Maintaining factors of posttraumatic stress symptoms following childbirth: a population-based, two-year follow-up study

Susan Garthus-Niegel[1,2*], Susan Ayers[3], Tilmann von Soest[4,5], Leila Torgersen[2], Malin Eberhard-Gran[2,6]

[1]Institute and Policlinic of Occupational and Social Medicine, TU Dresden, Faculty of Medicine, Fetscherstr. 74, 01307 Dresden, Germany

[2]Department of Psychosomatics and Health Behavior, Norwegian Institute of Public Health, Oslo, Norway

[3]Centre for Maternal and Child Health, School of Health Sciences, City University London, London, UK

[4]Department of Childhood, Development, and Cultural Diversity, Norwegian Institute of Public Health, Oslo, Norway

[5]Department of Psychology, University of Oslo, Norway

[6]HØKH, Research Centre, Akershus University Hospital, Norway

*Corresponding author

Susan Garthus-Niegel

Fetscherstr. 74

01307 Dresden

Germany

Tel.: +49 351 3177-453

Fax: +49 351 3177-459

Email address: susan.garthus-niegel@tu-dresden.de

Abstract

Background

Previous research has established a number of risk factors that are associated with the onset of PTSD following childbirth. However, little is known about factors that maintain PTSD symptoms.

Methods

This study is part of the Akershus Birth Cohort. Questionnaire data from pregnancy week 17, 8 weeks postpartum and 2 years postpartum were used. 1,473 women completed all these three questionnaires and were included in the analyses. Post-traumatic stress symptoms were measured with the Impact of Event Scale. Potential maintaining factors were personality, sleep, support and life events.

The factors that were significantly correlated with post-traumatic stress symptoms were entered into regression analyses. Mediation analyses were run to test whether significant predictors would serve as mediator of post-traumatic stress symptoms at 8 weeks postpartum to post-traumatic stress symptoms at 2 years postpartum.

Results

We found several low to moderate associations between maintaining factors and PTSD symptoms two years postpartum. Adjusting for the starting point - PTSD symptoms 8 weeks postpartum - only insomnia remained significantly associated. Further, insomnia mediated a small portion of the effect of PTSD symptoms 8 weeks postpartum to PTSD symptoms 2 years postpartum.

Limitations

Limitations of the study include a relative homogeneous sample, modest effect sizes, low internal consistency of some of the measures and the challenge to distinguish insomnia from PTSD symptoms.

Conclusions

Treatment of postpartum PTSD might benefit from addressing insomnia if present. Alleviating insomnia may itself reduce daytime symptoms of PTSD and it may also increase the efficacy of primary PTSD treatments.

Introduction

The importance of women's health during pregnancy and after birth is internationally recognised by governments and health organisations. In the UK, government policy for the development of health services states that *'Improving the health and welfare of mothers and their children is the surest way to a healthier nation'* (Department of Health, 2004). The impact of maternal health on women and their children is well established. Women's physical health in pregnancy is associated with the health of the infant and reduced risk of later adult-onset diseases such as metabolic syndrome and cardiovascular disease (Lau et al., 2011). Stress and anxiety during pregnancy are associated with preterm labour, poor infant outcomes, and greater cognitive, behavioural and interpersonal problems in young children (Glasheen et al., 2010). Similarly, postnatal mental health problems have adverse impacts on mothers, their children, and their relationships. For example, psychological illness is a significant indirect cause of maternal death in the first year after birth (World Health Organization, 2014). This has led to an international call for the integration of maternal mental health into maternal and child health programmes (Rahman et al., 2013).

In Europe approximately 5.4 million women give birth every year (European Commission, 2011), and over 4.5 million women give birth in the USA and Canada every year (United Nations, 2013). Evidence shows that women can suffer from a range of psychological problems during this time. Postpartum posttraumatic stress disorder (PTSD) following a traumatic birth experience, has particularly attracted increasing attention (Alcorn et al., 2010;Ayers et al., 2001). There are varying estimates of the prevalence of postpartum PTSD, with studies reporting from 0 to 8% in normal populations (Adewuya et al., 2006;Alcorn, O'Donovan, Patrick, Creedy, and Devilly, 2010;Ayers et al., 2009;Czarnocka et al., 2000;Soet et al., 2003;White et al., 2006;Wijma et al., 1997) and around 20 to 29% in high-risk groups such as women who have severe complications during pregnancy and labor or fetal or infant loss (Poel et al., 2009;Turton et al., 2001). Studies that recruit mothers from the community and exclude women with pre-existing PTSD or depression in pregnancy provide converging evidence that the incidence is likely to be between 1 to 3% (Alcorn, O'Donovan, Patrick, Creedy, and Devilly, 2010;Ayers and Pickering, 2001). This means that approximately 108,000 women in Europe and 90,000 women in the USA and Canada may be affected every year.

Conceptual frameworks or models for understanding postpartum PTSD draw together key vulnerability, risk, and maintaining factors that may be important in the development of postpartum PTSD (Ayers, 2004;Slade, 2006;van Son et al., 2005). For example, Ayers (2004)

uses a diathesis-stress framework to propose a model that incorporates vulnerability factors in pregnancy, risk factors during birth, and maintaining factors after birth in the onset and maintenance of PTSD. Vulnerability factors in pregnancy include a history of trauma or psychological problems, severe anxiety, depression, and being a first time mother. These vulnerability factors interact with birth events to determine traumatic stress responses. Birth risk factors include complications and intervention during birth, lack of support, high levels of negative emotion, and dissociation. Postnatal factors that might maintain initial PTSD symptoms are additional stress, maladaptive coping, and poor support.

Evidence broadly confirms the associations between the factors outlined above and postpartum PTSD (Cigoli et al., 2006;Cohen et al., 2004;Creedy et al., 2000;Czarnocka and Slade, 2000;Lev-Wiesel et al., 2009;Soderquist et al., 2002;Soderquist et al., 2009;Wijma, Soderquist, and Wijma, 1997), although research is not always consistent (Ayers, 2004). It is now well established that the subjective birth experience is more important in determining women's psychological responses to birth than objective events of labor (Garthus-Niegel et al., 2013;Garthus-Niegel et al., 2014;Ozer et al., 2003). Studies that have looked at the interaction between vulnerability and birth factors are consistent with the proposal that trauma history interacts with birth intervention to increase risk of PTSD after birth (Ayers, Harris, Sawyer, Parfitt, and Ford, 2009;Ford et al., 2011). Likewise health practitioner support during birth can moderate the relationship between previous trauma and postpartum PTSD, as well as the relationship between birth intervention and postpartum PTSD (Ford and Ayers, 2011).

Much less is known about factors that maintain PTSD symptoms after birth. Theories of PTSD distinguish between factors associated with the onset and factors associated with the maintenance of PTSD (Ehlers et al., 2000). "Maintaining factors" have been conceptualized as factors that may either increase or reduce PTSD symptoms over time. This distinction between onset and maintaining factors is important because a proportion of those who have PTSD symptoms immediately after a traumatic event recover spontaneously in the first few months (Rothbaum et al., 1993). Understanding more about factors that maintain PTSD can therefore inform how we can care for women after traumatic birth to maximize recovery.

Reviews of PTSD in other populations, such as war trauma and motor vehicle accidents, suggest factors such as additional stress, poor coping, disturbed sleep and unemployment to be associated with long-term maintenance of symptoms (Beck et al., 2006;Johnson et al., 2008;Mellman et al., 1995). In addition, certain personality types could predict PTSD chronicity over 10 years (Thomas et al., 2014). Conversely, good social support may facilitate recovery with intimate partners playing a vital role as support figures (Johnson

and Thompson, 2008;Monson et al., 2009). Research on postpartum PTSD has examined a few possible maintaining factors, and some studies have found that additional stress and poor coping are associated with PTSD symptoms up to 12 months postpartum (Ford et al., 2010;Leeds et al., 2008;Onoye et al., 2009;Soderquist, Wijma, Thorbert, and Wijma, 2009;Tham et al., 2007). For example, Soderquist et al. (2009) looked at perinatal mental health in 1,224 women in Sweden and found women with poor stress coping in pregnancy were 4.4 times more likely to report PTSD one month after giving birth.

This research provides preliminary information on some of the maintaining factors that might be important in postpartum PTSD. However, the research to date is limited in extent and scope. Very few studies have been conducted, and those that have been done focus predominantly on stress and coping. Research has also not looked at factors that might maintain PTSD symptoms beyond 12 months after birth. This study therefore aimed to extend this research by examining stress, social support, and other possible maintaining factors of short and long-term symptoms of PTSD in a Norwegian cohort of women who were recruited in pregnancy and followed up to two years after birth. In addition to stressful life events and social support, we examined whether sleep difficulties (insomnia and the baby's sleeping patterns), a poor relationship with the baby's father, and personality contribute to the maintenance of PTSD symptoms from eight weeks after birth to two years, as these variables have been relevant factors in other populations (Mellman, Kulick-Bell, Ashlock, and Nolan, 1995;Monson, Taft, and Fredman, 2009;Thomas, Hopwood, Donnellan, Wright, Sanislow, McDevitt-Murphy, Ansell, Grilo, McGlashan, Shea, Markowitz, Skodol, Zanarini, and Morey, 2014).

Materials and Methods

Design and study population

The Akershus Birth Cohort (ABC) study is a prospective cohort study which targeted all women scheduled to give birth at Akershus University Hospital, Norway, which serves approximately 350,000 people from both urban and rural areas. Recruitment took place from November 2008 to April 2010. Women were recruited for the study during their routine fetal ultrasound examination, which is performed at 17 weeks gestation, and were asked to complete questionnaires at 17 weeks gestation, 32 weeks gestation, 8 weeks postpartum and 2 years postpartum. Of the eligible women (i.e. those able to complete a questionnaire in Norwegian), 80% (N = 3,752) agreed to participate and returned the first questionnaire. The number of eligible women dropped somewhat during the study time because some women

had moved or were withdrawn from the study due to severe complications. Response rates were 81% (2,936 out of 3,621), 79% (2,217 out of 2,806) and 73% (1,480 out of 2.019) respectively (see Figure 1). For the present study, we used questionnaire data from pregnancy week 17, 8 weeks postpartum and 2 years postpartum. 1,473 women completed all these three questionnaires and thus were included in the analyses.

The ABC study obtained ethical approval from the Regional Committees for Medical and Health Research Ethics (approval number S-08013a), and all participants provided written informed consent.

Measures

PTSD symptoms following childbirth

The Impact of Event Scale (Horowitz et al., 1979) was used to measure PTSD symptoms at 8 weeks and 2 years postpartum. The Impact of Event Scale is a self-rating scale that measures symptoms of intrusion and avoidance. The scale has been validated in postpartum women (Olde et al., 2006) and can be used as a continuous or categorical measure, with scores over 19 reflecting clinically significant distress, and scores above 34 indicating that PTSD is likely to be present (Neal et al., 1994). Reliability in the current sample was good (Cronbach's α = .84 and .87, respectively).

Maintaining factors

Personality was assessed with a Norwegian version of the Mini-IPIP scale (Donnellan et al., 2006). The Mini-IPIP is a 20-item short form of the 50-item International Personality Item Pool-Five Factor Model measure (Goldberg, 1999), which was developed and validated across five studies (Donnellan, Oswald, Baird, and Lucas, 2006). The Mini-IPIP measures the Big Five factors of personality: extraversion, agreeableness, conscientiousness, neuroticism, and intellect/imagination, with scores ranging from 5 to 20 for each factor. Reliability was good for extraversion (α = .81), acceptable for neuroticism (α = .70), and nearly acceptable for agreeableness (α = .65) and conscientiousness (α = .67), though somewhat low for intellect/imagination (α = .57).

Insomnia symptoms were assessed using the Bergen Insomnia Scale (BIS) (Pallesen et al., 2008). This questionnaire consists of six items, of which the first four pertain to night factors such as (1) sleep onset delayed more than 30 minutes, (2) waking up for more than 30 minutes during the night, (3) waking up more than 30 minutes earlier than desired without

managing to go back to sleep again, and (4) not feeling adequately rested after sleep. These items correspond to the DSM-IV-TR criterion A for insomnia (American Psychiatric Association, 2000). The last two items assess level of daytime impairment (affecting work/studies or personal life) due to (5) sleepiness, and (6) dissatisfaction with sleep, corresponding to the DSM-IV-TR criterion B (American Psychiatric Association, 2000). Each item is rated on average occurrence from 0 to 7 days per week, giving a possible total sum score from 0 to 42. The BIS has been validated against other self-reporting scales as well as polysomnographic data (Pallesen, Bjorvatn, Nordhus, Sivertsen, Hjornevik, and Morin, 2008). Reliability was good with $\alpha = .74$.

Child sleep was assessed by the following question: "How often does the child wake up during the night?" Answer categories were as follows: "three or more times each night", "one to two times each night", "some nights every week", and "less often".

Relationship satisfaction was measured by the 10-item Relationship Satisfaction (RS10) Scale. The scale is a modified and shortened version of Mehrabian's Marital Satisfaction Scale, used in previous Norwegian studies (Rosand et al., 2011;Rosand et al., 2012). The sum score ranges from 10 to 40. Reliability in the current sample was excellent with $\alpha = .92$.

Social support was measured using the 3-item Oslo Social Support Scale, which has been used in several studies, confirming the feasibility and predictive validity of the scale with respect to psychological distress (Boen et al., 2010;Boen et al., 2012). The total sum score ranges from 3 to 14. Reliability was somewhat low, with $\alpha = .54$.

Ten items were selected from existing life event scales (Coddington, 1972;Swearingen et al., 1985). The life events included are 1) having been separated or divorced, 2) serious problems in the marriage or co-habital relationship 3) problems or conflicts with family members, friends or neighbours, 4) problems at work or in the place of education, 5) economic problems, 6) serious illness or injury, 7) serious illness or injury in the close family, 8) traffic accident, fire or theft, 9) loss of a close relative, and 10) other difficulties. The answers are scored according to the woman's reported reaction to the event (emotionally not so difficult/difficult/very difficult). The sum of scores from each item (graded on severity 1-3) is used as a negative life event indicator (Coddington, 1972).

History of physical and sexual abuse were both measured with an adapted version of the Abuse Assessment Screen (McFarlane et al., 1992). History of physical abuse was measured by the following question: "Have you ever, after the age of 18 years, been hit, slapped, kicked, or otherwise physically hurt by someone?" The answers were coded as yes

("1") or no ("0"). If the participants ticked off "I don't remember", the answer was coded as value missing.

History of sexual abuse was assessed by the question: "Have you ever, as an adult, been coerced or forced into sexual activities?" The answers were coded as yes ("yes, exercised power", "yes, coerced", or "yes, raped") or no ("no, never").

All maintaining factors were measured at 8 weeks postpartum, except personality which was measured at pregnancy week 17.

Statistical analyses

All potential maintaining factors were correlated with PTSD symptoms at two years postpartum. To determine the influence of potential maintaining factors above and beyond posttraumatic stress status at 8 weeks, the factors that were significantly correlated with PTSD symptoms were entered into regression analyses. In the first regression model, PTSD symptoms at two years postpartum were regressed on each potential maintaining factor separately and adjusted for PTSD symptoms at 8 weeks postpartum. In the second model, all maintaining factors were entered simultaneously in the regression analysis, also adjusted for PTSD symptoms at 8 weeks postpartum. Further, mediation analyses were run to test whether significant predictors from the multivariate regression analyses would serve as mediators of PTSD symptoms at 8 weeks postpartum to PTSD symptoms at 2 years postpartum.

Results

Mean maternal age at delivery was 31.7 years (SD 4.9 years, range 18.9– 45.5 years), and 51.5% were first-time mothers. Most of the women (97.7%) were married or cohabitating and did not smoke at the time of delivery (96.8%). Of all women, 72.5% had an education of more than 12 years. Compared with the national data from the Medical Birth Registry of Norway from 2009, the women in the study were less likely to be smokers (3.2% vs. 8.2% at the time of delivery), were somewhat older (mean age of 31.7 years vs. 29.7 years), and were less often single (2.3% vs. 9.1%) (Norwegian Institute of Public Health, 2013).

At 8 weeks postpartum, 6.7% of women had clinically significant distress (scores above 19 on the Impact of Event Scale) and 1.9% had probable PTSD (scores above 34) (Neal, Busuttil, Rollins, Herepath, Strike, and Turnbull, 1994). The average score for PTSD symptoms following childbirth was 6.83 (SD = 8.23). The mean score for the subscale intrusion was 4.38 (SD = 4.96) and 2.54 (SD = 4.12) for the subscale avoidance. At 2 years postpartum, 5.5% of women had clinically significant distress and 1.0% had probable PTSD.

For some of the women, this was newly arising distress, i.e. they scored above the cut-off only then. The average score was 5.26 (SD = 7.44) at two years postpartum. Scores for intrusion and avoidance were 3.45 (SD = 4.49) and 1.89 (SD = 3.82) respectively.

Correlations between possible maintaining factors and PTSD symptoms at 2 years postpartum are shown in Table 1. It can be seen that PTSD symptoms were significantly related to all support and life event variables, insomnia symptoms, conscientiousness and neuroticism. PTSD symptoms were not associated with child sleep, extraversion, agreeableness and intellect/imagination. Furthermore, PTSD symptoms at 8 weeks after birth were strongly correlated with symptoms at 2 years (β = .60).

Regression models, in which we controlled for PTSD symptoms at 8 weeks postpartum, are shown in Table 2. In the first regression model, when each variable was entered separately, high levels of insomnia symptoms and negative life events and low social support were significantly associated with PTSD symptoms 2 years postpartum. Thus, they could predict PTSD at 2 years, over and above initial PTSD symptoms at 8 weeks (see Table 2). In the second model, when all variables were entered simultaneously, the only variable that remained significant was insomnia symptoms at 8 weeks postpartum (β = .052). To check whether this was due to the overlap between re-experiencing symptoms and disrupted sleep, we re-ran the regression model using re-experiencing and avoidance symptoms as outcome variables. This showed that the association between maintaining factors and re-experiencing and avoidance symptoms was very similar, and insomnia symptoms significantly predicted both avoidance and re-experiencing symptoms at 2 years. We then tested whether insomnia symptoms mediate the relationship between PTSD symptoms at 8 weeks and 2 years postpartum (Baron et al., 1986;Hayes, 2009). This is shown in Figure 2, and it can be seen that insomnia symptoms have a small but significant indirect effect (.0161).

Discussion

Previous research on PTSD following childbirth has mainly focused on its etiology and thus established a number of risk factors. However, knowledge about the further course of postpartum PTSD and its maintaining factors has been lacking. Given this context, the present study fills an important gap. We found several low to moderate associations between potential maintaining factors and PTSD symptoms two years postpartum. . Insomnia symptoms, low social support and negative life events at 8 weeks postpartum were all associated with an increase in PTSD symptoms at 2 years postpartum. However, only insomnia symptoms remained significant after controlling for the other factors. Indeed, insomnia symptoms

mediated a small portion of the effect of PTSD symptoms at 8 weeks postpartum to PTSD symptoms 2 years postpartum.

Although sleep is recognized as playing a critical role in physical and psychological adaptation (Kobayashi et al., 2013), little is known regarding the association between sleep and postpartum PTSD. Still, extensive research has been done in the non-postpartum literature (Lamarche et al., 2007). Similarly as in our study, insomnia has been found to constitute a maintaining factor for ongoing PTSD (Pigeon et al., 2013). A meta-analysis of polysomnographic studies has also found that individuals with PTSD have more Stage-1 sleep and less slow-wave sleep (deep sleep) compared to those without PTSD (Kobayashi et al., 2007) . Hence, the additional burden of insomnia may directly exacerbate postpartum PTSD symptoms, as well as diminish the women's capacities to manage them (Germain et al., 2012).

However, the postpartum period represents a special situation, in which disturbed sleep is rather common because of nocturnal breastfeeding, infant crying etc. In a recent study on insomnia and postpartum depression, Dørheim and colleagues found that the women's sleep duration and sleep efficiency decreased in the postpartum period, but their insomnia scores improved from pregnancy week 32 to week 8 postpartum (Dorheim et al., 2014). They also found that insomnia, but not sleep duration or sleep efficiency was a risk factor for postpartum depression. Hence, even though most women are affected by disturbed sleep during the postpartum period, women's subjective assessments of sleep, rather than their actual amount of sleep, seem to play a vital role for postpartum mental health (Dorheim, Bjorvatn, and Eberhard-Gran, 2014;Park et al., 2013).

Regarding intervention, addressing insomnia early in the postpartum period may therefore be a strategy to alter the course of PTSD. For instance, one study of insomnia treatment among women with postpartum depression and insomnia showed improvements regarding insomnia severity and subjective mood (Swanson et al., 2013). Indeed, alleviating insomnia may itself reduce daytime symptoms of PTSD (Germain, 2013;Pigeon, Campbell, Possemato, and Ouimette, 2013). It may also increase the efficacy of primary PTSD treatments, especially cognitive-behavioural approaches relying on habituation or cognitive processing, which are markedly affected by sleep loss. Combined behavioural treatments for nightmares and insomnia in women with PTSD may also be effective (Germain, 2013). Even though the number of women with probable PTSD decreases, the importance of clinical intervention is stressed by the strong association between PTSD symptoms at 8 weeks and 2 years.

Although they have been found to be relevant maintaining factors in other populations, in our study, neither personality nor relationship satisfaction could predict PTSD symptoms at 2 years postpartum over and above PTSD symptoms at 8 weeks postpartum. Regarding intimate relationship problems, the association to PTSD is well documented. However, the directionality has been unclear (Monson, Taft, and Fredman, 2009). In fact, most researchers have assumed a causal pathway from traumatization to relationship problems and not vice versa, and our results seem to indirectly support this notion.

The lack of a prospective association between personality and PTSD symptoms at 2 years postpartum beyond the initial PTSD status may possibly be due to our personality measure. The Mini-IPIP is a short scale and reliability of the subscales is not impeccable. Moreover, a previous study has shown that personality variability in PTSD considerably depends on how and with which measurement tool personality is assessed (Thomas, Hopwood, Donnellan, Wright, Sanislow, McDevitt-Murphy, Ansell, Grilo, McGlashan, Shea, Markowitz, Skodol, Zanarini, and Morey, 2014).

Limitations

To our knowledge, this is the first study that investigates maintaining factors of postpartum PTSD symptoms beyond 12 months after delivery. This is a population-based study, including a large number of women with an acceptable response rate. Due to the size of the study and the fact that the majority of women responding to the first questionnaire remained in the study, we believe our results are fairly representative for this population of childbearing women. A limitation of the study is that only Norwegian-speaking women were included, resulting in a relatively homogeneous, mainly Caucasian sample. Furthermore, with regard to socio-demographic characteristics, there is reason to believe that there is a slight social gradient associated with participation. However, it is important to bear in mind that selection bias does not necessarily influence the results when associations between variables are investigated (Nilsen et al., 2009).

Although we found significant associations between insomnia symptoms, low social support and negative life events and PTSD symptoms 2 years postpartum, the effects were only modest, as reflected in the relatively small sizes of the standardized regression coefficients. Consequently, caution is needed when recommending intervention. Still, we regard our results as clinically significant since we could show that insomnia symptoms, adjusted for several other factors and over and beyond PTSD status at 8 weeks, could predict PTSD symptoms after such a long time.

Furthermore, insomnia might be considered a symptom of PTSD (Germain, 2013). Nightmares, for instance, are likely to cause dissatisfactory sleep (insomnia criterion B), at the same time they form a part of PTSD intrusion symptoms. We therefore examined the degree to which insomnia symptoms related to PTSD intrusion and avoidance symptoms. We found that the association of insomnia symptoms was nearly identical regarding both symptom clusters. If insomnia symptoms were merely an indicator of intrusion symptoms, their association with avoidance symptoms would have been weaker. Thus, we concluded, assessing insomnia symptoms, we measured a distinct phenomenon.

Internal consistency of intellect/imagination and our social support scale was somewhat low. Whereas no large associations were expected between intellect/imagination and PTSD symptoms, previous research has stressed the importance of social support as risk and maintenance factor of (postpartum) PTSD (Ford and Ayers, 2011;Johnson and Thompson, 2008). Possibly, with a better measure the association with PTSD symptoms at 2 years postpartum would have been stronger and remained significant in the multivariate analyses. Future research should apply a more reliable measure to further explore the role of lack of social support as a maintaining factor of postpartum PTSD.

Conclusion

This large population-based study is the first to examine maintaining factors of postpartum PTSD symptoms beyond 12 months after delivery. We found that insomnia symptoms predicted PTSD symptoms at 2 years postpartum over and beyond PTSD status at 8 weeks. We also found that a small part of the effect from PTSD symptoms at 8 weeks to 2 years postpartum was mediated by insomnia symptoms. This is consistent with other research suggesting insomnia may be important in postpartum mental health.

Treatment of postpartum PTSD might therefore benefit from addressing insomnia if present. Alleviating insomnia may itself reduce daytime symptoms of PTSD and it may also increase the efficacy of primary PTSD treatments.

Further research looking at factors that might maintain postpartum PTSD is needed to replicate and extend these findings.

References

1. Adewuya,A.O., Ologun,Y.A., Ibigbami,O.S., 2006. Post-traumatic stress disorder after childbirth in Nigerian women: prevalence and risk factors. BJOG: An International Journal of Obstetrics & Gynaecology 113(3), 284-288.

2. Alcorn,K.L., O'Donovan,A., Patrick,J.C., Creedy,D., Devilly,G.J., 2010. A prospective longitudinal study of the prevalence of post-traumatic stress disorder resulting from childbirth events. Psychol. Med. 40(11), 1849-1859.

3. American Psychiatric Association, 2000. Diagnostic and Statistical Manual of Mental Disorders. American Psychiatric Press, Washington DC.

4. Ayers,S., 2004. Delivery as a traumatic event: prevalence, risk factors, and treatment for postnatal posttraumatic stress disorder. Clinical Obstetrics & Gynecology 47(3), 552-567.

5. Ayers,S., Pickering,A.D., 2001. Do women get posttraumatic stress disorder as a result of childbirth? A prospective study of incidence. Birth 28(2), 111-118.

6. Ayers,S., Harris,R., Sawyer,A., Parfitt,Y., Ford,E., 2009. Posttraumatic stress disorder after childbirth: Analysis of symptom presentation and sampling. J. Affect. Disord. (1-3), 200-204.

7. Baron,R.M., Kenny,D.A., 1986. The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical

considerations. Journal of Personality & Social Psychology 51(6), 1173-1182.

8. Beck,J.G., Palyo,S.A., Canna,M.A., Blanchard,E.B., Gudmundsdottir,B., 2006. What factors are associated with the maintenance of PTSD after a motor vehicle accident? The role of sex differences in a help-seeking population. Journal of Behavior Therapy & Experimental Psychiatry 37(3), 256-266.

9. Boen,H., Dalgard,O.S., Bjertness,E., 2012. The importance of social support in the associations between psychological distress and somatic health problems and socio-economic factors among older adults living at home: a cross sectional study. BMC Geriatr. 12, 27.

10. Boen,H., Dalgard,O.S., Johansen,R., Nord,E., 2010. Socio-demographic, psychosocial and health characteristics of Norwegian senior centre users: a cross-sectional study. Scand. J. Public Health 38(5), 508-517.

11. Cigoli,V., Gilli,G., Saita,E., 2006. Relational factors in psychopathological responses to childbirth. J. Psychosom. Obstet. Gynaecol. 27(2), 91-97.

12. Coddington,R.D., 1972. The significance of life events as etiologic factors in the diseases of children. II. A study of a normal population. J. Psychosom. Res. 16(3), 205-213.

13. Cohen,M.M., Ansara,D., Schei,B., Stuckless,N., Stewart,D.E., 2004. Posttraumatic stress disorder after pregnancy, labor, and delivery. J. Women's Health 13(3), 315-324.

14. Creedy,D.K., Shochet,I.M., Horsfall,J., 2000. Childbirth and the development of acute trauma symptoms: incidence and contributing factors. Birth 27(2), 104-111.

15. Czarnocka,J., Slade,P., 2000. Prevalence and predictors of post-traumatic stress symptoms following childbirth. Br. J. Clin. Psychol. 39(Pt 1), 35-51.

16. Department of Health. Core Document, National service framework for childen, young people, and maternity services. 2004. London, DH.

17. Donnellan,M.B., Oswald,F.L., Baird,B.M., Lucas,R.E., 2006. The mini-IPIP scales: tiny-yet-effective measures of the Big Five factors of personality. Psychol. Assess. 18(2), 192-203.

18. Dorheim,S.K., Bjorvatn,B., Eberhard-Gran,M., 2014. Can insomnia in pregnancy predict postpartum depression? A longitudinal, population-based study. PLoS ONE [Electronic Resource] 9(4), e94674.

19. Ehlers,A., Clark,D.M., 2000. A cognitive model of posttraumatic stress disorder. Behav. Res. Ther. 38(4), 319-345.

20. European Commission. Demography report 2010 - Older, more numerous and diverse Europeans. 2011. Luxembourg, Publications Office of the European Union.

21. Ford,E., Ayers,S., 2011. Support during birth interacts with prior trauma and birth intervention to predict postnatal post-traumatic stress symptoms. Psychol. Health 26(12), 1553-1570.

22. Ford,E., Ayers,S., Bradley,R., 2010. Exploration of a cognitive model to predict post-traumatic stress symptoms following childbirth. J. Anxiety Disord. (3), 353-359.

23. Garthus-Niegel,S., Knoph,C., von,S.T., Nielsen,C.S., Eberhard-Gran,M., 2014. The role of labor pain and overall birth experience in the development of posttraumatic stress symptoms: a longitudinal cohort study. Birth 41(1), 108-115.

24. Garthus-Niegel,S., von,S.T., Vollrath,M.E., Eberhard-Gran,M., 2013. The impact of subjective birth experiences on post-traumatic stress symptoms: a longitudinal study. Arch. Womens Ment. Health 16(1), 1-10.

25. Germain,A., 2013. Sleep disturbances as the hallmark of PTSD: where are we now? Am. J. Psychiatry 170(4), 372-382.

26. Germain,A., Richardson,R., Moul,D.E., Mammen,O., Haas,G., Forman,S.D., Rode,N., Begley,A., Nofzinger,E.A., 2012. Placebo-controlled comparison of prazosin and cognitive-behavioral treatments for sleep disturbances in US Military Veterans. J. Psychosom. Res. 72(2), 89-96.

27. Glasheen,C., Richardson,G.A., Fabio,A., 2010. A systematic review of the effects of postnatal maternal anxiety on children. Arch. Womens Ment. Health 13(1), 61-74.

28. Goldberg,L.R., 1999. A broad-bandwidth, public-domain, personality inventory measuring the lower-level facets of several five-factor models. In: Mervielde,I., Deary,I.J., De Fruyt,F., Ostendorf,F.(Eds.), Personality psychology in Europe. Tilburg University Press, Tilburg, The Netherlands, 7-28.

29. Hayes,A.F., 2009. Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. ComM (4), 408-420.

30. Horowitz,M., Wilner,N., Alvarez,W., 1979. Impact of Event Scale: a measure of subjective stress. Psychosom. Med. 41(3), 209-218.

31. Johnson,H., Thompson,A., 2008. The development and maintenance of post-traumatic stress disorder (PTSD) in civilian adult survivors of war trauma and torture: A review. Clin. Psychol. Rev. 28(1), 36-47.

32. Kobayashi,I., Boarts,J.M., Delahanty,D.L., 2007. Polysomnographically measured sleep abnormalities in PTSD: a meta-analytic review. Psychophysiology 44(4), 660-669.

33. Kobayashi,I., Delahanty,D.L., 2013. Gender differences in subjective sleep after trauma and the development of posttraumatic stress disorder symptoms: a pilot study. J. Trauma Stress. 26(4), 467-474.

34. Lamarche,L.J., De,K.J., 2007. Sleep disturbance in adults with posttraumatic stress disorder: a review. J. Clin. Psychiatry 68(8), 1257-1270.

35. Lau,C., Rogers,J.M., Desai,M., Ross,M.G., 2011. Fetal programming of adult disease: implications for prenatal care. Obstet. Gynecol. 117(4), 978-985.

36. Leeds,L., Hargreaves,I., 2008. The psychological consequences of childbirth. Journal of Reproductive and Infant Psychology 26(2), 108-122.

37. Lev-Wiesel,R., Chen,R., Daphna-Tekoah,S., Hod,M., 2009. Past traumatic events: are they a risk factor for high-risk pregnancy, delivery complications, and postpartum posttraumatic symptoms? J. Womens Health (Larchmt.) 18(1), 119-125.

38. McFarlane,J., Parker,B., Soeken,K., Bullock,L., 1992. Assessing for abuse during pregnancy. Severity and frequency of injuries and associated entry into prenatal care. JAMA 267(23), 3176-3178.

39. Mellman,T.A., Kulick-Bell,R., Ashlock,L.E., Nolan,B., 1995. Sleep events among veterans with combat-related posttraumatic stress disorder. Am J Psychiatry 152(1), 110-115.

40. Monson,C.M., Taft,C.T., Fredman,S.J., 2009. Military-related PTSD and intimate relationships: from description to theory-driven research and intervention development. Clin. Psychol Rev. 29(8), 707-714.

41. Neal,L.A., Busuttil,W., Rollins,J., Herepath,R., Strike,P., Turnbull,G., 1994. Convergent validity of measures of post-traumatic stress disorder in a mixed military and civilian population. J. Trauma. Stress 7(3), 447-455.

42. Nilsen,R.M., Vollset,S.E., Gjessing,H.K., Skjaerven,R., Melve,K.K., Schreuder,P., Alsaker,E.R., Haug,K., Daltveit,A.K., Magnus,P., 2009. Self-selection and bias in a large prospective pregnancy cohort in Norway. Paediatr. Perinat. Epidemiol. 23(6), 597-608.

43. Norwegian Institute of Public Health. Medical Birth Registry of Norway. http://www.fhi.no/eway/default.aspx?pid=240&trg=Main_6664&Main_6664 =6898:0:25,7840:1:0:0:::0:0. accessed 02.10.2014.

44. Olde,E., Kleber,R.J., van der Hart,O., Pop,V.J.M., 2006. Childbirth and posttraumatic stress responses: A validation study of the Dutch Impact of Event Scale-Revised. European Journal of Psychological Assessment 22(4), 259-267.

45. Onoye,J.M., Goebert,D., Morland,L., Matsu,C., Wright,T., 2009. PTSD and postpartum mental health in a sample of Caucasian, Asian, and Pacific Islander women. Arch Womens Ment. Health 12(6), 393-400.

46. Ozer,E.J., Best,S.R., Lipsey,T.L., Weiss,D.S., 2003. Predictors of posttraumatic stress disorder and symptoms in adults: a meta-analysis. Psychol. Bull. 129(1), 52-73.

47. Pallesen,S., Bjorvatn,B., Nordhus,I.H., Sivertsen,B., Hjornevik,M., Morin,C.M., 2008. A new scale for measuring insomnia: the Bergen Insomnia Scale. Percept. Mot. Skills 107(3), 691-706.

48. Park,E.M., Meltzer-Brody,S., Stickgold,R., 2013. Poor sleep maintenance and subjective sleep quality are associated with postpartum maternal depression symptom severity. Archives of Women's Mental Health 16(6), 539-547.

49. Pigeon,W.R., Campbell,C.E., Possemato,K., Ouimette,P., 2013. Longitudinal relationships of insomnia, nightmares, and PTSD severity in recent combat veterans. J. Psychosom. Res. 75(6), 546-550.

50. Poel,Y.H., Swinkels,P., de Vries,J.I., 2009. Psychological treatment of women with psychological complaints after pre-eclampsia. Journal of Psychosomatic Obstetrics & Gynecology 30(1), 65-72.

51. Rahman,A., Surkan,P.J., Cayetano,C.E., Rwagatare,P., Dickson,K.E., 2013. Grand challenges: integrating maternal mental health into maternal and child health programmes. PLoS. Med. 10(5), e1001442.

52. Rosand,G.M., Slinning,K., Eberhard-Gran,M., Roysamb,E., Tambs,K., 2011. Partner relationship satisfaction and maternal emotional distress in early pregnancy. BMC Public Health 11, 161.

53. Rosand,G.M., Slinning,K., Eberhard-Gran,M., Roysamb,E., Tambs,K., 2012. The buffering effect of relationship satisfaction on emotional distress in couples. BMC Public Health 12, 66.

54. Rothbaum,B.O., Foa,E.B., 1993. Subtypes of posttraumatic stress disorder and duration of symptoms. In: Davidson,J.R.T., Foa,E.B.(Eds.), Posttraumatic Stress Disorder: DSM-IV and beyond. Psychiatric Press, Washington, 23-35.

55. Slade,P., 2006. Towards a conceptual framework for understanding post-traumatic stress symptoms following childbirth and implications for further research. Journal of Psychosomatic Obstetrics & Gynecology 27(2), 99-105.

56. Soderquist,J., Wijma,B., Thorbert,G., Wijma,K., 2009. Risk factors in pregnancy for post-traumatic stress and depression after childbirth. BJOG. 116(5), 672-680.

57. Soderquist,J., Wijma,K., Wijma,B., 2002. Traumatic stress after childbirth: the role of obstetric variables. Journal of Psychosomatic Obstetrics & Gynecology 23(1), 31-39.

58. Soet,J.E., Brack,G.A., DiIorio,C., 2003. Prevalence and predictors of women's experience of psychological trauma during childbirth. Birth 30(1), 36-46.

59. Swanson,L.M., Flynn,H., Adams-Mundy,J.D., Armitage,R., Arnedt,J.T., 2013. An open pilot of cognitive-behavioral therapy for insomnia in women with postpartum depression. Behavioral Sleep Medicine 11(4), 297-307.

60. Swearingen,E., Cohen,L., 1985. Measurement of adolescents' life events: The junior high life experiences survey. Am J Commun Psychol 13(1), 69-85.

61. Tham,V., Christensson,K., Ryding,E.L., 2007. Sense of coherence and symptoms of post-traumatic stress after emergency caesarean section. Acta Obstet. Gynecol. Scand. 86(9), 1090-1096.

62. Thomas,K.M., Hopwood,C.J., Donnellan,M.B., Wright,A.G.C., Sanislow,C.A., McDevitt-Murphy,M.E., Ansell,E.B., Grilo,C.M., McGlashan,T.H., Shea,M.T., Markowitz,J.C., Skodol,A.E., Zanarini,M.C., Morey,L.C., 2014. Personality heterogeneity in PTSD: Distinct temperament and interpersonal typologies. Psychological Assessment 26(1), 23-34.

63. Turton,P., Hughes,P., Evans,C.D., Fainman,D., 2001. Incidence, correlates and predictors of post-traumatic stress disorder in the pregnancy after stillbirth. Br. J. Psychiatry 178, 556-560.

64. United Nations, Department of Economic and Social Affairs Population Division. World Fertility Data 2012. http://www.un.org/esa/population/publications/WFD2012/MainFrame.html. accessed 02.10.2014.

65. van Son,M.J., Verkerk,G., van der Hart,O., Komproe,I., Pop,V.J., 2005. Prenatal depression, mode of delivery and perinatal dissociation as predictors of postpartum posttraumatic stress: an empirical study. Clinical Psychology and Psychotherapy 12(4), 297-312.

66. White,T., Matthey,S., Boyd,K., Barnett,B., 2006. Postnatal depression and post-traumatic stress after childbirth: Prevalence, course and co-occurrence. Journal of Reproductive and Infant Psychology 24(2), 107-120.

67. Wijma,K., Soderquist,J., Wijma,B., 1997. Posttraumatic stress disorder after childbirth: a cross sectional study. J. Anxiety Disord. 11(6), 587-597.

68. World Health Organization. Maternal Health & Child Health and Development. http://www.who.int/mental_health/prevention/suicide/MaternalMH/en/. accessed 11.08.2008.