Depression and sleep in the postnatal period.

A study in Nepal and Norway.

Signe Karen Dørheim

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Section for General Practice, Department of Public Health and Primary Health Care, University of Bergen, Norway

Division of Psychiatry, Stavanger University Hospital, Norway

Division of Mental Health, Norwegian Institute of Public Health, Norway

The Norwegian Competence Center for Sleep Disorders, Haukeland University Hospital, Norway.

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Bakgrunn

Mentale lidelser er utbredt, også i utviklingsland. Depresjon er den nest største årsaken til sykelighet blant kvinner i reproduktiv alder på verdensbasis. I tillegg til å medføre betydelig lidelse for kvinnen selv, kan depresjon etter fødselen også ramme barnet. Kvinners søvn forandres i tiden etter fødsel, men det har vært lite forskning på dette endrede søvnmønsteret og en mulig sammenheng med depresjon i barselperioden.

Målsetning

Målet med studien var å måle forekomst og risikofaktorer for depresjon etter fødselen i to populasjoner, den ene fra Lalitpur, Nepal og den andre fra Rogaland, Norge. I Norge ønsket vi i tillegg å studere søvnmønsteret etter fødsel, risikofaktorer for dårlig søvn, samt måle forskjeller i søvn mellom deprimerte og ikke deprimerte mødre, både subjektivt og objektivt.

Metode

a) Nepal: 426 kvinner ble intervjuet med et spørreskjema 5-10 uker etter fødselen. Disse ble rekruttert fra et sykehus, to helsestasjoner på landsbygda, samt ved dør-til-dør besøk i Patan by. Edinburgh Postnatal Depression Scale (EPDS) og Self Report Questionnaire–20 (SRQ-20) ble brukt for å måle depressive symptomer og psykisk stress.
b) Norge: Alle kvinner som hadde født ved Stavanger Universitetssykehus i løpet av et år (oktober 2005 - september 2006, 4191 kvinner) fikk tilsendt et spørreskjema i posten syv uker etter fødselen. Depresjon ble målt med EPDS og søvn med Pittsburgh Sleep Quality Index (PSQI). En prospektiv søvnregistrering med søvndagbok og aktigrafi 9-10 uker etter fødsel ble gjort med 42 kvinner, hvorav halvparten hadde høy og den andre halvparten lav skåre på EPDS.

Resultater

Forekomst av depressive plager (EPDS>12) i Nepal var 4,9 %, og 3,1 % rapporterte psykisk stress (SRQ>10). De tre faktorene sterkest knyttet til depresjon var alkoholisme hos ektemannen, flerkoneri og tidligere depresjon. Depresjon under svangerskapet, negative livshendelser siste året, flere enn tre barn samt røyking gav også økt risiko for depresjon etter fødselen. Tradisjonen med å dra til mors barndomshjem noen måneder etter fødselen så ut til å beskytte mot depressive plager.

I Norge var svarprosenten 68 % (2830 kvinner). Forekomsten av depressive plager (EPDS≥10) var 16,5 %, og 58 % hadde søvnproblemer (PSQI >5). Kvinnene sov i gjennomsnitt 6,5 timer pr natt, med en selvrapportert søvneffektivitet på 73 %. Den største risikofaktoren for dårlig søvn var depresjon. I tillegg fant vi dårligere søvn hos mødre som tidligere hadde hatt søvnproblemer, førstegangsfødende, mødre som kombinerte amming med flaskemelk, hadde yngre baby eller hadde født en gutt. Mor rapporterte bedre søvn der barnet sov på eget rom. Depresjon var, i tillegg til søvn, assosiert med et dårlig partnerforhold, tidligere depresjon, depresjon i svangerskapet samt negative livshendelser siste året. I søvnregistreringen (både dagbok og aktigrafi) var det ingen forskjell i søvn mellom deprimerte og ikke-deprimerte, men de deprimerte hadde en dårligere funksjon på dagtid. Førstegangsmødre hadde dårligere søvn også i søvnregistreringen.

Konklusjon

Forekomsten av depressive symptomer etter fødselen var lavere enn tidligere rapportert fra Nepal, men høyere enn tidligere rapportert fra Norge. I tillegg til allerede kjente risikofaktorer kan tradisjonelle familiestrukturer påvirke risikoen for depresjon hos Nepalske barselkvinner. Dårlig selvrapportert søvn var forbundet med depresjon også når vi justerte for andre store risikofaktorer for depresjon i denne perioden. Likevel fant vi ingen forskjell i søvn mellom deprimerte og ikke-deprimerte målt objektivt og prospektivt.

Abstract

Background

Mental disorders are highly prevalent across the world and are associated with serious impairment. Depression after childbirth affects both the mother and her infant. Women sleep less in the postnatal period, but there has been little attention to the altered sleep pattern in the postnatal period and its association with maternal depression.

Objectives

The aim of the study was to assess the prevalence of depression and to identify risk factors for the disease among postnatal mothers in Lalitpur, Nepal and in Rogaland, Norway. In Norway, we further aimed to study the prevalence and risk factors for postnatal maternal sleep problems, as well as associations between depression and sleep, measured retrospectively, prospectively and objectively.

Methods

c) In Nepal: from October 2001 to January 2003, 426 postnatal women from three primary health care populations were included in a cross-sectional structured interview study of mental health. Depressive symptoms were measured by the Edinburgh Postnatal Depression Scale (EPDS), and mental distress by the Self Report Questionnaire–20 (SRQ-20).

d) In Norway: All women (n=4191) who had delivered at Stavanger University Hospital from October 2005 to September 2006 were mailed a questionnaire seven weeks after delivery. Sleep was measured by the Pittsburgh Sleep Quality Index (PSQI), and depressive symptoms by the EPDS. From this population-based study, we recruited 42 women, of whom half scored 10 or more and the other half low at the EPDS, for prospective sleep registrations by sleep diaries and actigraphy two months after delivery.

Results

In Nepal, the prevalence of depressive symptoms (EPDS >12) was 4.9 % and the prevalence of mental distress (SRQ-20 >10) was 3.1 %. Multivariate analysis showed that postnatal depression was strongly associated with husband's alcoholism, polygamy and previous depression. Other significant factors were stressful life events, multiparity, smoking and depression during pregnancy. There was a non-significant trend of lower depressive scores among women practicing the tradition of going to their maternal home some weeks after delivery.

In Norway, the response rate was 68% (n=2830). The prevalence of depressive symptoms (EPDS ≥10) was 16.5%, and the prevalence of postnatal sleep problems (PSQI >5) was 58%. Mean self-reported nightly sleep time was 6.5 hours and sleep efficiency was 73%. Depression was the factor most strongly associated with sleep problems in this period. Being primipara, having previously had sleep problems, not exclusively breastfeeding, having younger or male infant, or co-sleeping were also factors associated with poor postnatal sleep quality. Poor sleep was associated with depression also when adjusted for known and significant risk factors for postnatal depression, such as poor partner relationship, previous depression, depression during pregnancy and stressful life events. There were no significant differences in sleep measured prospectively by subjective sleep diaries and objective measures of actigraphy according to depressive status. Primiparas had worse sleep, measured by actigraphy, compared with multiparas.

Conclusions

The prevalence of depressive symptoms in the postnatal period was lower than previously reported from Nepal, but higher than previously reported from Norway. Traditional family structures may influence the risk of depression among postnatal women in Nepal. Poor sleep, reported retrospectively, was associated with depression independently of other risk factors. However, there were no differences in prospective and objective sleep registrations according to depressive status.

List of papers

1. **Signe Dørheim Ho-Yen**, Gunnar Tschudi Bondevik, Malin Eberhard-Gran, Bjørn Bjorvatn. *The prevalence of depressive symptoms in the postnatal period in Lalitpur district, Nepal* Acta Obstetricia et Gynecologica. 2006; 85: 1186-1192.

2. **Signe Dørheim Ho-Yen**, Gunnar Tschudi Bondevik, Malin Eberhard-Gran, Bjørn Bjorvatn. *Factors associated with depressive symptoms among postnatal women in Nepal.* Acta Obstetricia et Gynecologica. 2007; 86: 291-297.

3. **Signe Dørheim**, Gunnar Tschudi Bondevik, Malin Eberhard-Gran, Bjørn Bjorvatn. *Sleep and depression in postpartum women – a population based study.* (Revised version, submitted to SLEEP, Nov 2008)

4. **Signe Dørheim**, Gunnar Tschudi Bondevik, Malin Eberhard-Gran, Bjørn Bjorvatn. *Subjective and objective sleep among depressed and non-depressed postnatal women.* (Acta Psychiatrica Scandinavica, 2008 Sep 23. [Epub ahead of print])

List of abbreviations

AASM	American Academy of Sleep Medicine
APA	American Psychiatric Association
BMI	Body Mass Index
CI	Confidence Interval
DALY	Disability Adjusted Life Years
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders – 4th edition
EPDS	Edinburgh Postnatal Depression Scale
HPA axis	hypothalamic-pituitary-adrenal axis
ICD-10	International Classification of Diseases, version 10
NICE	The National Institute for Health and Clinical Excellence
OR	Odds Ratio
PSQI	Pittsburgh Sleep Quality Index
PTSD	Post Traumatic Stress Disorder
ROC	Receiver Operating Characteristic
REM	Rapid Eye Movement
SD	Standard deviation
SE	Sleep Efficiency (Time asleep/Total time in bed)
SPSS	Statistical Package for the Social Sciences
SRQ-20	Self Report Questionnaire-20
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organization

1. Introduction

During their reproductive years, women are at increased risk of most disorders that affect the emotions. These include depression, anxiety, post traumatic stress disorder and anorexia (Holden, 2005). First-time mothers have a more than twofold risk of needing mental health care during the first months after delivery as compared to a year later, and the increased risk of depression lasts the first five postnatal months (Munk-Olsen et al., 2006). In addition to the risk for new mental disease, the pregnancy and postnatal period pose a challenge for pre-existing psychiatric diseases. Women taking psychopharmaca who discover a pregnancy may abruptly stop their medication. This may result in relapse of their disease. Previous depressive illness may also worsen during the pregnancy and postnatal period.

Depression in the postnatal period contributes to several problems in the individual, family and society. In severe depression, especially with psychotic symptoms, there is a risk of suicide (Oates, 2003). In addition, a depression in the mother may affect the child's cognitive, emotional and social development (Moore et al., 2001; Murray et al., 1999; Sinclair and Murray, 1998; Weinberg and Tronick, 1998). Depressed mothers are also less likely to breastfeed (Abou-Saleh et al., 1998; Bick et al., 1998; Warner et al., 1996), and thoughts of harming infants are higher among depressed mothers (Cadzow et al., 1999; Wisner et al., 1999). In developing countries such as Pakistan, India and Nigeria, exposure to maternal mental distress and depression has been found to be associated with low birth weight and poor infant growth (Adewuya et al., 2008; Anoop et al., 2004; Inandi et al., 2005; Patel and Prince, 2006; Rahman et al., 2004; Rahman et al., 2008b). Maternal depression is also associated with less adherence to child health promotion, including vaccinations (Minkovitz et al., 2005; Rahman et al., 2004).

Thus, depression in the postnatal period is a major public health problem (Wisner et al., 2006). However, the evidence does not support postnatal depression as a separate

entity, but supports the specific triggering of mood disorders by childbirth in at least a proportion of women. Giving birth to and caring for a new baby could act as a psychosocial as well as a biological stressor (Riecher-Rössler and Rohde, 2005). One of these biological stressors could well be sleep deprivation connected to infant care in the postnatal period, but very few studies have examined this (Lee, 1998; Ross et al., 2005).

In developing countries, the physical health of mothers and children receives high priority in health programs. Less emphasis has been placed upon the mental health of the mothers. Programmes for improving women's health should concentrate upon more than merely reproductive issues, and also include a woman's total well being, both physically and mentally. Social factors such as workload, nutrition, war, migration, violence and gender inequalities need to be addressed (Desjarlais et al., 1995; Van der Kwaak et al., 1991). There is a close interaction and co-morbidity between mental and physical disorders. Mental disorders increase the risk for both communicable and non-communicable diseases, as well as injuries, and may also complicate diagnosis, treatment and follow up of somatic diseases. The importance of proper attention to mental health, especially in developing countries, was therefore highlighted in the Lancet Series of Global Mental Health in 2007, with the conclusion that there is "no health without mental health" (Prince et al., 2007).

Previously, some authors proposed that depression in the postnatal period was a culturally based syndrome, mainly confined to industrialized societies (Stern and Kruckman, 1983), but recent research challenges this theory (Oates et al., 2004). This thesis will therefore focus upon depression in the postnatal period in two different populations, one from Nepal and one from Norway.

Background

Prevalence of depression across cultures

In 2000, neuro-psychiatric disorders accounted for approximately 13% of all disability adjusted life years (DALYs) lost world wide, and 11% in the South-East Asian region (WHO, 2001). Major depression was ranked fourth among the leading causes of global disease burden, and second among females aged 15-44 years (10.6% of DALYs lost). In 2006, depression was estimated to become among the three largest causes both of disability and of life years lost within the next 10-15 years (Mathers and Loncar, 2006). A multinational population survey initiated by the World Health Organization (WHO) in 2000 found that mental disorders were highly prevalent, often associated with serious role impairment and often went untreated. In developing countries, more than three-quarters of people with serious mental disease do not receive any treatment (Demyttenaere et al., 2004). Suicide was the leading cause of maternal mortality in the United Kingdom (28 %) (Oates, 2003) and the fourth most common cause of death for women of reproductive age in Europe in 1999 (Jacobsson and Renberg, 1999). In 1997, suicide was the second largest cause of deaths (10%) among women in reproductive age in the Nepal, following mortality related to pregnancy and childbirth (20%). The highest rate was among women with two or three children (Pathak et al., 1999).

The situation for women in Nepal and Norway

Nepal is a landlocked country, squeezed between the two giants China in the North and India in the South. It is economically one of the poorest countries in Asia, ranking as number 142 on the UNDP Human Development Indicator in 2005 (UNDP, 2008). This index compares life expectancy, literacy rate, school enrolment, gross domestic product, health and income. Much has been invested in development the last decades, but a population growth of 2.3 percent per annum conceals much of the gain of development. The last years, however, the life expectancy for women has reached up to that of men, and currently they are both 62.6 years.

Women in Nepal

The women in Nepal have little influence upon who they marry, and are the lowest ranked members in their husbands family, with whom they often live. Their access to safe family planning has improved over the last years. Nepali women got on average 4.1 children at the time the study was initiated (2001), but this has now declined to 3.4 (UNICEF, 2005). Nepal has one of the highest maternal mortality rates in the world; studies estimate 280-830 maternal deaths per 100 000 live births (UNICEF, 2005). This is partly a result of anaemia and malnutrition (Bondevik et al., 2000), in addition to the lack of accessible, affordable or reliable maternal health care. Infant mortality is also high. It is more important to give birth to boys than girls, as sons are needed both to inherit the family's land, and also for spiritual assistance in the rituals when the parents die. Gender disparity is also reflected through adult illiteracy being nearly twice as common among women as compared to men. The overall combined literacy rate (both men and women) in the country is only 51% (UNDP, 2008). However, numbers of girls enrolled in school are increasing, and are now 87% of that of boys. Lack of local employment opportunities have led to an increased urbanisation with uprooting of the traditional family patterns. Traumatic experiences and internal migration due to a long conflict between the Maoists and the security forces since 1996 may also have contributed to increased prevalence of mental disorders, including depression (Thapa and Hauff, 2005). On the other hand, women in Nepal are expected to become pregnant soon after marriage, and by giving birth fulfil both their own and their society's role expectations. This could be a factor protecting against mental distress. In addition, they often have relatives in the extended family near by for advice and practical support. Low maternal age and low education are frequent in rural Nepal, and might not lead to social stigma and problems in the same way as in high income countries. Giving birth to a boy could raise the woman's status as a successful mother.

Women in Norway

Norway was in 2008 rated as number two at the UN's Human Development Index (UNDP, 2008). Norwegian women may face other challenges than their Nepali sisters. The family structure has changed a lot in the last decades. About half of the children

born in Norway have parents who are not formally married, although 90% are born into established relationships. Even so, children under the age of 1-2 years are at the greatest risk of experiencing parental break up, especially if they have young mothers (Byberg et al., 2001). Most women have their own professional life, and the grandparents may also have their own occupation and networks to take care of. With moving and family break up, there may be less possibility of contact with the extended family, weakening the transference of knowledge between the generations. A Swedish study found that women with postnatal depression experienced loss of professional role, loneliness, insecurity of baby care, as well as with keeping up equality in the relationship and involve her partner in caring for the baby (Edhborg et al., 2005). There is also an increase in psychiatric symptoms among young women in Norway (Statistics-Norway, 2006). On the other hand, working parents in Norway are entitled to 44 weeks of fully paid maternity leave, of which the father of the baby is entitled at least 6 weeks. This gives opportunities for both the parents to concentrate fully upon their new roles as parents, and to bond with the infant. There are also laws against employment discrimination of pregnant and postnatal mothers, and gender disparity is greatly reduced in the last decades.

Postnatal depression

Nomenclature

Postnatal versus postpartum

The literature varies in how it labels the period after delivery, and this may lead to some confusion. Some authors use the term postnatal, whereas others prefer the term postpartum. Both words are derived from latin, where “Post” means “after”. “Natal” comes from Natalis, derived from the verb Nasci – “to be born” and “Partum” is derived from Partus, which means childbirth. Both words thus refer to the time after childbirth and are synonymous with each other. We have chosen to use the term postnatal in most of this thesis (but postpartum is used in Paper III due to linguistic preferences in the journal SLEEP).

Duration of the postnatal period

The literature, the diagnostic classification systems and clinical practice have different definitions of the length of time after delivery termed "postnatal". According to the current psychiatric diagnostic systems (se below), onset of depression has to be within 4 weeks (Diagnostic and Statistical Manual of Mental Disorders – 4th edition; DSM-IV(APA, 1994)) or within 6 weeks (International Classification of Diseases, version 10; ICD-10 (WHO, 1992) after delivery to be labeled postnatal. However, according to epidemiological studies, depression typically arises within 3 months after delivery (Cooper et al., 1988; Cox et al., 1993). A large population based register study from Denmark found an increased risk of admission for major depressive disorder among primiparous mothers through the first 5 months after delivery, compared with mothers 11 to 12 months later (Munk-Olsen et al., 2006). Another study of family aggregation of postnatal depression suggested a debut within 6-8 weeks of delivery for depressive illness triggered by childbirth (Forty et al., 2006).

Definition of depression

The DSM-IV (APA, 1994) defines depression by nine criteria, where at least five need to have been present for most of the day, nearly every day for at least two weeks. In addition, the symptoms need to cause clinically significant distress or impairment in social or occupational functioning, and should not be better explained by a general medical condition, by the physiological effects of a substance or by bereavement.

<u>The DSM criteria for depression</u>

At least one of these:

1. Persistent depressed mood or feeling of sadness
2. Markedly diminished interest or pleasure in nearly all activities

Additional criteria:

3. Change in weight or appetite, either decreased or increased.
4. Insomnia or hypersomnia
5. Psychomotor retardation or agitation
6. Fatigue or loss of energy

7. Difficulty concentrating or indecisiveness
8. Guilt or low self-esteem
9. Recurrent thoughts of death or suicide

Rating of severity is based upon number and severity of the criteria symptoms, as well as the degree of functional disability and distress.

The ICD-10 (WHO, 1992) has a similar description of depression, but does not state an exact duration of symptoms. There is more emphasis upon the clinical description, and less at the exact number of symptoms. However, less numbers of symptoms (only 2-3) are required for the diagnosis of milder depression, but as for the DSM-IV, the severity and number of symptoms decide the classification into mild, moderate and major depression.

Diagnostic classification of depression in the postnatal period

The ICD-10 (WHO, 1992) has three main categories for the classification of depression: Bipolar, unipolar episode or unipolar recurrent. (F31-33) In addition, there is a category F53 named "psychiatric disturbances occurring in the postnatal period", including postnatal depression (F53.0) and postnatal psychosis (F53.1). These disturbances should occur within the first six weeks after delivery, and not fulfill criteria for other disease classifications in chapter V (psychiatric diseases), either because of lack of information, or because "clinical reasons renders classification other places unreasonable". This wording in ICD-10 therefore leaves considerable room for individual clinical judgment by professionals. Some may classify a depressive episode that occurs within 6 weeks after delivery under F53.0, whereas others may prefer to use the points from F31 to F33 to be able to describe the depressive condition in more detail.

This problem is avoided in the DSM-IV (APA, 1994), as they do not have a specific category for postnatal depression. Instead, there is a specifier called "With postpartum onset" that can be added to a range of mood disorders: major depressive disorder, single episode or recurrent, bipolar 1 manic, mixed or depressed presentations,

depressed bipolar 2 disorder, and to brief psychotic disorder. The onset of the disorder has to be within four weeks after delivery.

Other postnatal mental illnesses

Several psychiatric disorders can occur during the postnatal period. Some may be exacerbations of pre-existing disease and liability, whereas other may arise de novo during the pregnancy or the postnatal period. This thesis will focus upon depression, but will briefly describe other psychiatric conditions and disorders that may be encountered during the postnatal period, as they may co-occur with depression or be considered as differential diagnoses.

Maternity "blues"

This condition occurs among 25-80% of women after delivery (Harris, 1994; Kendell et al., 1981), and are considered to be part of the normal reactions to child birth. The large range of estimated prevalence may reflect different study methods and definitions. The syndrome consists of emotional lability, dysphoric mood, tearfulness, irritability, anxiety and sleep disturbance. It peaks around 3-4 days after delivery, and resolves within hours to a few days. It is thought to be brought about by abrupt hormone withdrawal, especially progesterone (Harris et al., 1994). It could also be caused by lack of sleep, as women with night time delivery have a greater risk of maternity blues (Wilkie and Shapiro, 1992), and the syndrome co-varies with less sleep time at night (Swain et al., 1997).

Postnatal psychosis

Postnatal psychosis often takes the form of agitated mania, with delusions, confusion or stupor. The condition is rare, occurring after about 0.1 percent of deliveries, and largely confined to women with a previous psychotic or bipolar illness (Harlow et al., 2007). There is also a genetic risk, reflected through a familial aggregation of bipolar disorder in women with postnatal psychosis (Jones and Craddock, 2001). Postnatal psychosis may also be a result of major unipolar depression with psychotic features, or be a debut or an aggravation of schizophrenia or schizoaffective disorder. The

psychosis occurs shortly after delivery; approximately 90% within the first four postnatal weeks. The incidence is similar across time and cultures (Kumar, 1994). Sleep loss may be a precipitant of postnatal psychosis in predisposed women (Sharma et al., 2004).

PTSD (Post Traumatic Stress Disorder)

The present delivery may reactivate memories of past trauma, or may be experienced as a trauma itself, presenting through flash backs, nightmares and increased arousal. The stressful experience is most commonly pain, but could also be loss of control and fear of death (Brockington, 2004).

Anxiety and other mental disorders

The physical, emotional, social and practical changes in the postnatal period may also pose challenges for women suffering from other mental disorders, such as anxiety disorders, phobias, compulsions, eating disorders and personality disorders. This may contribute to or complicate depression during this period, as well as be considered as differential diagnoses. Anxiety may be just as common as depression in the postnatal period (Heron et al., 2004; Matthey et al., 2003; Wenzel et al., 2003).

Prevalence

The prevalence of depression in the postnatal period is by some estimated to be between 5-20 % (Miller, 2002) and others site an average prevalence of 13% (O'Hara and Swain, 1996). However, prevalence figures range from close to zero to 60% (Halbreich and Karkun, 2006). This variability might be due to cross-cultural variables, reporting style, differences in perception of mental health and its stigma, differences in socio-economic environments and biological vulnerability. A large variety of diagnostic criteria and instruments may also explain this variation (Eberhard-Gran et al., 2001a). High prevalence rates of depression among postnatal women have been found also in developing countries, including India (11% and 23%) (Chandran et al., 2002; Patel et al., 2002) and Pakistan (40%) (Rahman et al., 2004).

In Nepal, the prevalence of depression among postnatal women in tertiary health care has been estimated to be 12% (Nepal et al., 1999; Regmi et al., 2002). In a semi-urban community in eastern Norway, Eberhard-Gran et al. found a prevalence of depression of 8.7% (Eberhard-Gran et al., 2002), whereas Berle et al. found a prevalence of depression of 10.0% in the city of Bergen (Berle et al., 2003).

Factors associated with an increased risk of postnatal depression.

The postnatal period is a time of transition in many areas. The women experience physiological and hormonal changes, as well as changes in sleep pattern. In addition, the birth of a baby into a family implies interpersonal change and may evoke psychodynamic aspects related to own childhood experiences (Epperson and Ballew, 2006). There are numerous articles reviewing both antenatal and postnatal risk factors for depression after delivery (Brockington, 2004; O'Hara and Swain, 1996; Robertson et al., 2004)

Familial and genetic risk factors

One of the strongest determinants for postnatal depression is a previous history of depression, anxiety or other mental disorder. This could have occurred during the present pregnancy, during previous postnatal periods or not have been related to childbirth (Beck, 2001; Berle et al., 2003; Brockington, 2004; Eberhard-Gran et al., 2002; Milgrom et al., 2008; Nielsen Forman et al., 2000; O'Hara and Swain, 1996; Webster et al., 2000; Wisner and Stowe, 1997). Women who previously have had the first depressive episode in the postnatal period have a higher risk for depression after subsequent deliveries as compared to postnatal women who have had a recurrence of previous non-perinatal depression in the postnatal period (Cooper and Murray, 1995). An Australian twin study found that genetic components explained 25-38% of the variation (Treloar et al., 1999). Personality factors, such as neuroticism and negative cognitive attribution style have been linked to higher risk of depression, also in the postnatal period (O'Hara and Swain, 1996).

Psychosocial risk factors

Psychological distress and stressful life events during the previous year increases the risk of postnatal depression (Eberhard-Gran et al., 2002; Nielsen Forman et al., 2000). The woman's relationship to her partner is important. Poor relationship increases the risk of depression (Beck, 2001; Eberhard-Gran et al., 2002; Milgrom et al., 2008; O'Hara and Swain, 1996). Low social support or social isolation have also been found to be risk factors for developing depression in the postnatal period (Baker and Taylor, 1997; Brugha et al., 1998; Nielsen Forman et al., 2000). However, depressed women may underestimate the level of social support they actually receive (Logsdon et al., 2000). Marital status in itself does not seem to be related to depression (O'Hara and Swain, 1996), but single mothers may receive less social support or have a more deprived socio-economic situation. Women who have experienced previous or current abuse are at high risk for postnatal depression (Kendall-Tackett, 2007b). Unemployment, having a low income, or unplanned pregnancy have been associated with increased risk of postnatal depression (Warner et al., 1996; Webster et al., 2000). Maternal age, parity and education does not seem to be related to risk of postnatal depression, with the exception of mothers below the age of 18 (Robertson et al., 2004).

Somatic risk factors

Current somatic illnesses have been shown to be associated with depression after delivery (Berle et al., 2003). Several studies have examined the special obstetric and hormonal factors related to pregnancy and delivery to identify risk factors. Women with previous severe pre-menstrual syndrome have been found to have a higher risk, suggesting a hormonal contribution (McGill et al., 1995). An experimental study found that mimicking the hormonal changes related to pregnancy and delivery induced depressive symptoms in women who had previously had postnatal depression, but not in women who had been depressed only outside the perinatal periods (Bloch et al., 2000).

There are complex and currently incompletely known interactions between stress, hormones and depression. Depression is associated with inflammation, lower cortisol

levels and depressed cellular immunity (Groer and Morgan, 2007). Psycho-social stress factors (along with sleep disturbance and postnatal pain) could mediate their effects upon depression through such mechanisms (Kendall-Tackett, 2007a). Individuals with exposure to early life stress may be more vulnerable to psychosocial stress in the perinatal period, due to previous alterations in the regulation of the HPA axis (Kajantie, 2006). On the other hand, breast feeding seems to weaken the association between stress, inflammation and depression (Groer, 2005). Several studies have shown that depressed mothers are less likely to breastfeed (Eberhard-Gran et al., 2002; Warner et al., 1996). Dysfunction of the HPA axis may also play a causative role in insomnia without depression (Buckley and Schatzberg, 2005).

Risk factors found in developing countries

Most studies of postnatal depression have been conducted in industrialized countries, and less has been known about risk factors specific to developing countries. In the last few years, however, more studies are emerging also from these parts of the world (Goldbort, 2006). Studies from South Africa, Nigeria, Pakistan, India, Turkey, China and Latin America have all found risk factors similar to the ones described above, including previous depressive episodes, poor social and family support and economic difficulties (Adewuya et al., 2005; Chandran et al., 2002; Inandi et al., 2005; Inandi et al., 2002; Lee et al., 2000a; Patel et al., 2002; Rahman et al., 2003; Ramchandani et al., 2008; Wolf et al., 2002). A risk factor specifically documented from the developing countries Nigeria, India, Turkey and China is female gender of the newborn where a boy is preferred (Adewuya et al., 2005; Chandran et al., 2002; Dindar and Erdogan, 2007; Inandi et al., 2002; Lee et al., 2000a; Patel et al., 2002). In many cultures, including India, Turkey, United Arab Emirates and China, lack of support from the in-laws seems equally important as lack of support from the woman's partner (Chandran et al., 2002; Dindar and Erdogan, 2007; Green et al., 2006; Lau and Keung, 2007; Lee et al., 2004). In Nepal, depression in the postnatal period has until recently only been studied in tertiary health care (Nepal et al., 1999; Regmi et al., 2002), and risk factors have not been presented. In addition, 82% of mothers in Nepal deliver at home (UNICEF, 2005). Therefore, community data were needed to get a more representative

picture of prevalence and of risk factors for depression among postnatal women in Nepal.

Screening and diagnosis

Screening for depression in connection with postnatal visits has proven to identify significantly more women with depression than routine clinical evaluation (Evins et al., 2000). Routine screening with the EPDS are acceptable to most women and health professionals when sensitive explanation is given. Some authors are concerned that the impact of misclassification of women by such screening has not been considered (Krantz et al., 2008). However, the EPDS as a screening instrument for postnatal depression fulfils the WHO guidelines for screening (Eberhard-Gran and Slinning, 2007; Wilson and Junger, 1968). A prerequisite for screening is the availability of treatment and follow-up in order to improve the clinical outcome for women affected, as detection alone does not help the women if clinical treatment and follow-up are not available (Eberhard-Gran and Slinning, 2007; Evins et al., 2000; Gjerdingen and Yawn, 2007). Training and supervision of community health nurses are also essential in order to implement routine screening (Eberhard-Gran and Slinning, 2007; Massoudi et al., 2007). Treatment of postnatal depression after early detection programmes have shown positive effects upon the mothers (Appleby et al., 1997; Cooper et al., 2003; Wickberg and Hwang, 1996).

The National Institute for Health and Clinical Excellence (NICE) guidelines recommend that healthcare professionals should ask pregnant or postnatal women at their first visit about past or present severe mental illness, previous treatment for this, and about a family history of perinatal mental illness (NICE, 2007). A two-stage screening procedure (in week 8 and 12) has been proposed to identify women at risk for more persistent postnatal depression (Wickberg and Hwang, 1997). Self-report measures such as the EPDS could be used as part of an assessment of depressive illness, or for monitoring of outcome. Where depression is suspected, a more thorough interview is needed to clarify depressive symptoms, impairment in daily functioning and coexisting psychiatric disorders (Wisner et al., 2002). Other psychometric

questionnaires, such as MADRS (Montgomery and Aasberg Depression Rating Scale) and HADS (Hamilton Anxiety and Depression Scale) may also be used in the clinical setting to clarify symptoms, although they have not yet been validated for use in the postnatal period.

Treatment

Even when aware of their condition, postnatal women may be reluctant to disclose their feelings and seek help for depression (Dennis and Chung-Lee, 2006). However, the negative effects of untreated mental illness on the mother as well as on the baby, highlight the need for early detection and treatment (Misri and Kendrick, 2007). This is especially important for mothers with bipolar disorders, as they have a high risk of relapse if not on medication (Viguera et al., 2000). Identifying and treating depression in postnatal women has also been shown to decrease the risk of depression later in life (Small et al., 1994).

Psychosocial and psychological treatments

Women prefer to have "talking therapies" rather than to receive pharmacological interventions (Dennis and Chung-Lee, 2006). A recent Cochrane review concluded that any psychosocial or psychological intervention studied, compared to usual postnatal care, was associated with a reduction in the likelihood of continued depression (Dennis and Hodnett, 2007). The psychosocial treatments evaluated were peer support and non-directive counselling, provided by either health visitors/nurses or trained volunteers. Cognitive behavioural therapy, interpersonal psychotherapy, and psychodynamic therapy were the psychological therapies found to be effective. Very few treatment studies are available from developing countries, but Rahman et al. documented large and lasting improvement of maternal depression in Pakistan from a cognitive behavioural intervention delivered by trained and supervised community health workers (Rahman et al., 2008a). Treatment of infant sleep problems may also be effective upon maternal depression (Hiscock et al., 2008; Matthey and Speyer, 2008), as may physical exercise (Armstrong and Edwards, 2004). Treatments of the mother alone or along with her infant, may improve the mother-infant relationship, as

well as the cognitive development in children of depressed mothers (Poobalan et al., 2007).

Pharmacological treatment

Depression in the postnatal period is normally treated similarly to depression during other periods of life. However, very few drugs are approved for use during pregnancy and nursing, due to the vulnerable situation of the fetus and the breastfed infant, and evidence based recommendations can not be given due to the lack of good studies in the postnatal period (Dennis and Stewart, 2004). It is therefore necessary to weigh the risks of exposure to drugs for the nursing infant against the potential risks of untreated depression. The degree of severity of the depression, as well as response to previous treatment must also be considered.

One study found Fluoxetine to be significantly more effective than placebo and as effective as a full course of cognitive-behavioural counselling in the treatment of postnatal depression (Appleby et al., 1997). The use of all selective serotonin reuptake inhibitors (SSRIs), Venlafaxine and tricyclic antidepressants (TCA) (except Doxepin) is generally considered compatible with breastfeeding (Berle et al., 2004; Eberhard-Gran et al., 2006; Gentile, 2005b; Weissman et al., 2004). If possible, agents with long half-lives (such as Fluoxetine) should be avoided (Meltzer-Brody et al., 2008). It has been recommended to avoid breastfeeding while using Lithium, due to lack of data (Eberhard-Gran et al., 2006). However, a recent study found serum Lithium levels in nursing infants to be low and well tolerated (Viguera et al., 2007). For other drugs, such as Bupropion, Mirtazapine and Reboxetine, information is still incomplete or absent; and these compounds are not recommended as first-line agents in nursing mothers until studies support their use (NICE, 2007). In cases where the effect of the drug secreted in breast milk is possibly harmful, or where the mother is very concerned about possible harm to the baby, nursing should be stopped where medical treatment of maternal depression is essential. One randomized controlled study found oestrogen treatment to be an effective treatment for depression among mothers 3-18 months after delivery (Gregoire et al., 1996). However, the role of oestrogen in

treatment of postnatal depression is not clear, as there are few studies, and of varying quality. The treatment could also have serous side effects (Gentile, 2005a; Howard, 2006).

Prevention

The major and more serious depressions can not be predicted antenatally (Stamp et al., 1996). Furthermore, non-targeted psychosocial or psychological interventions do not significantly reduce the number of women who develop postnatal depression (Dennis, 2005). However, professional postnatal support individually targeted at at-risk women may be beneficial (Dennis, 2005; Larun et al., 2005).

Sleep

Depression and insomnia are co-morbid and interrelated conditions (Ohayon and Roth, 2003), possibly sharing a common pathophysiological mechanism (Roth, 2007). Having insomnia is often a precursor of as well as a negative prognostic factor for depression (Ancoli-Israel, 2006; Buysse et al., 2008; Neckelmann et al., 2007). However, there has been little attention to the altered sleep pattern in the postnatal period and its association to maternal depression (Lee, 1998; Ross et al., 2005).

Insomnia

Having a sleep problem is not equivalent to having insomnia, as there may be several reasons contributing to poor sleep. However, insomnia is the sleep condition most commonly associated with depression, and about 40% of people suffering from insomnia have a co-morbid psychiatric condition (Ford and Kamerow, 1989).

Insomnia is defined with the following criteria (AASM, 2005):

1. Difficulties falling asleep, staying asleep or non-restorative sleep
2. This difficulty is present despite adequate opportunity to sleep
3. This impairment in sleep is associated with daytime impairment or distress

4. This sleep difficulty occurs at least 3 times pr week and has been a problem for at least one month.

The prevalence of insomnia has been estimated to be 12% among Norwegian women (Ursin et al., 2005), and also to be associated with long-term effect upon work disability (Sivertsen et al., 2006b). In addition to depression, the following risk factors have been identified for insomnia: Older age and female gender (especially at onset of menses and menopause), co-morbid medical disorders (Katz and McHorney, 1998) and shift work (Ohayon and Roth, 2003). Primary sleep disorders, such as restless legs syndrome (Bjorvatn et al., 2005), periodic limb movement disorder, sleep related breathing disorders and phase delay or advance syndromes also frequently present with insomnia symptoms (Pallesen et al., 2007; Roth, 2007).

Normal sleep in the postnatal period

Postnatal women sleep less during the early weeks after delivery as compared to during pregnancy and other periods of reproductive age (Kang et al., 2002; Lee et al., 2000c; Nishihara et al., 2002). Normalising of the mothers sleep pattern occurs around 11-12 weeks after delivery, and coincides with the infant developing its circadian rhythm (Nishihara et al., 2000). The definition of insomnia as specified above is the presence of a sleep problem despite adequate opportunity to sleep. This is certainly not the case during the first postnatal months. Several factors can influence sleep among new mothers, including physical changes, demands from the infant and social factors (Bayer et al., 2007). However, some authors have suggested that the externally induced sleep deprivation in the postnatal period may develop into chronic insomnia (Silber, 2005). There are conflicting results as to the effect of breastfeeding and co-sleeping on maternal sleep quality, some reporting less sleep for mothers who breastfed (Bayer et al., 2007) while others report better sleep (Blyton et al., 2002; Quillin and Glenn, 2004).

Sleep and depression in the perinatal period

One model for postnatal mood disturbance could be that sleep deprivation in normal individuals produce daytime sleepiness, cognitive deficits, fatigue and irritability. These are symptoms that could be similar to and mimic postnatal mood symptoms (Armstrong et al., 1998; Bonnet and Arand, 2003). On the other hand, poor sleep quality can be a consequence, as well as a cause, of depression, as postnatal depression may aggravate an already impaired sleep quality.

Women who delivered during the night had a higher prevalence of maternal "blues", possibly reflecting the effect of the sleep deprivation during labor (Wilkie and Shapiro, 1992). Associations between poor maternal sleep quality and depressive symptoms have been reported in questionnaire studies of first-time mothers (Goyal et al., 2007; Huang et al., 2004). Associations between poor infant sleep, maternal daytime tiredness and depressive symptoms have been reported also in population studies (Bayer et al., 2007; Dennis and Ross, 2005). Interestingly, one of these studies found that good *maternal* sleep quality attenuated the link between poor *infant* sleep and maternal health problems (Bayer et al., 2007).

Studying sleep diaries from primiparous women the first month after delivery, Swain et al. found a correlation between time awake at night and dysphoric mood (Swain et al., 1997). On the other hand, Wolfson et al., also studying sleep diaries from primiparas, found longer total sleep time and later rise time among depressed mothers as compared to non-depressed mothers in the last trimester of pregnancy, but no differences in sleep in the first postnatal month (Wolfson et al., 2003).

As far as we know, there are no other studies except the present one (paper IV) investigating actigraphic sleep and it's association with depression in the postnatal period (Ross et al., 2005).

Polysomnography measures brain activity during sleep, and is often considered the gold standard for the measurement of sleep. One polysomnography study found

negative mood state to be related to increased wake time at night and marked reduction in sleep efficiency one month after delivery (Lee et al., 2000b). Depressed mothers had less total Rapid Eye Movement (REM) sleep, less total sleep time, more wake time and less sleep efficiency when compared to non-depressed mothers, whereas both groups showed decreased REM sleep latency. Disturbances in sleep pattern were particularly prominent for first time mothers (Lee et al., 2000c).

Several studies have focused on the infants' sleep and its relationship to maternal depression. In a community study, mothers reporting their infant (6-12 months) as having a sleep problem had a higher risk of depression (Hiscock and Wake, 2001). However, mothers that perceived their own sleep quality as good in spite of an infant sleep problem did not have a higher EPDS score than mothers of "well-sleeping" babies. Reporting infant sleep problem in a more objective manner gave a prevalence of sleep problem far less (17%) than the mother's report of the infant having a sleep problem (35%) (Morrell, 1999).

2. Aims of the study

General objective

The overall aim of the study was to measure prevalence and risk factors for depression among postnatal mothers in Nepal and Norway. In the Norwegian study we had an additional focus upon sleep in the postnatal period.

Specific objectives

In Nepal

To estimate the prevalence of depressive symptoms among mothers 5-10 weeks after delivery in one clinical, one urban and one rural population in Lalitpur district, as well as to examine possible risk factors for depression in the postnatal period among these women.

In Norway

To study the prevalence of depressive symptoms and maternal sleep problems two months after delivery in order to identify risk factors independently associated with either condition. We also aimed to describe and compare sleep measured prospectively and objectively in a sub-sample of depressed and non-depressed postnatal women.

3. Methodology

Participants and populations

Nepal

The study was conducted in three areas in Lalitpur district; one clinical, one rural and one urban population. Lalitpur district is located next to the country's capital Kathmandu, situated in the mid-hill geographical region at an altitude of around 1300 meters above sea level. Women who had given birth to a living child 5-10 weeks earlier were approached and included. Women whose children had died at birth were excluded.

1) The first (clinical) part of the study included women attending the regular postnatal check-up at Patan Hospital 6 weeks after delivery (in October 2001 and February 2002). Women from the cities in Kathmandu valley, as well as from the surrounding villages, attend the hospital's Post Natal Clinic on a self-referral basis, following a normal delivery at the hospital.
2) The second (rural) part of the study was conducted among women attending two rural health posts (Chapagaun and Battedada) for the first vaccination of their infant (around 6 weeks after delivery, from November 2001 to June 2002). Chapagaun is a village with a population of 12 500, located within the Kathmandu valley, 30 minutes bus drive from Patan Hospital. Battedada is a village with a population of 4000, located in steep hills four hours bus drive and a further 30 minutes walk from the hospital.
3) The third (urban) part of the study was conducted in Patan City, and aimed also to include women who did not attend any postnatal check up. Patan City has a population of 160 000. A stratified sampling procedure was done in co-operation with the local authorities, selecting 9 out of 22 wards to secure representation from different social, political and ethnic groups. These wards also had a functioning system of volunteers, which was necessary in order to identify the postnatal women in the area. The study period was from May 2002 to January 2003.

Norway

Between October 2005 and September 2006 all women giving birth to a live child at Stavanger University Hospital, Norway, were mailed a questionnaire asking about sleep and depressive symptoms. The hospital recruits women from a population of 300 000, including both urban and rural areas, and is the region's only facility for deliveries (approximately 4200 annually). The area is located at the south-western coast of Norway, and contains two larger towns, as well as fertile farmland villages and smaller island- and fjord communities.

Study procedures

Nepal

Three female specially trained health workers, not otherwise connected to the health facilities involved, filled in the questionnaire while interviewing the postnatal women. Women at the hospital and health posts were referred by the Auxiliary Nurse Midwives at the end of their regular consultation to the interviewers. A consent form was then read out to the subjects by the interviewers, asking for a signed informed consent before an interview could be conducted. In Patan City, a systematic house-to-house visit prior to the interviews identified women with an expected delivery date within the study period. These women were then contacted and interviewed at home six weeks after the given delivery dates. The interviews were performed in a separate area where the women and the interviewers could speak in privacy, without health workers, patients or relatives interfering.

Norway

a) <u>Population study</u>

Seven weeks after delivery, questionnaires were mailed to the women living within the hospital's catchment area. Women whose children had died at birth or before posting of the questionnaire, were excluded. Women who had not responded within 2.5 weeks received a reminder, whereas women who replied later than 20 weeks after delivery were excluded (three women).

b) Sleep registrations

From the main study population, we continuously recruited one group of women with high scores at the Edinburgh Postnatal Depression Scale (EPDS, see below) and one group with low scores to the prospective sub-study of subjective and objective sleep. Women who delivered a single infant at term (≥37 weeks gestation) and returned the questionnaire within 2.5 weeks without reservation against the sleep registration were eligible for participation in the actigraphy study. A total sample of 40 women, of whom 20 having elevated EPDS scores, would be able to detect an effect size of 0.89 at 5 % level of significance, with a power of 80% (Altman, 1991). Women were selected, contacted and included in the study until we had obtained the desired number of registrations (January - May 2006). For each woman scoring 10 or more at the EPDS, one woman with an EPDS score less than 7 was selected. In order to make the two groups comparable for age, parity and postnatal week, the two women's ages should not differ more than three years, parity should be similar (primipara or multipara) and the age of their infants should not differ with more than four days. After receiving a letter of invitation, the women were contacted by telephone, asking for consent and agreeing on a start up date.

Measurements /Tools

The Edinburgh Postnatal Depression Scale (EPDS)

The Edinburgh Postnatal Depression Scale was used to measure depressive symptoms both in Nepal and Norway. The EPDS is a 10-item self-rating questionnaire that was developed in Edinburgh by Cox et al. (Cox et al., 1987) to screen for depression in the postnatal period. Each question has four alternative answers, scoring 0-3, giving a maximum score of 30. The questionnaire has subsequently been validated and used in many cultures and languages (Eberhard-Gran et al., 2001a), including Nepal (Nepal et al., 1999; Regmi et al., 2002) and Norway (Berle et al., 2003; Eberhard-Gran et al., 2001b). For the Nepali version, a score above 12 was recommended as cut–off value, and was hence used in Nepal. The sensitivity for detecting moderate and major depression according to the DSM-IV criteria was 68% and the specificity 94%. Factors associated with an EPDS score above 12 were regarded as factors associated with

depression in Nepal. The Norwegian version, with a cut-off ≥10 in community studies, has a sensitivity of 100% and a specificity of 87% for detecting major depression according to the DSM-IV criteria, whereas the sensitivity for minor depression was 67% and specificity 97% (Eberhard-Gran et al., 2001b). In the Norwegian study, we used EPDS ≥ 10 as cut-off, as recommended by the validation.

The Self Report Questionnaire (SRQ-20)

The SRQ-20 is a 20-item mental health questionnaire designed for use in low-income countries, taking into account that the questionnaire has to be read out to illiterate subjects and that mental distress often is presented through somatic complaints. The answer alternatives are dichotomized (yes/no). It was introduced by Harding et al. for the WHO (Harding et al., 1980). The SRQ-20 identifies the presence of mental distress and psychiatric disturbance in a community health setting. Twelve questions are related to psychiatric complaints, five questions ask about somatic symptoms (headaches, poor appetite, shaking hands, indigestion and uncomfortable feelings in the stomach) and three questions measure sleep quality (sleeping badly, easily tired and being tired all the time). In population based studies, the SRQ-20 has been found to be a cost-effective instrument (Harpham et al., 2003). In Nepal, Wright et al. determined a SRQ-20 score above 10 as the best cut-off to identify presence of mental distress, and found it to be an understandable and accepted tool among village populations in Nepal (Wright et al., 1989).

General questionnaire, Nepal

The general questionnaire collected information about basic socio-demographic variables as well as variables related to family and marriage. The mothers' obstetrical and mental health statuses were recorded by asking dichotomized questions about the presence or absence of disorders and complaints. Height and weight were measured to examine the nutritional status of the women, and Body Mass Index (BMI, kg/m^2) was calculated. Questions regarding breastfeeding and sex of the baby were also included. Social factors, such as practical support in the household, alcohol problems among family members, violence in marriage, and the experience of specific stressful life

events during the last year were recorded. We also asked whether the woman presently was staying in her maternal home, a common tradition after delivery in some ethnic groups in Nepal. Presence or absence of specific sleep problems such as problem falling asleep, interrupted sleep or early awakening were asked for. If a sleep problem was confirmed, we asked about possible reasons for this (the baby, many household chores or "no specific reason"). Level of energy was assessed by the question "How well rested are you during the day?" (lots of energy, enough energy for the day, a little tired, very tired or exhausted).

General questionnaire, Norway

The women were asked about their highest completed education and their main occupation (employed, self-employed, housewife, student, unemployed or receiving disability/ rehabilitation allowance). Most women in Norway have the rights to 44 weeks fully paid maternity leave after delivery, based upon their income, whereas women without their own income receive a monetary grant immediately after delivery. Students get funding enabling them to postpone their studies for 6 months. Most women would therefore be at home with the baby at the time of the study. We also asked about breastfeeding practice (exclusively, with supplement, or not breastfeeding) and where the baby slept at night (co-sleeping, separate bed, separate room, other). Information about a history of depression (after the current delivery, during the last pregnancy or previously) was obtained by a scale of five questions (concerning sadness, appetite changes, lack of energy, self blame and concentration) constructed to measure lifetime history of major depression, based on the DSM-IV criteria (Kendler et al., 1993a). When a woman reported having experienced three or more of these symptoms simultaneously for more than two weeks, she was asked to specify when this had occurred: during pregnancy, after the current delivery and/or previously. A question of depression among close family members was coded yes, no or "I don't know". We also asked about the experience of ten specific stressful life events during the last year (rated emotionally not so difficult, difficult or very difficult), questions previously used among postnatal mothers in Norway (Eberhard-Gran et al., 2002). Finally, women who had a partner were asked to rate their

satisfaction with this relationship (very content, content, some discontent or very discontent).

Variables obtained from the birth records, Norway

Demographic characteristics (age, marital status, address) and obstetric history (parity, previous stillbirths and miscarriages, previous caesarean sections) were obtained from the birth records at the hospital. These records also provided information of the present mode and time of delivery and characteristics of the infants, such as sex, twins/triplets, gestational age, birth weight and Apgar scores.

Measure of sleep

a) The Pittsburgh Sleep Quality Index (PSQI)

The Pittsburgh Sleep Quality Index is a widely used self-rating questionnaire that assesses clinical and subjective sleep complaints the previous month (Buysse et al., 1989). Nineteen individual items generate seven component scores (range 0-3): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. The sum of scores for the seven components yields one global sleep quality score (maximum score 21). A cut-off value of 5 has showed a sensitivity of 90% and a specificity of 87% for discrimination between “good” and “poor” sleepers. It has been translated into Norwegian and validated (Pallesen et al., 2005).

Four questions derived from a Norwegian population study (Ursin et al., 2005), asked about a history of sleep problems outside perinatal periods; each coded yes/no (previous difficulties falling asleep, multiple awakenings at night, early morning awakenings and sleep problems affecting daytime function). Women answering yes to one or more of these questions were classified as having had “previous sleep problems”.

b) Sleep diary

Subjective sleep measures were obtained with a modified version of the sleep diary presented by Morin (Morin, 1993). The diary consisted of the woman's estimates for daytime and night-time sleep recorded daily for a period of two weeks. The following measures were derived from the diary: number of daytime naps, total daytime nap duration, daytime function (1= very good, 5= very poor), bedtime, sleep-onset latency, wake after sleep onset, number of awakenings, early morning awakening (time spent in bed after final wake-up), get-up time, total wake time (sleep-onset latency + wake after sleep onset + early morning awakening), total sleep time, time in bed, sleep efficiency (total sleep time as a percentage of time in bed), any use of sleep medication (including alcohol) and an overall rating of the night's sleep (1 = very restless, 5 = very sound).

c) Actigraphy

Objective sleep-wake activity was recorded with an Actiwatch recorder (Cambridge Neurotechnology Ltd, Cambridge, England), which is a small wrist-worn device, sized 1x3x3cm, containing an accelerometer that is optimized for highly effective sleep-wake inference from wrist activity. The sensitivity of the Actiwatch was set to medium. Data were collected in 1-minutes epochs and transferred, via an interface, to a computer, and then analyzed (Actigraphy Sleep Analysis, 2001, Cambridge Neurotechnology Ltd., Cambridge, England). The women wore the actigraph for two consecutive weeks, except when taking a bath or a shower. They were instructed to register the time they went to bed and the time they got out of bed by pressing a button on the actigraph. The following measures were derived from the actigraph: sleep-onset latency, wake after sleep onset, early morning awakening, total wake time, total sleep time, time in bed, sleep efficiency and day/night activity ratio (day and night were set based on mean bedtime and get-up time for the whole sample).

Data processing and statistical analysis

In Nepal, the data were manually entered into a database using Epi-Info 2000, by one trained assistant in addition to the main investigator. The data were checked for

seemingly abnormal figures and all missing data were checked against the original records. In addition, every fifth entry was double checked by the main investigator for mistakes. If there seemed to be a systematic mis-registration of a certain variable, all forms were manually checked for this variable.

In Norway, the questionnaires were optically scanned, and later manually checked for seemingly abnormal figures that appeared during data cleaning, as well as missing values. SPSS for Windows, versions 11 through 15.0 (SPSS Inc. Chicago, Illinois, USA) was used for all statistical analyses except for the calculation of effect sizes, where HyperStat Online's effect size calculator was used (Lane, 2007). If any of the data contributing to the PSQI total score were missing (110/2830, 3.9%), these respondents were excluded from the analysis of the corresponding sub-score(s). However, if the sum of the remaining scores was above 5, these respondents were allocated to the group of high scorers. Similarly, if only one sub-score was missing, and the sum of the remaining observations was 2 or less, these women were counted as low scorers. Only 39 women (1.4%) could not be categorized as either high or low scorers. For missing data in the EPDS (n=49, 1.7%), sample means for these questions were used when the woman had completed at least eight of the ten questions contributing to the score (n=44).

The distributions of numerical data were checked for normality using P-P charts. Internal consistencies of the scales used were calculated by Cronbach's alpha. For numerical data, means and standard deviations (SD) were calculated, while for categorical data, proportions are presented. Independent samples t-test was used to analyze numerical differences between the groups. For categorical data, proportions with 95% confidence intervals and Chi-square tests were first used to study binominal differences between the different groups. Thereafter, univariate and multivariate logistic regressions analyses were performed, giving adjusted odds ratios (OR) with 95% confidence intervals (CI). Due to differences in the sample sizes, the multivariate procedures differed between the data from Nepal and Norway, see below. The level of significance was set set to a p-value lower than 0.05 for the statistical calculations in

paper I, II and IV. In paper III, statistical significance was set to a p-value lower than 0.01 in the final models due to the large sample size and number of calculations.

Analyses specific for the Nepali data

Pearson's correlation between the EPDS and the SRQ-20 was estimated. For categorical variables, differences were tested by exact logistic regression analyses, giving crude and adjusted odds ratios (OR) with 95% confidence intervals (CI). The variables associated with a high depressive score in the univariate analyses ($p<0.1$) were included into a forward stepwise multiple logistic regression. By repeating this procedure, three variables were identified as those being the strongest associated with a high depressive score. Each of the other variables was then included in a multiple logistic regression adjusting for these three main risk factors.

Analysis of risk factors, Norway

Effect sizes for the differences in mean PSQI scores between depressed and non-depressed women were calculated with Hedges bias correction. Differences between women scoring above or below cut-off values of the PSQI and the EPDS were tested by logistic regression analyses. The variables significantly associated with a PSQI value >5, or with an EPDS value ≥10 in the univariate analyses ($p<0.05$) were included in forward multiple logistic regression models along with age.

Analyses of the sleep registrations

From the sleep diary and the actigraph, mean values obtained from day 5-11 were preferably analysed. In case of missing data, the seven consecutive days with the least combined missing data from the actigraph and the sleep diary were used (six cases). In case the subjects had forgotten to press the actigraphy button, values for bedtime or get-up time were obtained from the sleep diary. The distributions of the data were checked for normality. Independent samples t-tests were used to analyse differences between the groups. Skewed variables were also analysed by Mann-Whitney U tests. Results from the t-tests are presented where both tests gave similar conclusions regarding significance.

Ethical considerations

All studies were approved by the Regional Committee for Medical Research Ethics in Western Norway. In addition, the Nepal study was approved by the Nepal Health Research Council, and the Norwegian study was approved by the National Data Inspectorate in Norway.

In Nepal, a consent form was read out to the subjects, asking for a signed informed consent before an interview could be conducted. All women with an EPDS score above 12 were referred to adequate follow-up at local mental health clinics.

In Norway, an invitation letter was sent to the women along with the questionnaire, explaining the purpose and content of the study and that participation was voluntary. Returning of a completed questionnaire was regarded as a written informed consent. Women who wanted to discuss issues related to the study, or who needed help or advice, were given the opportunity to contact the main investigator. A written information letter was also sent to each woman selected for the sub-study, asking for oral consent before inclusion into the sleep registrations. The women could also mark in the main questionnaire if they did not want to be contacted for sleep registrations.

4. Synopsis of the papers

Paper I

The prevalence of depressive symptoms in the postnatal period in Lalitpur district, Nepal

Objective: The aim of this study was to estimate the prevalence of depressive symptoms among mothers 5-10 weeks after delivery in one clinical, one rural and one urban population in Lalitpur district, Nepal.

Results:
A total of 426 women were included in the study; 203 from a hospital (Patan), 102 from two villages and 121 from Patan city. The consent rate ranged from 94-100%. The mean age of the participants was 24.5 years (range 16-40). The overall literacy rate was 72%, with significantly more literate women recruited from the hospital. Forty-seven percent of the mothers in the villages had delivered at a clinical facility, whereas 90% of the women included from Patan City had delivered at a hospital or a birthing center. Mean EPDS score was 5.0 (range 0-24). The overall prevalence of depressive symptoms in the postnatal period (defined as EPDS > 12) was 4.9% (95% CI 2.9 - 7.0). The prevalence was 7.4% in Patan City and 3.9% in the hospital and in the villages (not significant). The mean SRQ-20 score was 3.3 (range 0-15). The prevalence of mental distress (defined as SRQ-20 > 10) was 3.1% (95% CI 1.4 - 4.7). There were no significant differences in SRQ-20 >10 among the three populations studied (2.5%-3.9%). The EPDS scores correlated moderately high with the SRQ-20 scores (Pearson's correlation 0.60, $p<0.01$).

Conclusions: The prevalence of depressive symptoms in the postnatal period in Lalitpur was lower than previously reported from Nepal.

Paper II

Factors associated with depressive symptoms among postnatal women in Nepal.

Objective: Knowledge of risk factors could improve the health workers' recognition of depression after childbirth. The objective of this paper was therefore to examine possible risk factors for depression 5-10 weeks after delivery among women in one clinical, one urban and one rural population in Lalitpur district, Nepal (n=426).

Results: All respondents were married, with mean number of children being 1.7 (SD 0.89). There were more mothers of boys (56%) than mothers of girls (44%) included (p=0.03). Women who did not give consent to participate (n=14) did not differ in age, parity or ethnicity from the participants. Multivariate analysis showed that depression (EPDS >12) was strongly associated with husband's alcoholism, polygamy and previous depression. Other significant factors were stressful life events, multiparity, smoking and depression during pregnancy. There was a non-significant trend of lower depressive scores among women practicing the tradition of staying in their maternal home after delivery. Age, occupation, breastfeeding pattern and sex of the infant were not associated with an EPDS above 12.

In the univariate analyses,the following factors were associated with increased risk of depression, but became non-significant when adjusted for the above mentioned variables: living with a violent husband, receiving practical support from fewer than two persons or having a BMI lower than 20 kg/m^2. Having more than 10 years of education (either the husband or the women herself) or having had an arranged marriage were factors associated with a significantly lower risk of depressive symptoms in the univariate analyses.

Conclusions: In addition to previously documented risk factors, traditional family structures may influence the risk of depression among postnatal women in Nepal.

Paper III

Sleep and depression in postpartum women – a population based study.

Objective: To study the prevalence of postnatal maternal sleep problems and of depressive symptoms two months after delivery among all women who gave birth at Stavanger University Hospital during one year. In this way, we aimed to identify factors independently associated with either condition, and to explore associations between specific postnatal sleep components and depression.

Results: The response rate was 68% (n=2830). The mean score at PSQI was 6.3 (SD 3.1), and the prevalence of sleep problems, defined as PSQI >5, was 57.7%. The mean self-reported sleep duration was 6.5 hours at night and sleep efficiency was 73%. The mean EPDS score was 5.3 (SD 4.5). The prevalence of depression, defined as EPDS ≥10, was 16.5%. Having previously had sleep problems, being primipara, not exclusively breastfeeding or having younger or male infant were all factors associated with poor postnatal sleep quality. Depression, however, was the factor most strongly associated with sleep problems in this period. Sleep disturbances and daytime function were the aspects of sleep problems (PSQI sub-scores) most strongly associated with depression. Subjective sleep quality and sleep onset latency were also associated with depression. Poor sleep was associated with depression also when adjusted for significant risk factors for postnatal depression, such as poor partner relationship, previous depression, depression during pregnancy and stressful life events. PSQI scores above 7 (for multiparas), or 8 (for primiparas) implied a risk of depressive symptoms above the mean 16.5% population prevalence.

Conclusions: Poor sleep was associated with depression, independent of other risk factors. Due to the cross-sectional design, we can not determine causality, but the results support a bidirectional relationship between sleep and depression. The study may guide the clinician when evaluating postnatal maternal sleep problems and whether these indicate a higher risk of depression.

Paper IV

Subjective and objective sleep among depressed and non-depressed postnatal women.

Objective: This study aimed at measuring sleep prospectively and objectively for two weeks in 21 depressed (EPDS ≥10) and 21 non-depressed women (EPDS <7) in order to examine differences in sleep according to depressive status.

Results: Women with depressive symptoms scored significantly higher than non-depressed women for subjective sleep measured retrospectively by the PSQI, both at the total scale and at the four sub-scales measuring subjective sleep quality, daytime function, sleep onset latency and total duration of sleep. In contrast, there were no significant differences in sleep measured prospectively by subjective sleep diaries and objective actigraphy. Women with depressive symptoms scored significantly poorer than the non-depressed women at the question for daytime function in the sleep diary (2.8, SD 0.6 versus 2.0, SD 0.4, p<0.001, effect size 1.4). According to the actigraphs, women with depressive symptoms had less difference in their activity level between day and night (day/night activity ratio 5.0, SD 1.7 versus 6.5, SD 2.5, p=0.04, effect size 0.6). Both depressed and non-depressed women had impaired sleep efficiency (82%) and were awake for about 1.5 hours during the night. There was no significant difference in the total PSQI score between primiparas (7.2, SD 3.2) and multiparas (7.5, SD 3.2), neither were there any differences in the PSQI sub-scores according to parity. However, the actigraphy recordings found worse sleep among primiparas compared to multiparas, with more time awake during the night (Wake After Sleep Onset: 74 minutes, SD 24, versus 51 minutes, SD 25, p=0.02, effect size 0.9) and lower sleep efficiency (83%, SD 5 versus 88%, SD 5, p=0.02, effect size 0.9).

Conclusions: Measured objectively and prospectively, women with depression did not have worse sleep than non-depressed women. Sleep was reduced in both groups, and this could imply that mothers diagnosed with depression are not merely suffering from the effects of chronic sleep deprivation. Primiparas had worse sleep than multiparas.

5. Discussion

Main findings

The prevalence of depressive symptoms in the postnatal period found in Nepal (4.9%) was lower than in previous studies from Nepal (12%) and India (11% - 23%) (Chandran et al., 2002; Nepal et al., 1999; Patel et al., 2002; Regmi et al., 2002). Depressive symptoms in the postnatal period in Nepal were strongly associated with the woman's relationship to her husband, reflected through the custom of polygamy and the husbands' alcoholism. Postnatal depressive symptoms were also associated with previous depression, with experiencing stressful life events the previous year, depression during pregnancy, multiparity and smoking.

In Norway, 16.5% of the postnatal women had depressive symptoms two months after delivery. Sleep problems were also prevalent, with nearly 58 % of the mothers reporting problems with their sleep, sleeping on average 6.5 hours at night, with a sleep efficiency of 73%. Depression was associated with poor global sleep quality, poor partner relationship, previous depression, depression during pregnancy and the experience of stressful life events. Next to depression, a history of sleep problems and being a first time mother were the factors most strongly associated with poor global sleep quality. Prospective and objective sleep registrations through sleep diary and actigraphy showed that the postnatal women spent on average 1.5 hours awake at night in the third postnatal month. Depressed women reported significantly lower daytime function (sleep diary) and had significantly lower day/night activity ratio (actigraphy). However, we found no significant differences in sleep between depressed and non-depressed women by these prospective and objective sleep registrations. On the other hand, primiparas had lower sleep efficiency (actigraphy) and spent more time awake at night (sleep diary) compared to multiparas.

Methodological issues

Sampling and design

Nepal

In Patan Hospital and in Chapagaun Health Post, only women who actively used the Mother and Child Health clinics were recruited. Mothers with depression could be less likely to attend the 6-week postnatal check up (Rahman et al., 2004; Turner et al., 2003). Never the less, in India, Patel et al. (Patel et al., 2002) found that mothers with depression were more likely to consult health care providers than other mothers. There were some logistic difficulties in identifying and tracing postnatal women in the urban part of our study, which may have posed a selection bias in this population. However, this part of the study was also the most comprehensive, with women being included independently of attendance to any postnatal clinic or hospital, probably lessening the selection bias as compared with the hospital and health post populations.

The women included from the villages and from Patan City were comparable with the general population of Lalitpur in terms of literacy level (61%), ethnicity and number of children, whereas the women recruited from the hospital had higher proportions of women with education and of primiparas. The combined literacy rate in the present study (72%) was substantially higher than the average for the country (43%), and contained a higher proportion of women delivering at a hospital (villages 50%, urban 90%, hospital 100%) than the average 10% in Nepal. Our sample might thus not be representative for areas in Nepal with less access to functioning health care or lower literacy rates. Some groups were possibly under-represented, such as mothers of girls, mothers working outside the home, and mothers who did not use the health facilities.

Norway

In the Norwegian study, the logistics were a lot simpler than in Nepal. All inhabitants in Norway have a registered address and identification number based upon date of birth, and can be reached by the postal service. Through their personal identification number, the patient lists at the hospital are related to the national population register.

As a result of this procedure, the Norwegian study included a large, heterogenous population based sample of postnatal women, limiting the possibility of self-selection that could occur using clinical samples. The response rate was acceptable (68%), but mothers who were single, younger, had more than two children or a premature baby were less likely to participate. This might have influenced the estimated prevalence of sleep problems and depression. However, a majority of women from these sub-groups (55-63%) still responded, enabling us to evaluate risk factors also related to these groups.

In order to register sleep in the 9-10th postnatal week, only early responders could be recruited to the sleep registration study (Paper IV). Women with severe depression or with severe sleep problems could have been more reluctant to participate, or have replied later than 2.5 weeks. We found, however, no significant differences in the proportions scoring ≥10 at the EPDS between early and late responders, or compared with women reserving themselves against further contact.

A cross-sectional study can only identify associations between depression, sleep and the other factors studied, and can not indicate the direction of effects (including causality) when two factors are associated. The factors identified as associated with depressive symptoms or sleep may also be mediators for other, unknown factors not included in the study.

Tools

Edinburg Postnatal Depression Scale (EPDS)

The prevalence estimates both in Nepal and Norway are based upon women scoring above a validated cut-off at the EPDS. For diagnosis of depression, a high score needs to be followed by an interview. The prevalence of depression according to the DSM-IV criteria could thus be somewhat different from the proportion identified as high scorers by the EPDS. However, the EPDS is a commonly used instrument to screen for depression in the postnatal period and has often been used alone in assessing maternal

mood (Eberhard-Gran et al., 2002; O'Hara et al., 1990; Patel et al., 2002; Rahman et al., 2004).

The Nepali validation of the EPDS showed a sensitivity of 68.4% and a specificity of 93.8%, using a cut-off value > 12 for moderate to major depression as defined by DSM-IV (Nepal et al., 1999). The relatively low sensitivity may have lead to an erroneously low prevalence estimate in the Nepal study, and milder forms of depression might thus be underrepresented among our cases in Nepal. However, a higher cut-off value, and thereby a higher specificity, will increase the probability that individuals with scores above cut-off value actually do have a depression (Eberhard-Gran et al., 2001a). This could strengthen the validity of the risk factors identified in Nepal.

When using the EPDS in primary health care as a component of a screening program, a cut-off value above 9 has been recommended (Cox et al., 1987). This was also the cut-off determined by the Norwegian validation study in a primary health care setting, for the identification also of women with minor depression (Eberhard-Gran et al., 2001b). This may have increased the proportion of false positive cases (i.e non-depressed women) among the Norwegian women scoring above cut-off.

The EPDS is based on self-rating. This implies that the women should be able to read, understand, and cross off correspondingly. For an illiterate person, this is not possible. In an interview situation there could also be a risk of underreporting psychiatric symptoms as opposed to filling in a written self-report. This could be aggravated by subjects not being familiar with the use of questionnaires or with a language describing emotions. However, the psychometric properties of the Nepali version of the EPDS have been shown to be satisfactory, also when interviews were used (Nepal et al., 1999). A study from Nigeria showed that reading out psychometric questionnaires to illiterate people did not alter the psychometric properties of the instruments used (Abiodun, 1994). Qualitative data from South Asian women in UK indicated that women preferred face-to-face interviews to self-complete questionnaires

(Downe et al., 2007). The responses given to each of the first nine questions at the EPDS in Nepal showed that the women used the scale's potential, with 20-58% of the women having experienced each of the emotional problems mentioned in the scale. Very few reported suicidal thoughts. This could indicate that the Nepali women were able to use emotional language, also in an unfamiliar test situation, and that major depression was not common in this population.

Self Report Questionnaire (SRQ-20)

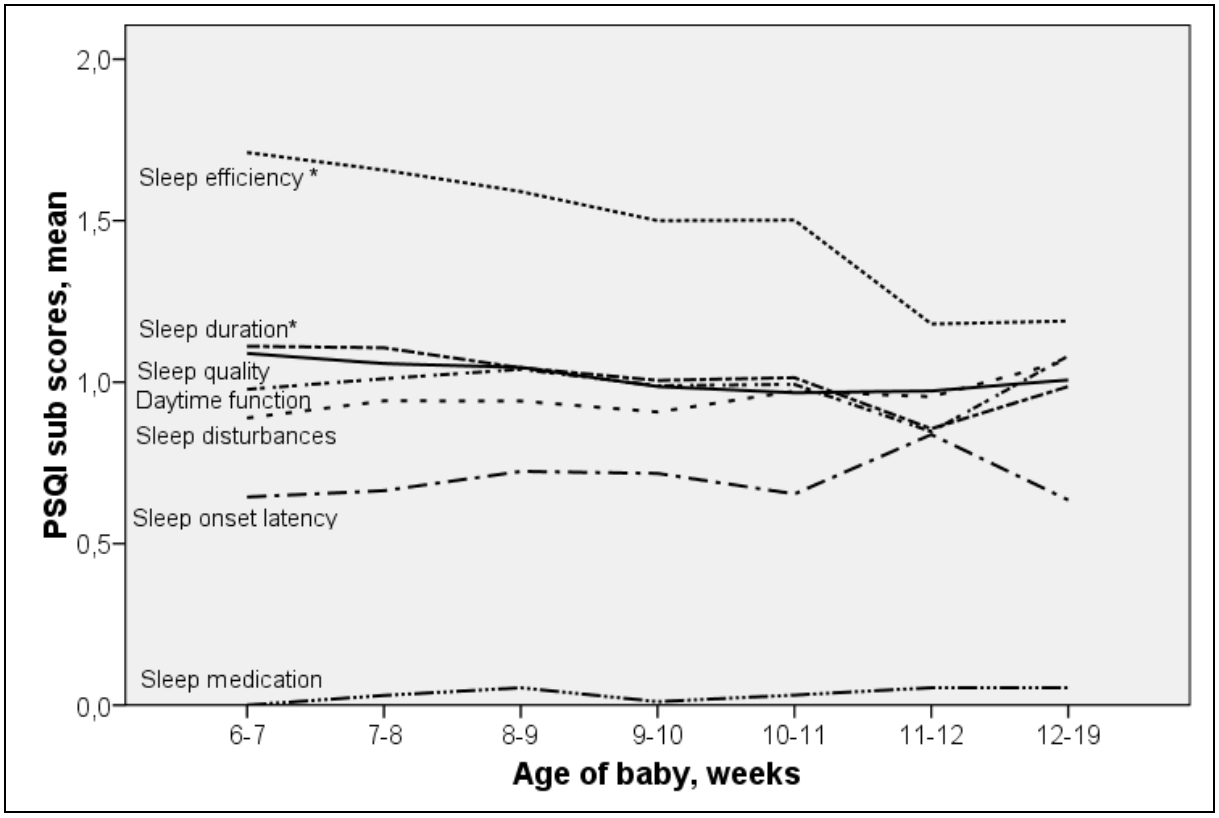
Somatisation has been described as a dominant expression of depressive illness in Nepal (Wright et al., 1989). Hence, the use of EPDS, which does not include somatic symptoms, may lead to a loss of cases in this culture. Five of the questions at the SRQ-20 ask about somatic complaints, and could be more likely to uncover a somatic presentation of mental distress. A large discrepancy in the proportions classified as cases by the two scales would give an indication of suitability of the EPDS in our population. We found a moderately high correlation between the EPDS and the SRQ-20, and we did not classify more women with mental distress when asking about somatic symptoms as compared to asking solely about mental complaints, 3.1% and 4.9% respectively. Somatic problems may be a depressed woman's presenting complaint at the health post, but these results suggest that women are able to talk about their mental state and emotions directly when asked.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI asks about the experience of several sleep problems as they have been present in the previous month, assuming that the sleep problems are relatively unchanged or stable. For postnatal mothers, however, the first three months after delivery is characterised by a continuous change in sleep parameters (Kang et al., 2002; Lee et al., 2000c; Nishihara et al., 2002). The women in our study may therefore have had difficulties evaluating the previous month's sleep. Furthermore, late responders may have scored lower at the PSQI than early responders. Figure 1 shows mean subscores at PSQI according to postnatal week (time of completion of the questionnaire). There was a small, but significant, decline in PSQI according to

postnatal week. This was mainly accounted for by an improved sleep efficiency from the 11th postnatal week (7% of the total sample).

Figure 1: PSQI sub-scores by age of baby:



PSQI - Pittsburgh Sleep Quality Index * - $p<0.01$

PSQI has previously been used among postnatal mothers as early as 2-3 weeks after delivery (Huang et al., 2004), with similar results to ours. In addition, the psychometric properties of the PSQI used among the postnatal women in our study were similar to previous international (Buysse et al., 1989) and national (Pallesen et al., 2005) validations. It therefore seems to be a valid tool for use also in this population of postnatal mothers with changing sleep patterns.

Demographic questionnaire, Norway

From industrialized countries, there has been published multiple studies investigating risk factors for postnatal depression, and data are available also from Norway (Berle et al., 2003; Eberhard-Gran et al., 2002). In order to obtain a high response rate we

therefore decided not to develop an extensive questionnaire exploring all possible risk factors in our Norwegian sample, but aimed at having a short, easy and focused questionnaire. Based upon previous research, we included major risk factors described by others in order to be able to adjust for important confounders (Brockington, 2004; O'Hara and Swain, 1996; Robertson et al., 2004). However, the short questionnaire led to limitations towards number of risk factors possible to examine and control for. Some of the risk factors found in Nepal (regarding smoking, practical support and nutritional situation) could therefore not be compared with the Norwegian population of postnatal women. On the other hand, the electronic transfer of obstetric and demographic data directly from the hospital records optimized the accuracy of these data in the Norwegian study.

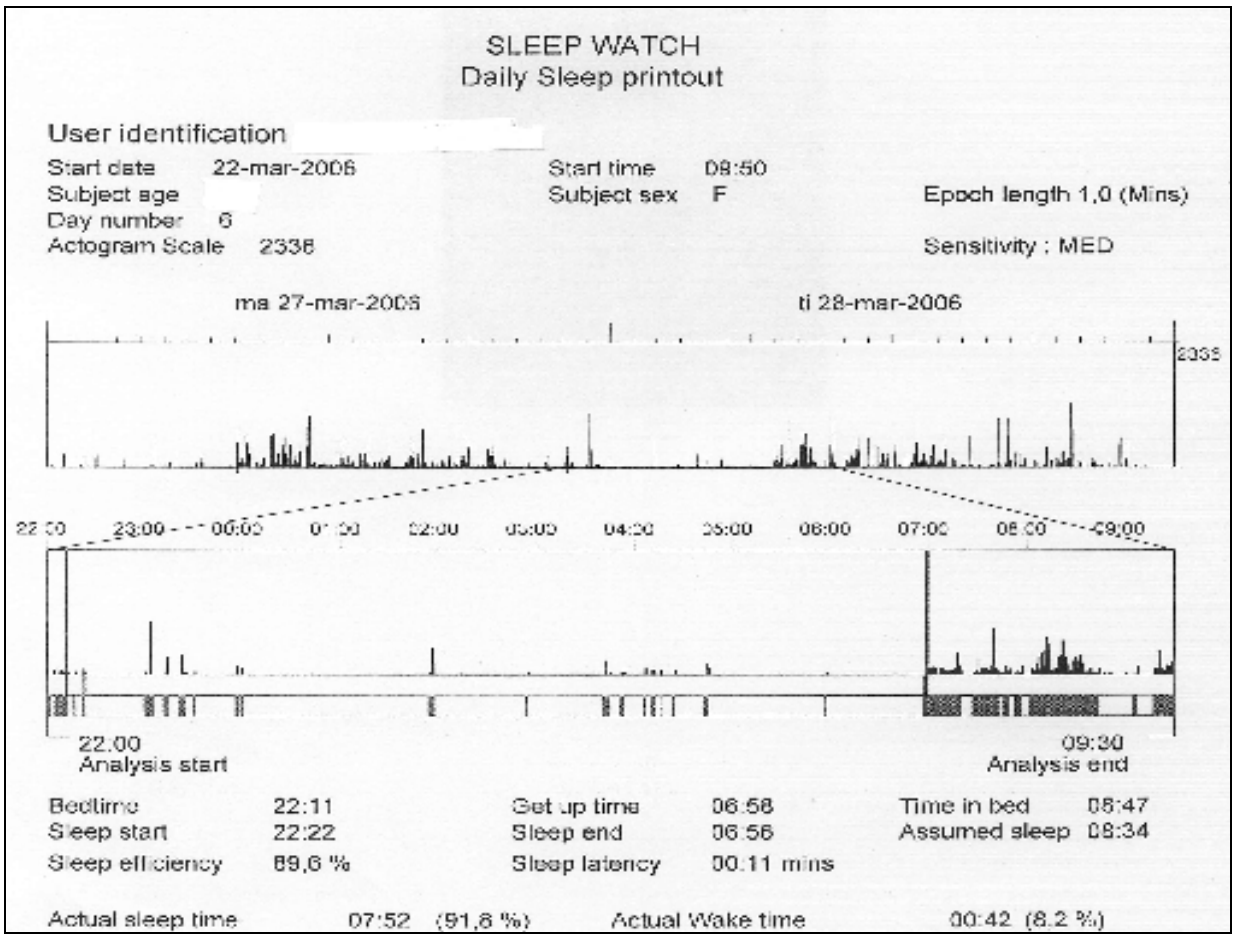
Sleep registrations

Questionnaires, such as PSQI, are retrospective, and thus liable to the influence of depressive cognition upon the subject's evaluation of her sleep problems. This influence can be minimized by prospective and objective registrations. Evaluation of each night's sleep in a sleep diary will provide less recall bias, and may produce a more accurate description of sleep, although it may be difficult to estimate exact sleep onset times. Actigraphy overestimates total sleep time and sleep efficiency, as well as underestimates sleep onset latency and wake after sleep onset when compared to polysomnography (Sivertsen et al., 2006a). The actigraphy does not measure as "time awake" periods when the mother is lying completely still. Depressed mothers may be less motorically active, and the actigraphy may possibly misclassify more time awake as sleep among depressed mothers. On the other hand, both laboratory and ambulant polysomnography could interfere with the natural sleep and activity pattern of the subjects (Dijk et al., 2001; Godfroid et al., 1997). Actigraphy has therefore been found to be a valid objective measure of sleep/wake times, suitable for the evaluation of sleep pattern over time in a natural setting (Morgenthaler et al., 2007).

The time lying still when awake could explain the somewhat better actigraphic sleep recorded among mothers who slept with the infant in their bed (Paper IV), as the sleep

diary did not describe better sleep for co-sleeping mothers. Actigraphy cannot measure the depth and restorative function of sleep. Thus, the information from the sleep diaries complements the information from the actigraphs, and values from the two different methods of registration can not be directly compared. However, also in the sleep diaries the estimated time awake at night were similar for depressed and non-depressed mothers. Figure 2 shows an example of an actigraphy recording for one woman with a typical (median) sleep pattern.

Figure 2: *Actigraph recordings for one night from one woman with median sleep efficiency*



Ethical considerations

When asking women sensitive questions about depressive symptoms, including suicidal thoughts, there should therefore be a possibility of offering treatment to women in distress. In Nepal, where the interviewers met the women face to face, we offered participants scoring above cut-off at the EPDS a referral to a trained local mental health worker. Very few, however, used this option. In Norway, nearly all women attend the six week check up at their general practitioner, as well as the monthly infant check ups by the community health nurse. The general practitioners are qualified to diagnose and treat mild to moderate depression, and may also refer patients to the secondary mental health care system when indicated. This provides women several opportunities to discuss depressive symptoms with her doctor or community health nurse, and for the health care workers to ask about depression.

The EPDS does not give a definite diagnosis of depression, and some women may only have a mild and transient depression that may improve without further treatment. Without the possibility of a face to face communication with the respondents, we therefore decided to rely on the existing public health system for diagnosing and treating depression, and not to inform women with elevated EPDS score about their status. However, the questionnaire could make some women more aware of their depressive symptoms. The respondents were therefore given the possibility to contact the main investigator (a clinical doctor with training in psychiatry) in case they had any questions. Advice or referral to appropriate level of follow up could then be given. Less than ten women used this opportunity. Some of these did not score above cut-off at the EPDS, but had other questions related to the study, to their baby or to the delivery.

Statistics and data analysis

The prevalence of depression in Nepal was lower than expected, resulting in relatively few cases (Paper I and II). A rather low statistical power therefore permitted only the detection of substantial differences between the different categories, and also resulted in wide confidence intervals for the estimated odds ratios. Furthermore, the low

number of cases limited the number of confounders to be examined simultaneously in the multiple logistic regression analyses. The results in paper II therefore reflect a compromise between correcting for confounders and respecting the statistical limitations of a low number of cases.

The Norwegian population based study (Paper III) included a higher number of study subjects (n=2830), and also had a higher rate of women scoring above cut-off at the EPDS, resulting in a higher number of cases. Statistically, this posed an opposite challenge from the Nepal data. We found many statistically significant associations between the different variables, but where the absolute differences in means or in odds ratios were small. We therefore had to use caution when interpreting these results, and evaluate whether the statistically significant differences also were clinically relevant. The calculation of effect sizes was helpful in this evaluation. Effect sizes >0.8 is considered large, >0.5 moderate, and <0.3 low. In the Norwegian sample, we were able to detect significant differences for variables with effect sizes less than 0.1, implying that the factors were probably of limited clinical relevance.

The sleep registration study (Paper IV) was powered to detect relatively large differences (0.89 SD) between the groups, posing a risk of not detecting moderate effects of sleep upon depression. However, we found several significant differences in the PSQI sub-scores in this relatively small sample (effect sizes from 0.67-1.70), whereas the effect sizes for differences in the actigraphy recordings were smaller than 0.3. Significant effect sizes were also found for differences between primi- and multiparas for a range of sleep variables using actigraphy. Other studies have previously documented differences in postnatal sleep in smaller samples than the present study, and our proportion of women with depressive symptoms were larger than previous studies (Lee et al., 2000b; Stremler et al., 2006; Waters and Lee, 1996; Wolfson et al., 2003). The sample size should thus be sufficient to document larger and clinically important differences.

Results

Prevalence of depressive symptoms

In Nepal, we found a lower prevalence of depressive symptoms among postnatal women than the 12 % previously reported in the country (Nepal et al., 1999; Regmi et al., 2002). Our study population had a relatively high level of education and access to good health care facilities. This could explain the low prevalence of depressive symptoms. Education has been suggested to protect against depression in the postnatal period in India (Patel et al., 2002). However, in the study by Nepal et al. the proportion of literate women was higher than in our sample (84% versus 72%). Nepal is a country with great diversity in terms of economy, geography, culture and ethnicity. The study district, Lalitpur, has been the target for preventive community health work including mother and child clinics for more than 40 years (UN, 1998), well before the rest of the country got access to such services, and has better health indicators than most Nepali districts (Onta et al., 1997). Therefore, the prevalence found in our study area might differ from other areas in Nepal.

In the Stavanger region of Norway, on the other hand, we found a prevalence of depressive symptoms higher than the 8.9% (Eberhard-Gran et al., 2002) and 10% (Berle et al., 2003) previously reported from studies among postnatal women in other parts of the country. The genetics, culture and socio-economic conditions of the Norwegian population are relatively homogenous as compared to the more than 60 different ethnic groups in Nepal. The results from the Norwegian study may therefore reflect a possible increase in psychiatric symptoms reported among young women in the country (Statistics-Norway, 2006).

A vast majority of studies of postnatal depression are still from industrialized countries, but the concept seems to be an universal experience (Goldbort, 2006; Oates et al., 2004). Postnatal depression does not appear to vary in incidence across different cultures in the few studies reported that have permitted direct comparisons (Kumar, 1994), but there is a lack of relevant research and limitations of methods (Asten et al., 2004; Eberhard-Gran et al., 2001a). Culturally appropriate terminology for depression

needs to be found and used in order to improve recognition of the depression (Patel, 2001).

The prevalence of depressive symptoms was 4.9% in Nepal, whereas it was 16.5% in Norway. It may appear from this study that depression in the postnatal period was more than three times as common in Norway as in Nepal. However, it is not possible to compare these populations directly, because of different translations of the scale, different methodology (self report versus structured interview) as well as a possible different understanding of the concepts asked for in the two cultures (Halbreich et al., 2006). In addition, the Nepali EPDS was validated against a diagnosis of moderate to major depression, and hence had a higher cut-off, whereas the Norwegian EPDS validation also included minor depression among the high scorers.

When using a translated scale, it is important to keep to the cut-off identified by the authors for the best psychometric properties. Even so, it is tempting to compare proportions of women scoring above the same cut-off's in both populations. Both the Nepali and the Norwegian studies identified about twice as many women scoring ≥10 at the EPDS as compared to the proportion of women scoring >12 (466 versus 233 in Norway and 43 versus 21 in Nepal). Prevalence of EPDS >12 in the Norwegian sample was 8.2% (compared to 4.9% in Nepal), whereas prevalence of EPDS ≥10 was 10.1% in Nepal (compared to 16.5% in Norway). From these estimates, it seems that depression was more common among Norwegian women as compared to Nepali women, with an absolute difference of 3.3 to 6.5% in population prevalence. However, the low number of cases from Nepal gives wide confidence interval for the prevalence estimation. These tentative calculations thus illustrate that much of the reported variance in estimated prevalence of postnatal depression could be explained by different cut-offs and different diagnostic classifications of depression (Eberhard-Gran et al., 2001a).

Risk factors for postnatal depression

Several of the factors identified as possible risk factors for depression in the postnatal period were similar in Nepal and Norway (depression during pregnancy or previously, stress factors the previous year, poor partner relationship). This is also in accordance with the largest risk factors identified in several review articles (Brockington, 2004; O'Hara and Swain, 1996; Robertson et al., 2004). In their meta-analysis of more than 14000 observations, Robertson et al. divided risk factors into strong, moderate and small. Strong to moderate factors were depression during pregnancy, stressful life events, social support and previous depression. Poor partner relationship was rated moderate, and socioeconomic and obstetric factors were rated small. Our results from Nepal and Norway, however, suggest stronger associations with poor partner relationship than with stressful life events.

Previous depression

Reporting previous depression or depression during pregnancy was significantly associated with depressive symptoms in the postnatal period, both in Nepal and Norway. In Norway, 48% of the women who had been depressed during pregnancy (20% of the currently depressed women) also scored above cut-off at the EPDS in the postnatal period, and 46% of the depressed women had been depressed earlier. This underscores the recurring nature of depression (Burt and Stein, 2002).

Partner relationship

One of the variables most strongly associated with depressive symptoms in the Norwegian study, was being discontent with the relationship to the partner. In Nepal, being unhappy with the marriage was highly correlated both to alcoholism in the husband and to polygamy. We therefore chose to include these latter two variables into the multivariate analyses instead of marital unhappiness, in order to examine factors likely to be causative for being unhappy with the marriage. These two factors gave the highest odds ratios for depression, and hence a poor relationship to her partner is a probable risk factor also for Nepali women. Poor partner relationship has previously been found to be associated with depression both among Indian (Patel et al., 2002) and

Norwegian postnatal women (Eberhard-Gran et al., 2002). In a qualitative study from India, women reported poor marital relationship as an important cause of their postnatal depression (Pereira et al., 2006). An alternative interpretation of the association is that a woman's depression may influence marital relationship negatively. However, most of the women in the polygamous relationship studied were second wives, thus omitting the possibility of a bad relationship causing the husband to take a second wife. Furthermore, alcohol related marital problems (i.e. conflicts, arguing, avoidance and violence) have been shown to occur before, and to be predictive of, later depressive symptoms in wives of alcoholic husbands (Homish et al., 2006). Depressed women may rate marital difficulties more negatively than non-depressed women. However, a longitudinal study of immigrant women in Canada found lower scores on the marital adjustment scale in pregnancy to be predictive of depressive symptoms two months after delivery (Zelkowitz et al., 2008).

Polygamous marriages in Saudi Arabia had more reports of marital discord (Chaleby, 1988). In Nigeria, one study found a significant association between polygamy and emotional distress in pregnancy, postulating marital disharmony and lower spousal support and intimacy as causes of the association (Fatoye et al., 2004). A study report from a women's advocacy group in Nepal (Saathi) found that women living in polygamy had an increased risk of experiencing violence (Deuba and Rana, 2001). Our study found similar results, with women living in polygamy more often having experienced violence from their husbands as compared to women in monogamous marriages. Violence has previously been found to be associated with perinatal depression in developing countries, for instance in Brazil and in India (Lovisi et al., 2005; Patel et al., 2002). Correlations between polygamy and violence, as well as between alcohol use and violence, may explain why violence did not remain significantly associated with depression in the final model in the Nepali data.

Stressful life events

Experiencing stressful life events the previous year was an independent risk factor for depression in both study populations, in line with the reviews and meta-studies cited

above. There was also a dose-effect relationship with the number of stress-factors experienced the previous year and risk for an EPDS score above cut-off, as also described by others (Rubertsson et al., 2005). When further analysing the questions contributing to the stressful life event score in the Norwegian study, the highest odds ratios were found for having experienced fire or a break-in (OR 1.7), closely followed by serious relationship problems (OR 1.6). Thus, there may be an overlap between a poor partner relationship and stressful life events. Eberhard-Gran et al. found that both a high score at the stressful life event scale as well as a poor partner relationship were factors strongly associated with depression both among postnatal and non-postnatal women, but that postnatal women had fewer stress factors and better relationships. They suggested a selection of women with lower risk of depression into motherhood (Eberhard-Gran et al., 2002).

Other factors

Large studies have indicated that parity is not considered a risk factor for postnatal depression (Beck, 2001; O'Hara and Swain, 1996). In Nepal, however, we found that mothers with four or more children were more likely to be depressed. No such association was found in the Norwegian part of the study, as opposed to a previous Norwegian study where first time mothers had a more than threefold risk for depression compared to multiparas (Eberhard-Gran et al., 2002). In a country such as Nepal where resources are limited, an extra child might well contribute to an increased stress level of the mother. On the other hand, there could be a selection bias in the Nepali data, where only multiparous mothers who experienced problems (i.e somatic complaints) would attend the six week's check up, whereas healthy, experienced multiparas would not see the need for this, and hence not be included in our study.

An association between acute operative delivery and postnatal depression has been suggested (O'Hara and Swain, 1996). However, no such association was found in a large population study of more than 14 000 deliveries (Patel et al., 2005). The results from the present study were in line with these results. Neither did we find any associations with the other data regarding birth, including birth weight of the infant.

Socio-economic status has been found to influence the prevalence of depression in the postnatal period, especially in poorer populations (Chandran et al., 2002). Many families in Nepal do not have enough income to provide sufficient food for the whole year. As a result of this, anemia and malnutrition are prevalent among pregnant women in Nepal (Bondevik et al., 2000). In the univariate analyses of the Nepal data we found that women with a BMI below the normal range (<20 kg/m^2) had an increased risk of depressive symptoms as compared to women with normal weight. Others have found a connection between poor maternal nutritional status and depressive symptoms, and found that iron supplementation of anaemic mothers in South Africa reduced their depression scores (Beard et al., 2005). Our finding could therefore reflect both economic and nutritional associations with depression. The association between depression during pregnancy and low birth weight of the baby (Patel and Prince, 2006) may partly be explained by low maternal BMI.

Although very few of the mothers in the Nepal study smoked, women with depressive symptoms were more likely to smoke. Depression has been found to be a predictor for progression into daily smoking, but smokers are also more prone to develop later depression (Breslau et al., 1998; Klungsoyr et al., 2006). Smoking could be seen as a method of self-medication to relieve stress and depression, but alternatively there could be harmful effects of smoke substances upon neurotransmittor substances linked to depression. Treatment of depression could ease cessation of smoking (Breslau et al., 2004). However, a twin study suggested that the relationship between smoking and depression could result mainly from genes that predispose to both conditions (Kendler et al., 1993b).

A common practice among some ethnic groups in Nepal is for the new mother to stay in her maternal home for some months after delivery. Receiving practical help was in univariate analyses associated with a lower risk of depressive symptoms, but did not remain significant in the multivariate analyses. The effect of staying in the maternal home is therefore probably not only a result of getting more practical help, but may

also contain other beneficial effects for the new mothers. A protective effect of such extra maternal support after delivery has previously been reported from Hong Kong (Lee et al., 2004), and may also be confirmed statistically in a larger sample from Nepal.

In Norway, most women have fully paid maternity leave after delivery, and would therefore be at home with the baby at the time of the study. Although this provides the mother of more time with her baby, she may feel alone and miss her professional role and colleagues (Edhborg et al., 2005). In addition, most of her friends and relatives, including the grandparents, may be working and not be available for day time support. Some women may therefore become insecure of their responsibilities as new mothers (Edhborg et al., 2005). The results from Nepal and from other developing countries could encourage studies also in developed countries to further explore the role of traditional support from the family and other social networks.

Another tradition in Nepal is the practice of the family deciding whom the children should marry. In univariate analyses we found an association between the so-called "love-marriages" (i.e. not arranged by the family) and high depression scores. When adjusting for husband's alcoholism our analyses still showed a tendency, although not longer significant, of higher depression risk among women in "love-marriages". There could be something about the arranged marriages that decreases the likelihood of excessive alcohol use in the husband. However, this was not the focus of our study, therefore we can not draw any conclusions about this, but the association may inspire further research. There are very few studies of the effect of martial arrangement upon mental health, but from Saudi Arabia (Chaleby, 1988) it has been described more marital discord in couples who had a long courtship before marrying as compared to couples who had had shorter courtship (i.e arranged marriage).

Prevalence of sleep problems

The most striking external factor that may affect postnatal maternal sleep is the arrival of the infant with a need for care also at night time. This leads to interrupted sleep

and/or shorter sleep duration for most mothers, with consequently lower sleep efficiency.

A majority of the depressed women in Nepal reported having trouble falling asleep at night, attributing the baby as the cause of the sleep problem. The association with poor sleep remained significant after controlling for alcoholism, polygamy and earlier depression (Table 1). It also remained significant after omitting the question in the EPDS that asks about sleep. We chose to focus upon the psychosocial risk factors in paper II, and therefore did not present the sleep data from Nepal in paper II. In the Norwegian study, however, we wanted to study the association between sleep and postnatal depression more thoroughly, and designed the study accordingly.

Table 1 Depression (EPDS >12) and sleep among 426 postnatal women in Nepal.

	EPDS score						
	Low ≤12	High >12	Total	OR	p-value	Adjusted OR*	p-value
	n (%)	n (%)	n	(95% CI)		(95% CI)	
Sleep problems							
No	318 (98)	8 (2)	326	1.0		1.0	
Yes	85 (87)	13 (13)	98	6.1 (2.4-15.1)	<0.001	4.6 (1.6-13.2)	0.004

EPDS: Edinburgh Postnatal Depression Scale; OR: Odds Ratio; CI: Confidence Interval

* - Adjusted for husband's alcoholism, polygamy and earlier depression

We found that postnatal women, regardless of depressive status, reported a lower mean sleep efficiency (73%) than the recommended 85% or more (Morin, 1993), and they also had a shorter sleep duration (6.5 hours) than reported among women (40-45 years) in Norway (7.1 hours) (Ursin et al., 2005). The PSQI values from this study provide estimates for normal subjective sleep among postnatal mothers two months after delivery. Through this it may be possible to compare whether one particular woman experience worse sleep than expected, and if so, how much worse. The study also describes what particular aspects of postnatal sleep that a woman can expect to find difficult in the postnatal period, and which women are at increased risk of postnatal sleep problems.

Sleep and depression

Depression was the largest factor associated with poor sleep. This association remained significant also after adjusting for known psychosocial stressors and individual disposition for depression. However, 75% of the mothers had poor sleep without being depressed. Mothers being diagnosed with postnatal depression are therefore not merely reporting symptoms of chronic sleep deprivation (Armstrong et al., 1998; Hiscock and Wake, 2002).

The mean PSQI score of 9.2 among women with EPDS ≥10 in our study was lower than the score of 11.1 found among depressed patients in the original validation study (Buysse et al., 1989). However, the patients in the original validation were all diagnosed with major depression, whereas not all women with EPDS ≥10 will be severely depressed, due to the inclusion of women with minor depression, and also some false positives (i.e. women scoring 10 or more at the EPDS without being depressed).

We found that the actual sleep duration and sleep efficiency were not associated with postnatal depression, whereas poorer subjective reports of sleep quality, sleep onset latency, sleep disturbances and daytime dysfunction were. Huang et al. also found sleep disturbances and daytime dysfunction to be the PSQI sub-scores most strongly related to depressive symptoms among new mothers three weeks after delivery (Huang et al., 2004), and the association between daytime tiredness and maternal depression has also been documented by Dennis and Ross (Dennis and Ross, 2005). Some of the association between daytime dysfunction and depression may, however, be explained by co-linearity between the two scales for this construct, as we found that the adjusted OR declined moderately when omitting overlapping questions from the analyses.

Although we found several large differences in sleep (measured by the PSQI) between depressed and non-depressed women both in the population study and in the smaller sleep registration study, the sleep registrations did not reflect these differences in the women's sleep at night. We found that depressed women reported significantly lower

daytime function (sleep diary) and had significantly lower day/night activity ratio (actigraphy). The lower day/night activity ratio measured by the actigraph could reflect the effect of psychomotor retardation in depression, with the depressed women being less active during the day. In this way, the sleep registration corresponds to the results from the final model in the population study, showing association between depression and daytime tiredness. Similarly to the findings in our study, others have found differences between depressed and non-depressed subjects' motor activity (Lemke et al., 1999; Mendlowicz et al., 1999), but no other differences in actigraphy data between depressed and non-depressed subjects. On the other side, physical activity (such as "pram-walking") has been documented to be an effective adjuvant treatment of depression among postnatal women (Daley et al., 2007). Alternatively, active women could be less prone to depression (De Moor et al., 2008).

There is not necessarily an association between the actual amount of sleep and the perception of sleep quality, and this might differ among depressed and non-depressed subjects (Edinger et al., 2000). There are also wide confidence intervals for normal sleep duration. Therefore, what one woman considers sufficient sleep, may be too little for another, and the woman's subjective experience of her sleep could be as important as the duration and efficiency of her sleep. One study showed that mothers reporting good sleep quality despite an infant's sleep problem were not at higher risk of depression (Bayer et al., 2007). This suggests that there are more factors influencing maternal sleep in the postnatal period than merely being woken up by the infant, and it is the subjective component of sleep, along with decreased daytime function, that defines the most common sleep disorder, insomnia (AASM, 2005).

Women may also react differently to the shorter sleep duration and lower sleep efficiency in the postnatal period. A polysomnographic study suggested that the sleep of women with a history of depression may be more sensitive to the psychobiological changes associated with childbirth (Coble et al., 1994). Sleep in the postnatal period could thus act as a moderator between the risk factors for depression and the precipitation of depression in women vulnerable to such sleep changes.

Other risk factors for postnatal sleep problems

Women with previous sleep problems had increased odds ratio for current sleep problems, also when adjusted for current or previous depression. Women with previous sleep problems may have more difficulties adapting to this externally required change of sleep pattern in the postnatal period (Moline et al., 2004), and may have problems with hyper arousal (Drake et al., 2004)

Even though many multiparous mothers described additional sleep disturbances due to their toddlers waking them up at night, we found that being primipara was the third largest factor associated with poor sleep in the population study. Primiparas experience a greater change in sleep pattern after delivery as compared to multiparas (Lee et al., 2000c), and this could influence the primipara's impression of sleep. However, similar results were found by the more objective and prospective sleep registrations, showing that the higher PSQI scores among primiparas were not only a subjective impression of worse sleep. Lee et al. documented a lower sleep efficiency measured by polysomnography among primiparas in the first postnatal month (Lee et al., 2000c). They further found that experienced multiparas were able to get into the deeper, more restorative stages of sleep after awakenings more quickly than primiparas. First time mothers have less experience with all aspects of becoming a mother and caring for an infant, and may therefore have more concerns in the postnatal period. They may also find it more challenging to integrate the new role as mothers into their lives (Edhborg et al., 2005; Waters and Lee, 1996). A further role expansion, by getting another child, may not be as strenuous for an experienced mother as it was becoming a mother for the first time (Waters and Lee, 1996).

Most women in our sample were exclusively breastfeeding. We found that breastfeeding mothers' overall global sleep quality (PSQI score) was better than among women who partially bottle fed their infants, but not better than women who did not breastfeed at all. Better sleep among breastfeeding mothers has been documented by polysomnography, showing a marked increase in slow wave sleep and

a compensatory decrease in lighter non-REM sleep (Blyton et al., 2002). This was suggested to be mediated through higher levels of circulating prolactin (Frieboes et al., 1998). However, our results could also reflect that mothers who experience poor sleep may have supplemented breast milk with bottle milk in an effort to improve their infants and/or their own sleep. Longitudinal studies are needed to test this hypothesis. In the sleep diaries in our study, there was a significant longer mean time until sleep onset for the women who did not breastfeed (31 minutes versus 20 minutes among breast feeders). However, as only five women in the sleep registration study were not breastfeeding, the size of the sample was too small to adjust for confounders, including depression, and these results must therefore be interpreted with caution. Maternal sleep was better where the infant slept in a separate room (and weakly better when the baby slept in a separate bed) compared to bed-sharing with the infant. Bed-sharing could reflect a strategy by the mother to calm a fussy infant in order to improve sleep, (Hauck et al., 2008) but this strategy could alternatively cause more sleep disturbance.

Our finding of worse sleep quality among mothers of younger and/or preterm babies corresponds to documented development of infant night-time sleep-wake patterns (Anders and Keener, 1985). Gender effects, with worse sleep among male infants, have also been found by others for sleep/wake patterns during the first two years of life (Bayer et al., 2007; Spruyt et al., 2007). The effect sizes of these risk factors, however, were small (around 0.15) and other factors, such as depression and parity are probably more clinically relevant risk factors for poor sleep.

Conclusions

Depression in the postnatal period is a problem also in Nepal, but probably not as large as in Norway. Poor partner relationship, stressful life events, and vulnerability to depression as reflected by previous depressive episodes remain important risk factors for depression in the postnatal period in both countries. In addition, traditional family structures may influence the risk of depression among postnatal women in Nepal. Our

finding of an association between polygamy and depression underscores the value of conducting research in all cultures to find locally important risk factors (Patel, 2007).

We found an association between subjective reports of poor sleep and depression in both cultures, but there were no differences in prospective and objective sleep registrations according to depressive status. However, we can not rule out that an individual vulnerability to the changed sleep pattern in the postnatal period may trigger depression among some women.

Clinical implications and future research

Depression after delivery is often not identified by the women and her helpers, whereas tiredness and lack of sleep are common complaints both in Nepal and in Norway. Talking about sleep might pose an entry point into discussing the mother's mental well being. This study may also serve as a guide to the clinician when evaluating the magnitude of postnatal maternal sleep problems and whether these sleep problems indicate a higher risk of depression. Special focus should be upon the mother's subjective impressions of her sleep quality, sleep disturbances and of daytime tiredness and dysfunction.

There is a large diversity in Nepal's population regarding culture, economy and geography, and results from this study can not necessarily be applied to the whole country or other cultures. Further studies should explore the role of family structure and support upon depression among postnatal women. Further studies are also needed to evaluate whether treatment of maternal sleep problems leads to reduced depression, or whether treatment of maternal depression leads to improved sleep quality.

6. References

Abiodun OA (1994) A validity study of the Hospital Anxiety and Depression Scale in general hospital units and a community sample in Nigeria. Br J Psychiatry 165(5):669-72.

Abou-Saleh MT, Ghubash R, Karim L, Krymski M, Bhai I (1998) Hormonal aspects of postpartum depression. Psychoneuroendocrinology 23(5):465-75.

Adewuya AO, Fatoye FO, Ola BA, Ijaodola OR, Ibigbami SM (2005) Sociodemographic and obstetric risk factors for postpartum depressive symptoms in Nigerian women. J Psychiatr Pract 11(5):353-8.

Adewuya AO, Ola BO, Aloba OO, Mapayi BM, Okeniyi JA (2008) Impact of postnatal depression on infants' growth in Nigeria. J Affect Disord 108(1-2):191-3.

Altman DG (1991) *Practical statistics for medical research.* First ed. Chapman & Hall, London.

Ancoli-Israel S (2006) The impact and prevalence of chronic insomnia and other sleep disturbances associated with chronic illness. Am J Manag Care 12(8 Suppl):S221-9.

Anders TF, Keener M (1985) Developmental course of nighttime sleep-wake patterns in full-term and premature infants during the first year of life. I. Sleep 8(3):173-92.

Anoop S, Saravanan B, Joseph A, Cherian A, Jacob KS (2004) Maternal depression and low maternal intelligence as risk factors for malnutrition in children: a community based case-control study from South India. Arch Dis Child 89(4):325-9.

APA (1994) *American Psychiatric Association: Diagnostic and statistical manual of mental disorders, fourth edition.* American Psychiatric Press, Washington, DC.

Appleby L, Warner R, Whitton A, Faragher B (1997) A controlled study of fluoxetine and cognitive-behavioural counselling in the treatment of postnatal depression. Bmj 314(7085):932-6.

Armstrong K, Edwards H (2004) The effectiveness of a pram-walking exercise programme in reducing depressive symptomatology for postnatal women. Int J Nurs Pract 10(4):177-94.

Armstrong KL, Van Haeringen AR, Dadds MR, Cash R (1998) Sleep deprivation or postnatal depression in later infancy: separating the chicken from the egg. J Paediatr Child Health 34(3):260-2.

Asten P, Marks MN, Oates MR (2004) Aims, measures, study sites and participant samples of the Transcultural Study of Postnatal Depression. Br J Psychiatry Suppl 46:s3-9.

Baker D, Taylor H (1997) The relationship between condition-specific morbidity, social support and material deprivation in pregnancy and early motherhood. ALSPAC Survey Team. Avon Longitudinal Study of Pregnancy and Childhood. Soc Sci Med 45(9):1325-36.

Bayer JK, Hiscock H, Hampton A, Wake M (2007) Sleep problems in young infants and maternal mental and physical health. J Paediatr Child Health 43(1-2):66-73.

Beard JL, Hendricks MK, Perez EM, Murray-Kolb LE, Berg A, Vernon-Feagans L, Irlam J, Isaacs W, Sive A, Tomlinson M (2005) Maternal iron deficiency anemia affects postpartum emotions and cognition. Journal of Nutrition 135(2):267.

Beck CT (2001) Predictors of postpartum depression: an update. Nurs Res 50(5):275-85.

Berle JO, Steen VM, Aamo TO, Breilid H, Zahlsen K, Spigset O (2004) Breastfeeding during maternal antidepressant treatment with serotonin reuptake inhibitors: infant exposure, clinical symptoms, and cytochrome p450 genotypes. J Clin Psychiatry 65(9):1228-34.

Berle JO, Aarre TF, Mykletun A, Dahl AA, Holsten F (2003) Screening for postnatal depression. Validation of the Norwegian version of the Edinburgh Postnatal Depression Scale, and assessment of risk factors for postnatal depression. J Affect Disord 76(1-3):151-6.

Bick DE, MacArthur C, Lancashire RJ (1998) What influences the uptake and early cessation of breast feeding? Midwifery 14(4):242-7.

Bjorvatn B, Leissner L, Ulfberg J, Gyring J, Karlsborg M, Regeur L, Skeidsvoll H, Nordhus IH, Pallesen S (2005) Prevalence, severity and risk factors of restless legs syndrome in the general adult population in two Scandinavian countries. Sleep Med 6(4):307-12.

Bloch M, Schmidt PJ, Danaceau M, Murphy J, Nieman L, Rubinow DR (2000) Effects of gonadal steroids in women with a history of postpartum depression. Am J Psychiatry 157(6):924-30.

Blyton DM, Sullivan CE, Edwards N (2002) Lactation is associated with an increase in slow-wave sleep in women. J Sleep Res 11(4):297-303.

Bondevik GT, Ulstein M, Lie RT, Rana G, Kvale G (2000) The prevalence of anemia in pregnant Nepali women--a study in Kathmandu. Acta Obstet Gynecol Scand 79(5):341-9.

Bonnet MH, Arand DL (2003) Insomnia, metabolic rate and sleep restoration. J Intern Med 254(1):23-31.

Breslau N, Novak SP, Kessler RC (2004) Psychiatric disorders and stages of smoking. Biol Psychiatry 55(1):69-76.

Breslau N, Peterson EL, Schultz LR, Chilcoat HD, Andreski P (1998) Major depression and stages of smoking. A longitudinal investigation. Arch Gen Psychiatry 55(2):161-6.

Brockington I (2004) Postpartum psychiatric disorders. Lancet 363(9405):303-10.

Brugha TS, Sharp HM, Cooper SA, Weisender C, Britto D, Shinkwin R, Sherrif T, Kirwan PH (1998) The Leicester 500 Project. Social support and the development of postnatal depressive symptoms, a prospective cohort survey. Psychol Med 28(1):63-79.

Buckley TM, Schatzberg AF (2005) On the interactions of the hypothalamic-pituitary-adrenal (HPA) axis and sleep: normal HPA axis activity and circadian rhythm, exemplary sleep disorders. J Clin Endocrinol Metab 90(5):3106-14.

Burt VK, Stein K (2002) Epidemiology of depression throughout the female life cycle. J Clin Psychiatry 63 Suppl 7:9-15.

Buysse DJ, Angst J, Gamma A, Ajdacic V, Eich D, Rossler W (2008) Prevalence, course, and comorbidity of insomnia and depression in young adults. Sleep 31(4):473-80.

Buysse DJ, Reynolds CF, 3rd, Monk TH, Berman SR, Kupfer DJ (1989) The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res 28(2):193-213.

Byberg IH, Foss AH, Noack T (2001) Gjete kongens harer - rapport fra arbeidet med å få samboerne mer innpasset i statistikken, in *Rapporter*, vol 2001/40.

Cadzow SP, Armstrong KL, Fraser JA (1999) Stressed parents with infants: reassessing physical abuse risk factors. Child Abuse Negl 23(9):845-53.

Chaleby K (1988) Traditional Arabian marriages and mental health in a group of outpatient Saudis. Acta Psychiatr Scand 77(2):139-42.

Chandran M, Tharyan P, Muliyil J, Abraham S (2002) Post-partum depression in a cohort of women from a rural area of Tamil Nadu, India. Incidence and risk factors. Br J Psychiatry 181:499-504.

Coble PA, Reynolds CF, 3rd, Kupfer DJ, Houck PR, Day NL, Giles DE (1994) Childbearing in women with and without a history of affective disorder. II. Electroencephalographic sleep. Compr Psychiatry 35(3):215-24.

Cooper PJ, Campbell EA, Day A, Kennerley H, Bond A (1988) Non-psychotic psychiatric disorder after childbirth. A prospective study of prevalence, incidence, course and nature. Br J Psychiatry 152:799-806.

Cooper PJ, Murray L (1995) Course and recurrence of postnatal depression. Evidence for the specificity of the diagnostic concept. Br J Psychiatry 166(2):191-5.

Cooper PJ, Murray L, Wilson A, Romaniuk H (2003) Controlled trial of the short- and long-term effect of psychological treatment of post-partum depression. I. Impact on maternal mood. Br J Psychiatry 182:412-9.

Cox JL, Holden JM, Sagovsky R (1987) Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. Br J Psychiatry 150:782-6.

Cox JL, Murray D, Chapman G (1993) A controlled study of the onset, duration and prevalence of postnatal depression. Br J Psychiatry 163:27-31.

Daley AJ, Macarthur C, Winter H (2007) The role of exercise in treating postpartum depression: a review of the literature. J Midwifery Womens Health 52(1):56-62.

De Moor MH, Boomsma DI, Stubbe JH, Willemsen G, de Geus EJ (2008) Testing causality in the association between regular exercise and symptoms of anxiety and depression. Arch Gen Psychiatry 65(8):897-905.

Demyttenaere K, Bruffaerts R, Posada-Villa J, Gasquet I, Kovess V, Lepine JP, Angermeyer MC, Bernert S, de Girolamo G, Morosini P, Polidori G, Kikkawa T, Kawakami N, Ono Y, Takeshima T, Uda H, Karam EG, Fayyad JA, Karam AN, Mneimneh ZN, Medina-Mora ME, Borges G, Lara C, de Graaf R, Ormel J, Gureje O, Shen Y, Huang Y, Zhang M, Alonso J, Haro JM, Vilagut G, Bromet EJ, Gluzman S, Webb C, Kessler RC, Merikangas KR, Anthony JC, Von Korff MR, Wang PS, Brugha TS, Aguilar-Gaxiola S, Lee S, Heeringa S, Pennell BE, Zaslavsky AM, Ustun TB, Chatterji S (2004) Prevalence, severity, and unmet need for treatment of mental disorders in the World Health Organization World Mental Health Surveys. Jama 291(21):2581-90.

Dennis CL (2005) Psychosocial and psychological interventions for prevention of postnatal depression: systematic review. Bmj 331(7507):15.

Dennis CL, Chung-Lee L (2006) Postpartum depression help-seeking barriers and maternal treatment preferences: a qualitative systematic review. Birth 33(4):323-31.

Dennis CL, Hodnett E (2007) Psychosocial and psychological interventions for treating postpartum depression. Cochrane Database Syst Rev (4):CD006116.

Dennis CL, Ross L (2005) Relationships among infant sleep patterns, maternal fatigue, and development of depressive symptomatology. Birth 32(3):187-93.

Dennis CL, Stewart DE (2004) Treatment of postpartum depression, part 1: a critical review of biological interventions. J Clin Psychiatry 65(9):1242-51.

Desjarlais R, Eisenberg L, Good B, Kleinman A (1995) Women, in *World Mental Health*, pp 179-206. Oxford University Press, New York, Oxford.

Deuba AR, Rana PS (2001) A study on the psycho-social impacts of violence against women and girls with special focus on rape, incest and polygamy. . Saathi, SNV Netherlands Development Organisation Kathmandu, Nepal.

Dijk DJ, Neri DF, Wyatt JK, Ronda JM, Riel E, Ritz-De Cecco A, Hughes RJ, Elliott AR, Prisk GK, West JB, Czeisler CA (2001) Sleep, performance, circadian rhythms, and light-dark cycles during two space shuttle flights. Am J Physiol Regul Integr Comp Physiol 281(5):R1647-64.

Dindar I, Erdogan S (2007) Screening of Turkish women for postpartum depression within the first postpartum year: the risk profile of a community sample. Public Health Nurs 24(2):176-83.

Downe SM, Butler E, Hinder S (2007) Screening tools for depressed mood after childbirth in UK-based South Asian women: a systematic review. J Adv Nurs 57(6):565-83.

Drake C, Richardson G, Roehrs T, Scofield H, Roth T (2004) Vulnerability to stress-related sleep disturbance and hyperarousal. Sleep 27(2):285-91.

Eberhard-Gran M, Eskild A, Opjordsmoen S (2006) Use of psychotropic medications in treating mood disorders during lactation : practical recommendations. CNS Drugs 20(3):187-98.

Eberhard-Gran M, Eskild A, Tambs K, Opjordsmoen S, Samuelsen SO (2001a) Review of validation studies of the Edinburgh Postnatal Depression Scale. Acta Psychiatr Scand 104(4):243-9.

Eberhard-Gran M, Eskild A, Tambs K, Samuelsen SO, Opjordsmoen S (2002) Depression in postpartum and non-postpartum women: prevalence and risk factors. Acta Psychiatr Scand 106(6):426-33.

Eberhard-Gran M, Eskild A, Tambs K, Schei B, Opjordsmoen S (2001b) The Edinburgh Postnatal Depression Scale: validation in a Norwegian community sample. Nord J Psychiatry 55(2):113-7.

Eberhard-Gran M, Slinning K (2007) *Nedstemthet og depresjon i forbindelse med fødsel.* Norwegian Institute of Public Health, Oslo.

Edhborg M, Friberg M, Lundh W, Widstrom AM (2005) "Struggling with life": narratives from women with signs of postpartum depression. Scand J Public Health 33(4):261-7.

Edinger JD, Fins AI, Glenn DM, Sullivan RJ, Jr., Bastian LA, Marsh GR, Dailey D, Hope TV, Young M, Shaw E, Vasilas D (2000) Insomnia and the eye of the beholder: are there clinical markers of objective sleep disturbances among adults with and without insomnia complaints? J Consult Clin Psychol 68(4):586-93.

Epperson C, Ballew J (2006) Postpartum depression: A complication of childbirth, in *Psychiatric disorders in pregnancy and the postpartum. Principles and treatment.*,(Hendrick V ed, pp 41-81. Humana Press Inc., Totawa, New Jersey.

Evins GG, Theofrastous JP, Galvin SL (2000) Postpartum depression: a comparison of screening and routine clinical evaluation. Am J Obstet Gynecol 182(5):1080-2.

Fatoye FO, Adeyemi AB, Oladimeji BY (2004) Emotional distress and its correlates among Nigerian women in late pregnancy. J Obstet Gynaecol 24(5):504-9.

Ford DE, Kamerow DB (1989) Epidemiologic study of sleep disturbances and psychiatric disorders. An opportunity for prevention? Jama 262(11):1479-84.

Forty L, Jones L, Macgregor S, Caesar S, Cooper C, Hough A, Dean L, Dave S, Farmer A, McGuffin P, Brewster S, Craddock N, Jones I (2006) Familiality of postpartum depression in unipolar disorder: results of a family study. Am J Psychiatry 163(9):1549-53.

Frieboes RM, Murck H, Stalla GK, Antonijevic IA, Steiger A (1998) Enhanced slow wave sleep in patients with prolactinoma. J Clin Endocrinol Metab 83(8):2706-10.

Gentile S (2005a) The role of estrogen therapy in postpartum psychiatric disorders: an update. CNS Spectr 10(12):944-52.

Gentile S (2005b) The safety of newer antidepressants in pregnancy and breastfeeding. Drug Saf 28(2):137-52.

Gjerdingen DK, Yawn BP (2007) Postpartum depression screening: importance, methods, barriers, and recommendations for practice. J Am Board Fam Med 20(3):280-8.

Godfroid IO, Hubain PP, Dramaix M, Linkowski P (1997) [Sleep during post-partum depression]. Encephale 23(4):262-6.

Goldbort J (2006) Transcultural analysis of postpartum depression. MCN Am J Matern Child Nurs 31(2):121-6.

Goyal D, Gay CL, Lee KA (2007) Patterns of sleep disruption and depressive symptoms in new mothers. Journal of Perinatal and Neonatal Nursing 21(2):123.

Green K, Broome H, Mirabella J (2006) Postnatal depression among mothers in the United Arab Emirates: socio-cultural and physical factors. Psychol Health Med 11(4):425-31.

Gregoire AJ, Kumar R, Everitt B, Henderson AF, Studd JW (1996) Transdermal oestrogen for treatment of severe postnatal depression. Lancet 347(9006):930-3.

Groer MW (2005) Differences between exclusive breastfeeders, formula-feeders, and controls: a study of stress, mood, and endocrine variables. Biol Res Nurs 7(2):106-17.

Groer MW, Morgan K (2007) Immune, health and endocrine characteristics of depressed postpartum mothers. Psychoneuroendocrinology 32(2):133-9.

Halbreich U, Alarcon RD, Calil H, Douki S, Gaszner P, Jadresic E, Jasovic-Gasic M, Kadri N, Kerr-Correa F, Patel V, Sarache X, Trivedi JK (2006) Culturally-sensitive complaints of depressions and anxieties in women. J Affect Disord.

Halbreich U, Karkun S (2006) Cross-cultural and social diversity of prevalence of postpartum depression and depressive symptoms. J Affect Disord 91(2-3):97-111.

Harding TW, de Arango MV, Baltazar J, Climent CE, Ibrahim HH, Ladrido-Ignacio L, Murthy RS, Wig NN (1980) Mental disorders in primary health care: a study of

their frequency and diagnosis in four developing countries. Psychol Med 10(2):231-41.

Harlow BL, Vitonis AF, Sparen P, Cnattingius S, Joffe H, Hultman CM (2007) Incidence of hospitalization for postpartum psychotic and bipolar episodes in women with and without prior prepregnancy or prenatal psychiatric hospitalizations. Arch Gen Psychiatry 64(1):42-8.

Harpham T, Reichenheim M, Oser R, Thomas E, Hamid N, Jaswal S, Ludermir A, Aidoo M (2003) Measuring mental health in a cost-effective manner. Health Policy Plan 18(3):344-9.

Harris B (1994) Biological and hormonal aspects of postpartum depressed mood. Br J Psychiatry 164(3):288-92.

Harris B, Lovett L, Newcombe RG, Read GF, Walker R, Riad-Fahmy D (1994) Maternity blues and major endocrine changes: Cardiff puerperal mood and hormone study II. Bmj 308(6934):949-53.

Hauck FR, Signore C, Fein SB, Raju TN (2008) Infant sleeping arrangements and practices during the first year of life. Pediatrics 122 Suppl 2:S113-20.

Heron J, O'Connor TG, Evans J, Golding J, Glover V (2004) The course of anxiety and depression through pregnancy and the postpartum in a community sample. J Affect Disord 80(1):65-73.

Hiscock H, Bayer JK, Hampton A, Ukoumunne OC, Wake M (2008) Long-term mother and child mental health effects of a population-based infant sleep intervention: cluster-randomized, controlled trial. Pediatrics 122(3):e621-7.

Hiscock H, Wake M (2001) Infant sleep problems and postnatal depression: a community-based study. Pediatrics 107(6):1317-22.

Hiscock H, Wake M (2002) Randomised controlled trial of behavioural infant sleep intervention to improve infant sleep and maternal mood. Bmj 324(7345):1062-5.

Holden C (2005) Sex and the suffering brain. Science 308(5728):1574.

Homish GG, Leonard KE, Kearns-Bodkin JN (2006) Alcohol use, alcohol problems, and depressive symptomatology among newly married couples. Drug Alcohol Depend 83(3):185-92.

Howard L (2006) Postnatal depression. Clin Evid (15):1919-31.

Huang CM, Carter PA, Guo JL (2004) A comparison of sleep and daytime sleepiness in depressed and non-depressed mothers during the early postpartum period. J Nurs Res 12(4):287-96.

Inandi T, Bugdayci R, Dundar P, Sumer H, Sasmaz T (2005) Risk factors for depression in the first postnatal year: a Turkish study. Soc Psychiatry Psychiatr Epidemiol 40(9):725-30.

Inandi T, Elci OC, Ozturk A, Egri M, Polat A, Sahin TK (2002) Risk factors for depression in postnatal first year, in eastern Turkey. Int J Epidemiol 31(6):1201-7.

Jacobsson L, Renberg ES (1999) On suicide and suicide prevention as a public health issue. Med Arh 53(3):175-7.

Jones I, Craddock N (2001) Familiality of the puerperal trigger in bipolar disorder: results of a family study. Am J Psychiatry 158(6):913-7.

Kajantie E (2006) Fetal origins of stress-related adult disease. Ann N Y Acad Sci 1083:11-27.

Kang MJ, Matsumoto K, Shinkoda H, Mishima M, Seo YJ (2002) Longitudinal study for sleep-wake behaviours of mothers from pre-partum to post-partum using actigraph and sleep logs. Psychiatry Clin Neurosci 56(3):251-2.

Katz DA, McHorney CA (1998) Clinical correlates of insomnia in patients with chronic illness. Arch Intern Med 158(10):1099-107.

Kendall-Tackett K (2007a) A new paradigm for depression in new mothers: the central role of inflammation and how breastfeeding and anti-inflammatory treatments protect maternal mental health. Int Breastfeed J 2:6.

Kendall-Tackett KA (2007b) Violence against women and the perinatal period: the impact of lifetime violence and abuse on pregnancy, postpartum, and breastfeeding. Trauma Violence Abuse 8(3):344-53.

Kendell RE, McGuire RJ, Connor Y, Cox JL (1981) Mood changes in the first three weeks after childbirth. J Affect Disord 3(4):317-26.

Kendler KS, Neale MC, Kessler RC, Heath AC, Eaves LJ (1993a) The lifetime history of major depression in women. Reliability of diagnosis and heritability. Arch Gen Psychiatry 50(11):863-70.

Kendler KS, Neale MC, MacLean CJ, Heath AC, Eaves LJ, Kessler RC (1993b) Smoking and major depression. A causal analysis. Arch Gen Psychiatry 50(1):36-43.

Klungsoyr O, Nygard JF, Sorensen T, Sandanger I (2006) Cigarette smoking and incidence of first depressive episode: an 11-year, population-based follow-up study. Am J Epidemiol 163(5):421-32.

Krantz I, Eriksson B, Lundquist-Persson C, Ahlberg BM, Nilstun T (2008) Screening for postpartum depression with the Edinburgh Postnatal Depression Scale (EPDS): an ethical analysis. Scand J Public Health 36(2):211-6.

Kumar R (1994) Postnatal mental illness: a transcultural perspective. Soc Psychiatry Psychiatr Epidemiol 29(6):250-64.

Lane DM (2007) Measuring Effect Size, in *HyperStat Online Statistics Textbook*,(Lane DM ed, pp http://davidmlane.com/hyperstat/effect_size.html Rice Virtual Lab in Statistics, Houston, TX, USA.

Larun L, Lyngstadaas A, Wiik IN, Mørland B (2005) Svangerskap og psykisk helse. Kvinners psykiske helse i forbindelse med svangerskap og første året etter fødsel. Nasjonalt kunnskapssenter for helsetjenesten, Oslo.

Lau Y, Keung DW (2007) Correlates of depressive symptomatology during the second trimester of pregnancy among Hong Kong Chinese. Soc Sci Med 64(9):1802-11.

Lee DT, Yip AS, Leung TY, Chung TK (2000a) Identifying women at risk of postnatal depression: prospective longitudinal study. Hong Kong Med J 6(4):349-54.

Lee DT, Yip AS, Leung TY, Chung TK (2004) Ethnoepidemiology of postnatal depression. Prospective multivariate study of sociocultural risk factors in a Chinese population in Hong Kong. Br J Psychiatry 184:34-40.

Lee KA (1998) Alterations in sleep during pregnancy and postpartum: a review of 30 years of research. Sleep Med Rev 2(4):231-42.

Lee KA, McEnany G, Zaffke ME (2000b) REM sleep and mood state in childbearing women: sleepy or weepy? Sleep 23(7):877-85.

Lee KA, Zaffke ME, McEnany G (2000c) Parity and sleep patterns during and after pregnancy. Obstet Gynecol 95(1):14-8.

Lemke MR, Puhl P, Broderick A (1999) Motor activity and perception of sleep in depressed patients. J Psychiatr Res 33(3):215-24.

Logsdon MC, Birkimer JC, Usui WM (2000) The link of social support and postpartum depressive symptoms in African-American women with low incomes. MCN Am J Matern Child Nurs 25(5):262-6.

Lovisi GM, Lopez JR, Coutinho ES, Patel V (2005) Poverty, violence and depression during pregnancy: a survey of mothers attending a public hospital in Brazil. Psychol Med 35(10):1485-92.

Massoudi P, Wickberg B, Hwang P (2007) Screening for postnatal depression in Swedish child health care. Acta Paediatr 96(6):897-901.

Mathers CD, Loncar D (2006) Projections of global mortality and burden of disease from 2002 to 2030. PLoS Med 3(11):e442.

Matthey S, Barnett B, Howie P, Kavanagh DJ (2003) Diagnosing postpartum depression in mothers and fathers: whatever happened to anxiety? J Affect Disord 74(2):139-47.

Matthey S, Speyer J (2008) Changes in unsettled infant sleep and maternal mood following admission to a parentcraft residential unit. Early Hum Dev 84(9):623-9.

McGill H, Burrows VL, Holland LA, Langer HJ, Sweet MA (1995) Postnatal depression: a Christchurch study. N Z Med J 108(999):162-5.

Meltzer-Brody S, Pace-Asciak P, Rubinow DR (2008) Postpartum depression: What to tell patients who breast-feed. Current Psychiatry 7(5).

Mendlowicz MV, Jean-Louis G, von Gizycki H, Zizi F, Nunes J (1999) Actigraphic predictors of depressed mood in a cohort of non-psychiatric adults. Aust N Z J Psychiatry 33(4):553-8.

Milgrom J, Gemmill AW, Bilszta JL, Hayes B, Barnett B, Brooks J, Ericksen J, Ellwood D, Buist A (2008) Antenatal risk factors for postnatal depression: a large prospective study. J Affect Disord 108(1-2):147-57.

Miller LJ (2002) Postpartum depression. Jama 287(6):762-5.

Minkovitz CS, Strobino D, Scharfstein D, Hou W, Miller T, Mistry KB, Swartz K (2005) Maternal depressive symptoms and children's receipt of health care in the first 3 years of life. Pediatrics 115(2):306-14.

Misri S, Kendrick K (2007) Treatment of perinatal mood and anxiety disorders: a review. Can J Psychiatry 52(8):489-98.

Moline M, Broch L, Zak R (2004) Sleep Problems Across the Life Cycle in Women. Curr Treat Options Neurol 6(4):319-330.

Moore GA, Cohn JF, Campbell SB (2001) Infant affective responses to mother's still face at 6 months differentially predict externalizing and internalizing behaviors at 18 months. Dev Psychol 37(5):706-14.

Morgenthaler T, Alessi C, Friedman L, Owens J, Kapur V, Boehlecke B, Brown T, Chesson A, Jr., Coleman J, Lee-Chiong T, Pancer J, Swick TJ (2007) Practice parameters for the use of actigraphy in the assessment of sleep and sleep disorders: an update for 2007. Sleep 30(4):519-29.

Morin CM (1993) *Insomnia: Psychological assessment and management.* Guildford Press, New York, NY, USA.

Morrell JM (1999) The role of maternal cognitions in infant sleep problems as assessed by a new instrument, the maternal cognitions about infant sleep questionnaire. J Child Psychol Psychiatry 40(2):247-58.

Munk-Olsen T, Laursen TM, Pedersen CB, Mors O, Mortensen PB (2006) New parents and mental disorders: a population-based register study. Jama 296(21):2582-9.

Murray L, Sinclair D, Cooper P, Ducournau P, Turner P, Stein A (1999) The socioemotional development of 5-year-old children of postnatally depressed mothers. J Child Psychol Psychiatry 40(8):1259-71.

Neckelmann D, Mykletun A, Dahl AA (2007) Chronic insomnia as a risk factor for developing anxiety and depression. Sleep 30(7):873-80.

Nepal MK, Sharma VD, Koirala NR, Khalid A, Shresta P (1999) Validation of the Nepalese Version of Edinburgh Postnatal Depression Scale in Tertiary Health Care Facilities in Nepal. . Nepal Journal of Psychiatry 1(1):46-50.

NICE (2007) Antenatal and postnatal mental health. National Institute for Health and Clinical Excellence:http://www.nice.org.uk/nicemedia/pdf/CG045NICEGuidelineCorrected.pdf.

Nielsen Forman D, Videbech P, Hedegaard M, Dalby Salvig J, Secher NJ (2000) Postpartum depression: identification of women at risk. Bjog 107(10):1210-7.

Nishihara K, Horiuchi S, Eto H, Uchida S (2000) Mothers' wakefulness at night in the post-partum period is related to their infants' circadian sleep-wake rhythm. Psychiatry Clin Neurosci 54(3):305-6.

Nishihara K, Horiuchi S, Eto H, Uchida S (2002) The development of infants' circadian rest-activity rhythm and mothers' rhythm. Physiol Behav 77(1):91-8.

O'Hara MW, Swain AM (1996) Rates and risk of postpartum depression-a meta-analysis. International Review of Psychiatry 8(1):37 - 54.

O'Hara MW, Zekoski EM, Philipps LH, Wright EJ (1990) Controlled prospective study of postpartum mood disorders: comparison of childbearing and nonchildbearing women. J Abnorm Psychol 99(1):3-15.

Oates M (2003) Perinatal psychiatric disorders: a leading cause of maternal morbidity and mortality. Br Med Bull 67:219-29.

Oates MR, Cox JL, Neema S, Asten P, Glangeaud-Freudenthal N, Figueiredo B, Gorman LL, Hacking S, Hirst E, Kammerer MH, Klier CM, Seneviratne G, Smith M, Sutter-Dallay AL, Valoriani V, Wickberg B, Yoshida K (2004) Postnatal depression across countries and cultures: a qualitative study. Br J Psychiatry Suppl 46:s10-6.

Ohayon MM, Roth T (2003) Place of chronic insomnia in the course of depressive and anxiety disorders. J Psychiatr Res 37(1):9-15.

Onta S, Baral K, Singh LM, Shrestha MP, Mulmi SL (1997) *Health in Nepal: Realities and Challenges.* Resource Centre for Primary Health Care, Kathmandu.

Pallesen S, Nordhus IH, Omvik S, Sivertsen B, Matthiesen SB, Bjorvatn B (2005) Pittsburgh Sleep Quality Index. Tidsskrift for norsk psykologforening 42:714-7.

Pallesen S, Nordhus IH, Omvik S, Sivertsen B, Tell GS, Bjorvatn B (2007) Prevalence and risk factors of subjective sleepiness in the general adult population. Sleep 30(5):619-24.

Patel RR, Murphy DJ, Peters TJ (2005) Operative delivery and postnatal depression: a cohort study. Bmj 330(7496):879.

Patel V (2001) Cultural factors and international epidemiology. Br Med Bull 57:33-45.

Patel V (2007) Closing the 10/90 divide in global mental health research. Acta Psychiatr Scand 115(4):257-9.

Patel V, Prince M (2006) Maternal psychological morbidity and low birth weight in India. Br J Psychiatry 188:284-5.

Patel V, Rodrigues M, DeSouza N (2002) Gender, poverty, and postnatal depression: a study of mothers in Goa, India. Am J Psychiatry 159(1):43-7.

Pathak LR, Pradhan A, Compbell BB, Malla DS, Lama DB, Rajlawat R, Kwast B (1999) Reduction of maternal mortality and morbidity in Nepal. Journal of Nepal Medical Association (38):109-111.

Pereira B, Andrew G, Pednekar S, Pai R, Pelto P, Patel V (2006) The explanatory models of depression in low income countries: Listening to women in India. J Affect Disord.

Poobalan AS, Aucott LS, Ross L, Smith WC, Helms PJ, Williams JH (2007) Effects of treating postnatal depression on mother-infant interaction and child development: systematic review. Br J Psychiatry 191:378-86.

Prince M, Patel V, Saxena S, Maj M, Maselko J, Phillips MR, Rahman A (2007) No health without mental health. Lancet 370(9590):859-77.

Quillin SI, Glenn LL (2004) Interaction between feeding method and co-sleeping on maternal-newborn sleep. J Obstet Gynecol Neonatal Nurs 33(5):580-8.

Rahman A, Iqbal Z, Bunn J, Lovel H, Harrington R (2004) Impact of maternal depression on infant nutritional status and illness: a cohort study. Arch Gen Psychiatry 61(9):946-52.

Rahman A, Iqbal Z, Harrington R (2003) Life events, social support and depression in childbirth: perspectives from a rural community in the developing world. Psychol Med 33(7):1161-7.

Rahman A, Malik A, Sikander S, Roberts C, Creed F (2008a) Cognitive behaviour therapy-based intervention by community health workers for mothers with depression and their infants in rural Pakistan: a cluster-randomised controlled trial. Lancet 372(9642):902-9.

Rahman A, Patel V, Maselko J, Kirkwood B (2008b) The neglected 'm' in MCH programmes--why mental health of mothers is important for child nutrition. Trop Med Int Health 13(4):579-83.

Ramchandani PG, Richter LM, Stein A, Norris SA (2008) Predictors of postnatal depression in an urban South African cohort. J Affect Disord.

Regmi S, Sligl W, Carter D, Grut W, Seear M (2002) A controlled study of postpartum depression among Nepalese women: validation of the Edinburgh Postpartum Depression Scale in Kathmandu. Trop Med Int Health 7(4):378-82.

Riecher-Rössler A, Rohde A (2005) Diagnostic Classification of Perinatal Mood Disorders, in *Perinatal stress, mood and anxiety disorders. From bench to bedside.*,(Riecher-Rössler A, Steiner M eds). Karger, Basel.

Robertson E, Grace S, Wallington T, Stewart DE (2004) Antenatal risk factors for postpartum depression: a synthesis of recent literature. Gen Hosp Psychiatry 26(4):289-95.

Ross LE, Murray BJ, Steiner M (2005) Sleep and perinatal mood disorders: a critical review. J Psychiatry Neurosci 30(4):247-56.

Roth T (2007) Insomnia: definition, prevalence, etiology, and consequences. J Clin Sleep Med 3(5 Suppl):S7-10.

Rubertsson C, Wickberg B, Gustavsson P, Radestad I (2005) Depressive symptoms in early pregnancy, two months and one year postpartum-prevalence and psychosocial risk factors in a national Swedish sample. Arch Womens Ment Health 8(2):97-104.

Sharma V, Smith A, Khan M (2004) The relationship between duration of labour, time of delivery, and puerperal psychosis. J Affect Disord 83(2-3):215-20.

Silber MH (2005) Clinical practice. Chronic insomnia. N Engl J Med 353(8):803-10.

Sinclair D, Murray L (1998) Effects of postnatal depression on children's adjustment to school. Teacher's reports. Br J Psychiatry 172:58-63.

Sivertsen B, Omvik S, Havik OE, Pallesen S, Bjorvatn B, Nielsen GH, Straume S, Nordhus IH (2006a) A comparison of actigraphy and polysomnography in older adults treated for chronic primary insomnia. Sleep 29(10):1353-8.

Sivertsen B, Overland S, Neckelmann D, Glozier N, Krokstad S, Pallesen S, Nordhus IH, Bjorvatn B, Mykletun A (2006b) The long-term effect of insomnia on work disability: the HUNT-2 historical cohort study. Am J Epidemiol 163(11):1018-24.

Small R, Astbury J, Brown S, Lumley J (1994) Depression after childbirth. Does social context matter? Med J Aust 161(8):473-7.

Spruyt K, Aitken RJ, So K, Charlton M, Adamson TM, Horne RS (2007) Relationship between sleep/wake patterns, temperament and overall development in term infants over the first year of life. Early Hum Dev.

Stamp GE, Williams AS, Crowther CA (1996) Predicting postnatal depression among pregnant women. Birth 23(4):218-23.

Statistics-Norway (2006) Increase in young women seeing a psychologist Health Interview Survey 2005:http://www.ssb.no/english/subjects/03/00/helseund_en/.

Stern G, Kruckman L (1983) Multi-disciplinary perspectives on post-partum depression: an anthropological critique. Soc Sci Med 17(15):1027-41.

Stremler R, Hodnett E, Lee K, MacMillan S, Mill C, Ongcangco L, Willan A (2006) A behavioral-educational intervention to promote maternal and infant sleep: a pilot randomized, controlled trial. Sleep 29(12):1609-15.

Swain AM, O'Hara MW, Starr KR, Gorman LL (1997) A prospective study of sleep, mood, and cognitive function in postpartum and nonpostpartum women. Obstet Gynecol 90(3):381-6.

Thapa SB, Hauff E (2005) Psychological distress among displaced persons during an armed conflict in Nepal. Soc Psychiatry Psychiatr Epidemiol 40(8):672-9.

Treloar SA, Martin NG, Bucholz KK, Madden PA, Heath AC (1999) Genetic influences on post-natal depressive symptoms: findings from an Australian twin sample. Psychol Med 29(3):645-54.

Turner C, Boyle F, O'Rourke P (2003) Mothers' health post-partum and their patterns of seeking vaccination for their infants. Int J Nurs Pract 9(2):120-6.

UN (1998) Success Stories - 1998 - (Education and Awareness) Community development and health project http://www.un.org/esa/sustdev/mgroups/success/c_dev.htm UN Department of economic and Social Affairs. Division for Sustainable Development.

UNDP (2008) Human Development Report. UNDP.

UNICEF (2005) Info by country - Nepal - statistics. UNICEF.

Ursin R, Bjorvatn B, Holsten F (2005) Sleep duration, subjective sleep need, and sleep habits of 40- to 45-year-olds in the Hordaland Health Study. Sleep 28(10):1260-9.

Van der Kwaak A, Van der Engel M, Richters A (1991) Woman and health. Vena Journal 3:2-33.

Viguera AC, Newport DJ, Ritchie J, Stowe Z, Whitfield T, Mogielnicki J, Baldessarini RJ, Zurick A, Cohen LS (2007) Lithium in breast milk and nursing infants: clinical implications. Am J Psychiatry 164(2):342-5.

Viguera AC, Nonacs R, Cohen LS, Tondo L, Murray A, Baldessarini RJ (2000) Risk of recurrence of bipolar disorder in pregnant and nonpregnant women after discontinuing lithium maintenance. Am J Psychiatry 157(2):179-84.

Warner R, Appleby L, Whitton A, Faragher B (1996) Demographic and obstetric risk factors for postnatal psychiatric morbidity. Br J Psychiatry 168(5):607-11.

Waters MA, Lee KA (1996) Differences between primigravidae and multigravidae mothers in sleep disturbances, fatigue, and functional status. J Nurse Midwifery 41(5):364-7.

Webster J, Linnane JW, Dibley LM, Pritchard M (2000) Improving antenatal recognition of women at risk for postnatal depression. Aust N Z J Obstet Gynaecol 40(4):409-12.

Weinberg MK, Tronick EZ (1998) The impact of maternal psychiatric illness on infant development. J Clin Psychiatry 59 Suppl 2:53-61.

Weissman AM, Levy BT, Hartz AJ, Bentler S, Donohue M, Ellingrod VL, Wisner KL (2004) Pooled analysis of antidepressant levels in lactating mothers, breast milk, and nursing infants. Am J Psychiatry 161(6):1066-78.

Wenzel A, Haugen EN, Jackson LC, Robinson K (2003) Prevalence of generalized anxiety at eight weeks postpartum. Arch Womens Ment Health 6(1):43-9.

WHO (1992) *The ICD-10 Classification of mental and behavioural disorders. Clinical descriptions and diagnostic guidelines.* World Health Organization. , Geneva.

WHO (2001) Mental health: New Understanding, New Hope, in *The World Health Report 2001*. World Health Organization, Geneva.

Wickberg B, Hwang CP (1996) Counselling of postnatal depression: a controlled study on a population based Swedish sample. J Affect Disord 39(3):209-16.

Wickberg B, Hwang CP (1997) Screening for postnatal depression in a population-based Swedish sample. Acta Psychiatr Scand 95(1):62-6.

Wilkie G, Shapiro CM (1992) Sleep deprivation and the postnatal blues. J Psychosom Res 36(4):309-16.

Wilson JMG, Junger G (1968) Principles and practice of screening for disease. World Health Organization, Geneva.

Wisner KL, Chambers C, Sit DK (2006) Postpartum depression: a major public health problem. Jama 296(21):2616-8.

Wisner KL, Parry BL, Piontek CM (2002) Clinical practice. Postpartum depression. N Engl J Med 347(3):194-9.

Wisner KL, Peindl KS, Gigliotti T, Hanusa BH (1999) Obsessions and compulsions in women with postpartum depression. J Clin Psychiatry 60(3):176-80.

Wisner KL, Stowe ZN (1997) Psychobiology of postpartum mood disorders. Semin Reprod Endocrinol 15(1):77-89.

Wolf AW, De Andraca I, Lozoff B (2002) Maternal depression in three Latin American samples. Soc Psychiatry Psychiatr Epidemiol 37(4):169-76.

Wolfson AR, Crowley SJ, Anwer U, Bassett JL (2003) Changes in sleep patterns and depressive symptoms in first-time mothers: last trimester to 1-year postpartum. Behav Sleep Med 1(1):54-67.

Wright C, Nepal MK, Bruce-Jones WD (1989) Mental health patients in primary health care services in Nepal. Asia Pac J Public Health 3(3):224-30.

Zelkowitz P, Saucier JF, Wang T, Katofsky L, Valenzuela M, Westreich R (2008) Stability and change in depressive symptoms from pregnancy to two months postpartum in childbearing immigrant women. Arch Womens Ment Health 11(1):1-11.

AASM (2005) *International classification of sleep disorders. Diagnostic and coding manual.* 2nd ed. American Academy of Sleep Medicine, Westchester.