the mother, with the father, and between the parents; sexual abuse and harsh corporal punishment; poor support from the spouse and significant others; a low level of education; economic hardship; and poor housing were more common among mothers with recurrent depression than in never-depressed mothers (Table 3).

There were no differences in comparisons between first onset and recurrent depressed mothers in relation to

Table 2. Adverse childhood experiences, poor present support in close relationships, and poor socioeconomic status in mothers with postpartum depression (PPD) and their controls.

| | **Non-depressed control group** N = 104 | | **Mothers with PPD** N = 104 | | $p$-value[1] |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Poor relationship with the mother in childhood | 5 | 4.8 | 17 | 16.3 | 0.007[2] |
| Poor relationship with the father in childhood | 14 | 13.5 | 35 | 33.7 | 0.001[2] |
| Poor relationship between the parents | 31 | 29.8 | 56 | 53.8 | <0.001[2] |
| Sexual abuse in childhood | 1 | 1.0 | 13 | 12.5 | 0.001[2] |
| Harsh corporal punishment in childhood | 3 | 2.9 | 16 | 15.4 | 0.002[2] |
| Physical violence in the childhood home | 18 | 17.3 | 28[4] | 27.2 | 0.087[2] |
| Poor spousal support | 3 | 2.9 | 21 | 20.2 | <0.001[2] |
| Poor support from significant others | 0 | 0 | 16 | 15.4 | <0.001[2] |
| Physical family violence | 1 | 1.0 | 8[4] | 7.8 | 0.019[3] |
| No upper secondary school | 29 | 27.9 | 49 | 47.1 | 0.004[2] |
| No professional education | 6 | 5.8 | 37 | 35.6 | <0.001[2] |
| Poor economic situation | 16 | 15.4 | 37 | 35.6 | 0.001[2] |
| Poor housing conditions | 1 | 1.0 | 16[4] | 15.5 | <0.001[2] |

[1]The false discovery rate was assessed using the Benjamini–Hochberg correction. No changes were found in the statistical significance of the comparisons.
[2]Pearson's Chi-squared test.
[3]Fisher's exact test.
[4]N = 103.

negative experiences during childhood and in the current life situation (Table 3).

According to the age-adjusted logistic regression, experiences of childhood adversities, poor present support in close relationships and low SES were associated with PPD (Table 4). Childhood adversities were associated with a new onset depressive episode during the postpartum period when compared to the never-depressed controls. In addition to these variables, poor present support and low SES were also associated with recurrent depression. Among

Table 3. Adverse childhood experiences, poor present support in close relationships, and poor socioeconomic status among mothers with no, new onset, or recurrent depression during postpartum period.

| | Never-depressed control mothers N = 72 | | Mothers with new onset depression N = 19 | | Mothers with recurrent depression N = 85 | | *p*-value[1] Never-depressed vs mothers with new onset depression | *p*-value[1] Never-depressed vs mothers with recurrent depression | *p*-value[1] Mothers with new onset vs recurrent depression |
|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | n | % | | | |
| Poor relationship with the mother in childhood | 1 | 1.4 | 1 | 5.3 | 16 | 18.8 | 0.376[2] | <0.001[2] | 0.188[3] |
| Poor relationship with the father in childhood | 6 | 8.3 | 9 | 47.4 | 26 | 30.6 | <0.001[3] | 0.001[2] | 0.162[2] |
| Poor relationship between the parents | 14 | 19.4 | 13 | 68.4 | 43 | 50.6 | <0.001[2] | <0.001[2] | 0.159[2] |
| Sexual abuse in childhood | 1 | 1.4 | 0 | 0 | 13 | 15.3 | 1.000[3] | 0.002[2] | 0.119[3] |
| Harsh corporal punishment in childhood | 0 | 0 | 1 | 5.3 | 15 | 17.6 | 0.209[2] | <0.001[2] | 0.293[3] |
| Physical violence in the childhood home | 9 | 12.5 | 5[7] | 27.8 | 23 | 27.1 | 0.144[3] | 0.024[2 5] | 1.000[3] |
| Poor spousal support | 2 | 2.8 | 3 | 15.8 | 18 | 21.2 | 0.060[2] | 0.001[2] | 0.758[3] |
| Poor support from significant others | 0 | 0 | 1 | 5.3 | 15 | 17.6 | 0.209[3] | <0.001[2] | 0.293[3] |
| Physical family violence | 1 | 1.4 | 1 | 5.3 | 7[8] | 8.3 | 0.376[3] | 0.070[3] | 1.000[3] |
| No upper secondary school | 17 | 23.6 | 7 | 36.8 | 42 | 49.4 | 0.244[2] | 0.001[2] | 0.321[2] |
| No professional education | 4 | 5.6 | 3 | 15.8 | 34 | 40.0 | 0.156[3] | <0.001[2] | 0.046[2 6] |
| Poor economic situation | 10 | 13.9 | 4 | 21.1 | 33 | 38.8 | 0.480[3] | <0.001[2] | 0.144[2] |
| Poor housing conditions | 1 | 1.4 | 3 | 15.8 | 13[8] | 15.5 | 0.028[3 4] | 0.002[2] | 1.000[3] |

[1]The false discovery rate was assessed using the Benjamini–Hochberg correction.
[2]Pearson's Chi-squared test.
[3]Fisher's exact test.
[4]Benjamini–Hochberg corrected *p*-value 0.073.
[5]Benjamini–Hochberg corrected *p*-value 0.067.
[6]Benjamini–Hochberg corrected *p*-value 0.112.
[7]n=18.
[8]n=84.

Table 4. Age-adjusted risk of having postpartum depression according to multivariate logistic regressions in relation to the course of depression.

| | PPD vs non-depressed controls N = 101/N = 104 | | | New onset depression (PPD) vs never-depressed controls N = 18/N = 72 | | | Recurrent depression (PPD) vs never-depressed controls N = 83/N = 72 | | | Recurrent depression vs new onset depression (PPD) N = 18/N = 83 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OR | 95% CI | *p*-value | OR | 95% CI | *p*-value | OR | 95% CI | *p*-value | OR | 95%CI | *p*-value |
| Childhood adverse experiences[1] | 1.37 | 1.05–1.78 | 0.020 | 2.07 | 1.25–3.41 | 0.005 | 1.70 | 1.18–2.45 | 0.005 | 0.98 | 0.69–1.38 | 0.891 |
| Poor present support in close relationships[2] | 5.69 | 1.91–16.93 | 0.002 | 3.17 | 0.68–14.87 | 0.143 | 5.02 | 1.33–18.99 | 0.017 | 1.24 | 0.45–3.41 | 0.676 |
| Poor socioeconomic status[3] | 2.48 | 1.54–3.99 | <0.001 | 1.35 | 0.51–3.62 | 0.545 | 3.55 | 1.91–6.61 | <0.001 | 2.27 | 1.1–4.70 | 0.027 |

PPD = postpartum depression. OR = odds ratio. 95% CI = 95% confidence interval.
[1]Includes poor relationship with the mother, with the father, and between parents, sexual abuse, corporal punishment, and physical family violence.
[2]Includes poor spousal support, poor support from significant others, and current physical family violence.
[3]Includes no upper secondary school, no professional education, economic hardship, and poor housing condition.

mothers with PPD, poor SES associated with recurrent depression when compared to new onset depression. In a subgroup of mothers who had had at least one previous depressive episode (N=115), poor present support (OR 11.37, 95% CI 1.46–88.70, $p$=0.020) and low SES (OR 2.04, 95% CI 1.07–3.87, $p$=0.029) were significant risk factors for PPD. In the control group, childhood adversities were associated with a history of depression when compared to the never-depressed mothers (OR 1.91, 95% CI 1.25–2.93, $p$=0.003).

Mothers with PPD attended psychiatric services and visited social workers more often than mothers in the control group. Moreover, they had also more often attended psychiatric services previously. In total, over one in five of mothers with PPD and one in ten of the control mothers stated that they had received poor support from maternity care services (Table 5).

Depressed mothers with a recurrent depressive episode had more often attended psychiatric services than mothers with a new onset depressive episode, and there was a trend that present attendance was also greater (Table 5). Thirty-six per cent (36.4%: 20/55) of mothers with PPD who had previously attended psychiatric services had a current contact there. Twenty-three per cent (23.1%: 24/104) of mothers with PPD had a present contact with a social worker, and there were no statistically significant differences according to the history of depression.

Low SES associated with attendance at psychiatric services in mothers with PPD (OR 1.76, 95% CI 1.01–3.07, $p$=0.045) after adjustment for age. Respectively, low SES (OR 1.84, 95% CI 1.03–3.28, $p$=0.039) and childhood adversities (OR 1.43, 95% CI 1.03–1.98, $p$=0.030) associated with contact with a social worker. In mothers with PPD, experiences of adversities in childhood, poor social support in close relationships, and low SES did not associate with poor support from maternity care services either in those with or without a history of depression (data not shown). Moreover, there were no differences between mothers with new onset or recurrent depression in the association between risk factors for PPD and attendance at psychiatric services and contact with social workers (data not shown).

## Discussion

In general, according to this study, childhood adversities, poor present support in close relationships, and low SES have an impact on PPD. Specifically, inadequate relationships and abuse in childhood are associated with new onset depression during the postpartum period. If depressed mothers had suffered from previous depression, a low level of support from the spouse and significant others, a low level of education, economic hardship, and poor housing were also associated with PPD. Support received from caregivers was often assessed as insufficient. This is highlighted by the fact that those mothers who had their first lifetime depression were mostly without psychiatric care.

Negative experiences during childhood were common among mothers with PPD, as previous studies have suggested[13,22,26,28]. Childbirth may act as a trigger for painful childhood memories and activate attachment. "An internal working model" may have developed during early attachment and been integrated into the personality[40,41]. This model may have regulated cognition and emotions such as depression, and also directed and motivated behaviours in relationships later in adulthood. It is plausible that the social, psychological, and physical changes in conjunction with the rapid hormonal shifts of the postpartum period may make women who have experienced childhood abuse and unresponsiveness particularly vulnerable to depression[14,22,42–44]. Poor relationships with the respondent's father and between

Table 5. Support from maternity care services and from a social worker, and attendance at psychiatric services in relation to the course of depression

| | Non-depressed group N = 104 | | Mothers with PPD N = 104 | | | Mothers with new onset depression (PPD) N = 19 | | Mothers with recurrent depression (PPD) N = 85 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | n | % | n | % | $p$-value[1] | n | % | n | % | $p$-value[1] |
| Poor support from maternity care services | 10 | 9.6 | 23 | 22.1 | 0.014[2] | 5 | 26.3 | 18 | 21.2 | 0.760[2] |
| Previous attendance at psychiatric services | 23 | 22.1 | 55 | 52.9 | <0.001[2] | 1 | 5.3 | 54 | 63.5 | <0.001[2] |
| Present attendance at psychiatric services | 3 | 2.9 | 26 | 25.0 | <0.001[2] | 1 | 5.3 | 25 | 29.4 | 0.038[2,3] |
| Support from a social worker | 10 | 9.6 | 24 | 23.1 | 0.005[2] | 2 | 10.5 | 22 | 25.9 | 0.229[2] |

[1]The false discovery rate was assessed using the Benjamini–Hochberg correction.
[2]Pearson's Chi-squared test.
[3]The Benjamini–Hochberg corrected $p$-value = 0.051

her parents in childhood were shown to be connected to new onset depression during the postpartum period. More difficulties in childhood associate with recurrent depression. One interesting finding was that mothers with recurrent depression also reported having had a poor relationship with their own mothers – the most significant attachment object during childhood. In addition, mothers with recurrent depression more often reported harsh corporal punishment and sexual abuse in childhood.

Furthermore, mothers with recurrent depression had experienced worse relationships with their spouse and significant others. The relationship between a low level of support and PPD may be reciprocal. A low level of support increases the risk of depression and, conversely, previous depressions impair the mother's ability to form good relationships[31]. Perhaps recurrently depressed mothers have personalities more prone to vulnerability[30] or their ability to obtain support is weaker because of their early insecure attachments.

Finally, low SES as a risk factor for recurrent depression was highlighted. Mothers reported economic hardship and poor housing more often, had a lower level of basic education, and commonly lacked professional education. These mothers seem to have a number of difficulties, and they may have fewer resources to cope with the transition to motherhood. Perhaps the problems are cumulative: previous episodes of depression may be an obstacle to good relationships, education, and later on to a job, good housing, and a good financial situation. Conversely, good support and high SES may be protective factors against postpartum depression[15,18,26,29].

All mothers had attended the municipal antenatal clinic and maternity hospital as usual in Finland. Nevertheless, in spite of emotional support from maternity caregivers, a group of mothers were depressed. Some mothers – more often those with PPD than others – considered the emotional support from the maternity caregivers insufficient. Only a quarter of depressed mothers attended psychiatric services. The proportion was only one in twenty mothers with new onset depression in the postpartum period. This suggests that emotional support from maternity care services is insufficient to prevent PPD.

There are many possible reasons why most mothers with PPD remain without psychiatric treatment. It is possible that depressed mothers are missed by hospital and primary care teams[34, 35]. When PPD is the first episode of depression in the mother's life, it may be unexpected and especially difficult for her and the maternity care to identify. Depressed mothers may not feel able to freely disclose their feelings or recognize the symptoms of depression, and they may also lack knowledge about postpartum depression[35]. Depression itself (e.g. a lack of energy and poor motivation) may prevent the mother from asking for help. Such mothers may face barriers in seeking help[35], for example, due to the stigma of mental health problems. They may be afraid that their capacity for motherhood will be doubted. In Finland, delays in seeking help and discontinuation of treatment seem to create a barrier to care among young adults such as these mothers[45]. Moreover, there may be a lack of knowledge in maternity care services about the antenatal risks of PPD[46]. It may also be that mothers are not given opportunities and encouragement to talk about their mental health[20]. Finally, mental health services for the treatment of depression may not be functioning efficiently[45], and there may be insufficient knowledge on the part of the mother about mental health services.

This study has several limitations. First, due to the retrospective self-reporting of previous depressions and childhood experiences, there may be a recall bias in some mothers[47]. Experiences of the current level of support and some determinants of SES – for example, the financial situation and housing conditions – might be reported subjectively. The mothers may have over- or underestimated their responses according to their beliefs. In the midst of a depressive episode, their thoughts probably tend towards the negative[48]. Secondly, there may be intercorrelations between the variables concerning childhood experiences, a low level of support and violence, and between SES determinants. Third, the cross-sectional nature of this study limits the assessment of causality. Fourth, the sampling was a convenience sample. The fact that we evaluated only mothers who accepted an invitation from the primary healthcare nurses to participate in the psychiatric investigation limits the generalizability. Nevertheless, these mothers represent the same socioeconomically diverse population as their controls. The fact that the sampling time was longer in the depressed than in the non-depressed group is not a strong threat to internal validity, because health services were stable during the sampling time and the mothers used the same obstetric and antenatal clinics. Fifth, the small sample size – especially in the group with first lifetime depression – limited the statistical power, and true differences between the groups might not have been detected. Sixth, the interviewing psychiatrist was not blind to the mothers' depression status. The strength of this study is the diagnostic interview. The diagnoses of major depressive disorder were made by the psychiatrist using the Structured Clinical Interview for DSM-IV Axis I Disorders[37].

## Conclusions

According to this study, poor relationships and being abused in childhood; inadequate support from the spouse, significant others, and maternity care; family violence; a low level of education; poor housing; and economic hardship are all connected to PPD. Childhood adversities are important risk factors when PPD is a new onset or recurrent depressive episode. Other risk factors, especially low SES, are more important in recurrent depressive

episodes. Support from maternity care services does not prevent depression in the postpartum period. Low SES associated with referral to psychiatric services and social workers. Most mothers with first lifetime depression during the postpartum period remained without psychiatric treatment.

In maternity healthcare, it continues to be important to develop more effective ways of identifying and supporting depressive mothers, especially when there is no history of previous depression.

## Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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