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ORIGINAL ARTICLE

# Adverse life experiences and common mental health problems in pregnancy: a causal pathway analysis

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## Abstract

Risk factors for antenatal common mental problems include a history of depression, lack of social support and a history of both childhood and adulthood sexual and physical abuse. However, it is less clear whether pregnancy is a time of particular susceptibility to mental disorders due to prior childhood experiences. The aim of the paper was to investigate the potential pathways to antenatal mental health problems. A total of 521 women attending prenatal care attended a clinical interview and answered psychological questionnaires. Univariate analysis, sequential binary logistic regression and structural equation modelling (SEM) were used to analyse the relationships between variables. Having experienced parental maladjustment, maltreatment and serious physical illness in childhood and domestic violence, financial difficulties and serious spousal substance abuse in adulthood significantly predicted antenatal common mental health symptoms. SEM showed that history of depression and adverse experiences in adulthood had mediating effects on the relationship between adverse childhood events and symptoms of antenatal common mental disorders. Adverse childhood experiences are distal risk factors for antenatal common mental health problems, being significant indicators of history of depression and adverse experiences in adulthood. We therefore conclude that pregnancy is not a time of particular susceptibility to common mental health problems as a result of childhood abuse, but rather, these childhood experiences have increased the risk of adulthood trauma and prior mental disorders. Women at risk for antenatal common mental disorders include those with a history of depression, domestic violence, financial difficulties, spousal substance abuse and lack of social support.

**Keywords** Common mental health problems · Adverse childhood experiences · Adverse experiences in adulthood · Pregnancy

## Introduction

Major depression and anxiety disorders are the most common mental health problems experienced in the antenatal period (Alipour et al. 2012; Howard et al. 2014) and if left untreated, the strongest risk factors for postnatal depression (Beck 2001; Milgrom et al. 2008; Robertson et al. 2004). This is true, both in high and low income settings (Norhayati et al. 2015). Systematic reviews indicate a prevalence rate of antenatal depression around 12–13% (Bennett et al. 2004; Gavin et al. 2005) and the prevalence of antenatal anxiety disorders around 15% (Dennis et al. 2017). Recent studies further show that antenatal depression and anxiety are often comorbid (Biaggi et al. 2016; Lydsdottir et al. 2014).

Adverse experiences in both childhood and adulthood have been associated with antenatal common mental disorders (Biaggi et al. 2016; Lancaster et al. 2010) with particularly consistent evidence of the significant influence of childhood abuse on antenatal depressive symptoms (Holzman et al. 2006; Plant et al. 2013; Robertson-Blackmore et al. 2013; Romano et al. 2006; Wosu et al. 2015). Less is known about the influence of other adverse childhood events. Several adverse experiences in adulthood have been found to be risk factors for antenatal common mental health problems

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(Biaggi et al. 2016; Lancaster et al. 2010) including lifetime physical or sexual abuse with more recent abuse being a greater risk than childhood abuse (Rich-Edwards et al. 2010). In a review of the influence of domestic violence, Howard et al. (2013) reported a relationship between domestic violence and antenatal depressive symptoms. However, other adverse experiences in adulthood have received little attention, including mental disorders or spousal substance abuse. Thus, it is important to investigate what kind of adverse experiences in childhood and adulthood, apart from sexual and physical violence, may influence antenatal common mental health problems, and how this is mediated—for example, via re-existing depression and/or an increased risk of adulthood abuse.

Research has shown that adverse experiences in childhood and adulthood are strong risk factors for common mental disorders in general (Cannon et al. 2010; Kessler et al. 2010). To our knowledge, no studies on such risk factors for antenatal common mental health problems have controlled for history of depression and social support. This is important, because history of depression is the strongest risk factor for common mental disorders, both during and after pregnancy, and support from a partner or significant others has been shown to mitigate antenatal common mental health problems (Lee et al. 2007; Zeng et al. 2015).

The aims of this study were twofold: first, to investigate which adverse experiences both in childhood and adulthood may affect antenatal common mental disorders; secondly, to analyse the potential mediating influences of adverse experiences in adulthood, history of depression and social support on the relationship between adverse experiences in childhood and common mental health symptoms.

## Methods

### Procedure and participants

In weeks 12 to 14 of gestation, women attending antenatal clinics at 11 Primary Health Care Centres in Iceland (November 2006–July 2011) were approached and invited to participate in the study of mental health in the perinatal period. Ten clinics were located in the capital region (the Greater Reykjavik area) and one clinic was located in Iceland's second largest urban area, Akureyri, in the North of Iceland. Inclusion criteria were (a) being pregnant, (b) being at least 16 years of age, (c) being able to read and speak Icelandic. Exclusion criteria were a diagnosis of schizophrenia, acute psychotic symptoms or significantly impaired cognitive functioning, as identified by Primary Health Care staff. Women who agreed to participate were asked to complete the Edinburgh Postnatal Depression Scale (EPDS) and the Depression Anxiety and Stress Scales (DASS-42) on three occasions during pregnancy (weeks 16, 25 and 36) and once postpartum (between weeks 9–13). In this paper, data from participants who completed the EPDS and the DASS-42 during pregnancy are reported. Recruitment of participants was carried out by midwives and nurses, working in antenatal care, under the supervision of an experienced clinical psychologist, who is one of the researchers (LBL). In total, 2523 pregnant women completed screening instruments during pregnancy. If the women were found to have an EPDS score of 12 or higher, DASS depression score of 10 or higher and/or DASS anxiety score of 8 or higher ("screen positive"), they were contacted by the researchers and asked to attend a psychiatric diagnostic interview within 2 to 4 weeks after screening. Women with a score below 12 on the EPDS, 10 on the DASS Depression scale and 8 on the DASS Anxiety scale ("screen negative") were randomly (one in every four) invited to participate in a diagnostic interview. The DASS Stress scale was not used in the screening phase.

In total, 521 pregnant women were interviewed. Experienced female clinicians conducted the interviews, using the Mini-International Neuropsychiatric Interview Plus (MINI-Plus), to diagnose the women according to the DSM-IV criteria. The interviewers had clinical experience in distinguishing pregnancy-related symptoms from mental health symptoms. Inter-rater reliability between the two main raters was high (kappa = .86 ($p < 0.001$), 95% CI 0.75, 0.97). Interviewers were blind to the participants' EPDS and DASS-42 scores. The interviewers also asked the women about adverse experiences in their lives and finally, asked them to fill out psychological questionnaires, including the Multidimensional Scale of Perceived Social Support (MSPSS) used in this study.

### Instruments

*The Edinburgh Postnatal Depression Scale* (EPDS: Cox et al. 1987) is a 10-item self-rating scale designed to screen for postpartum depression. The scale covers the most common symptoms of depression, without somatic symptoms such as fatigue and change in appetite that may be expected both at postpartum and during pregnancy. Scoring for each item is from 0 to 3, high scores indicating more symptoms of depression (ranging between 0 and 30). The EPDS is a reliable instrument and has been validated in both the postpartum and the antenatal periods (Eberhard-Gran et al. 2001; Gibson et al. 2009; Murray and Cox 1990). A cut-off score of ≥ 12 was used. Chronbach's alphas for the EPDS in the study were good to excellent (Cronbach and Shavelson 2004) on all measurement points (ranging between 0.84 and 0.85).

*The Depression Anxiety and Stress Scales-42* (DASS-42; Lovibond and Lovibond 1995a) is a set of three self-report scales used to screen for symptoms of depression, anxiety and stress. Each of the three scales consists of 14 items that have been shown to be reliable, Chronbach's alpha: 0.91 for the

Depression scale, 0.81 for the Anxiety scale and 0.89 for the Stress scale, with good validity (Lovibond and Lovibond 1995b). The following cut-off scores were used: ≥ 10 for depression and ≥ 8 for anxiety, which indicate a mild state of either condition (Lovibond and Lovibond 1995a). The Stress scale was not used for screening in this study. Chronbach's alphas for all the subscales in the study were good to excellent (ranging between 0.85 and 0.93).

The Mini-International Neuropsychiatric Interview Plus (MINI-Plus; Lecrubier et al. 1997) is a semi-structured diagnostic interview that contains 26 modules for the major axis I psychiatric disorders on the DSM-IV TR and the ICD-10. The modules used in this study that represent common mental disorders were as follows: major depressive episodes, dysthymia, panic disorders, agoraphobia, social phobia, simple phobia, obsessive compulsive disorder (OCD), posttraumatic stress disorder (PTSD) and generalised anxiety disorder (GAD). The MINI-PLUS also contains a question about history of depression episodes, which was used in the study. The MINI-Plus has acceptable test-retest and inter-rater reliability and has been validated against the SCID for the DSM-III R and the CIDI for the ICD-10 (Lecrubier et al. 1997; Sigurdsson 2008).

*The Adverse Experiences Interview* (AEI) was designed by the researchers, as no instrument was available in Icelandic that met the purpose of the study, i.e. to gather information on several adverse events, including events not found in existing instruments, i.e. serious physical illness, spousal substance abuse. The interview is semi-structured and consists of dichotomous questions about several adverse experiences in childhood and in adulthood. Participants were asked to endorse (yes/no) the 11 adverse experiences in childhood (occurring before age 18). Two questions included interpersonal loss (parental or siblings' death and parental divorce), two questions included parental maladjustment (serious mental illness, serious substance abuse), two included maltreatment (physical abuse, sexual abuse) and five other adverse experiences in childhood (being bullied, serious physical illness, serious accident, close friend or parent in serious accident, parent having a serious physical illness, poverty). After being asked about adverse experiences in childhood, the participants were asked 13 questions about adverse experiences in adulthood (occurring after age of 17 years). Four questions included interpersonal loss (divorce, death of parent or spouse, loss of a child and miscarriage), two included having experienced violence (domestic violence, including physical, emotional or sexual, sexual assault), one included other adversity with spouse (serious substance abuse) and three included adversities involving close relatives (serious mental illness, serious physical illness and serious accident). Three questions included other negative personal events (serious accident, serious physical illness, serious problems at work and financial difficulties).

*The Multidimensional Scale of Perceived Social Support* (MSPSS; Zimet et al. 1988) is a 12-item questionnaire assessing perceived social support. The list consists of three subscales: family, friends and other important persons. Each subscale has four items and the total score consists of all items added up. The authors found good reliability of the total scale, the family subscale, the friend subscale and the significant other subscale (Chronbach's alpha .88, .87, .85 and .91, respectively; Zimet et al. 1990). Other studies have shown good psychometric properties of the scale (Canty-Mitchell and Zimet 2000; Dahlem et al. 1991).

## Data analysis

Statistical analysis was carried out using the IBM SPSS Statistics version 21 (IBM CORP n.d.) and R: A language and environment for computing (R Core Team 2013; http://www.R-project.org/). Two kinds of analyses were carried out. In the first analysis, consisting of two steps, the relationship between the history of depression, adverse experiences in childhood and adverse experiences in adulthood with common mental disorders during pregnancy was examined. The first step was a univariate analysis, in which Chi-squares and odds ratios were calculated for all adverse experiences, past history of depression and current common mental disorders. The second step was carried out to detect the prediction power of adverse experiences in childhood and in adulthood and prior history of depression on common mental disorders. In this step, sequential binary logistic regression analysis was performed using forced entry method. A separate analysis was carried out for adverse experiences in childhood and adverse experiences in adulthood. On both occasions, all events that tested significant in the univariate analysis were included.

In the second analysis, SEM was conducted using the R 3.0.2. Lavaan (Rosseel 2012) to simultaneously estimate the relationship between adverse experiences in childhood, adverse experiences in adulthood, prior history of depression, social support and symptoms of common mental disorders measured with the DASS-42 and the EPDS. In this analysis, we retained only those variables that were found to be significantly related to common mental disorders in the first analysis. Before estimation of the parameters, assumption of normality and equal factor loadings of latent variables were tested. These variables were social support, using the three subscales of the MSPSS and symptoms of common mental disorders, using the EPDS and the three subscales of the DASS-42. The data was analysed using the weighted least squares mean and variance (WLSMV) robust estimator. This method does not assume a normal distribution (DiStefano and Morgan 2014). To test the fit of the model, the following statistics were used: the comparative Fit Index (CFI; Bentler 1990) and the Tucker-Lewis index (TLI; Tucker and Lewis 1973), with value greater than .95 indicating a good fit (Hu and Bentler

1999); the root mean square error of approximation (RMSEA), with values under .06 suggesting close approximate fit (Schumacker and Lomax 2010); and the weighted root mean square residual (WRMR), seeing it is appropriate for non-normally distributed data (Muthén and Muthén 1998).

## Ethics

Approval for the study was received from the Icelandic National Bioethics Committee (ref. no. 05-107-S1) and the Icelandic Data Protection Authority (ref. no. S2589). When pregnant women attended the antenatal clinics at the beginning of their pregnancy (weeks 12–16), they received information about the study from the midwives, who also invited them to participate. If the women agreed to participate they signed an informed consent. Parental consent was required for women under the age of 18. If the women were in need of psychiatric treatment, they were referred to appropriate treatment at the Mental Health Services at Landspitali–The National University Hospital of Iceland.

# Results

Of the 2523 women completing screening instruments in weeks 16, 25 and 36, 521 (20.6%) attended the diagnostic interview and answered questionnaires (mean age 28.88, sd = 5.30, range 17–47). Of those women, 320 (61.4%) scored above cut-off scores on the EPDS and/or the DASS-42, and 201 (38.6%) scored below cut-off scores on both the EPDS and the DASS-42 (they were randomly selected from the screening group as a comparison group). One woman in the screen negative group screened positive in week 36 and was removed from the group. Of the 521 women, 189 women (37.8%) were pregnant with their first child, 429 (82.3%) were married or cohabiting, 240 (46.1%) had a university degree, 307 (58.9%) were working and 41 (7.9%) were without work because of sickness or unemployment. A total of 227 women (43.6%) were diagnosed with one or more mental disorders. Eighty-seven (16.7%) women were diagnosed with major depression and 174 (33.4%) were diagnosed with anxiety disorders. Of those diagnosed with major depression, 30 (34.5%) had comorbid diagnosis of GAD, 28 (20.7%) of panic, 21 (24.2%) of OCD, 13 (14.9%) of simple phobia, 19 (21.8%) of social phobia and 6 (6.9%) of PTSD. Two hundred and nineteen women (42.03%) had a history of depression. Of those, 146 were diagnosed with CMD. Women diagnosed with CMD scored significantly lower on all the MSPSS subscales than those who were not diagnosed with CMD as can be seen in Table 1.

## History of depression, adverse experiences and CMD

To test the relationship between history of depression and adverse experiences in both childhood and adulthood with common mental disorders during pregnancy, Chi-squares and odds ratios were calculated for all the items on the AEI. Only the significant findings are displayed in Table 2. As can be seen, there were strong significant relationships between being diagnosed with common mental disorders during pregnancy and both prior history of depression and adverse experiences in childhood and adulthood. The odds of being diagnosed with MD were highest for those with prior history of depression (OR = 5.76) and having experienced physical abuse in childhood (OR = 5.17), followed by having a spouse with serious substance abuse (OR = 3.94), having been a victim to domestic violence (OR = 3.76) and having experienced financial difficulties in adulthood (OR = 3.32).

In order to explore the predictive power of adverse experiences in childhood on common mental disorders, a hierarchical logistic regression analysis was carried out using forced entry method. The data were entered into the logistic regression model in one block: serious physical illness in close family member, poverty, being bullied, serious substance abuse in close family member, serious mental disorder in close family member, physical illness, sexual abuse and physical abuse. No significant collinearity problems were found among the independent variables (VIF < 2.5). Table 3 gives the results and provides the beta values and their standard errors, odds ratio (exp b) and the $R^2$ value (Nagelkerke adjusted value) and the model Chi-square. The following variables remained strong predictors of common mental disorders: serious substance abuse in a close family member, serious mental disorder in a close family member, physical illness, sexual abuse and physical abuse.

A separate logistic regression analysis was then performed to explore the predictive power of adverse experiences in adulthood on common mental disorders. The data were entered in one block: serious mental disorder in a close family member, divorce, sexual assault, financial difficulties, domestic violence and serious spousal substance abuse. The following events were found to be predictive of common mental disorders, as can be seen in Table 4: domestic violence, serious spousal substance abuse and financial difficulties.

## Causal pathway analysis

To examine the relationships between all the variables, we built a structural equation model based on the results of the above analysis (Fig. 1). The indicator variables for (1) adverse experiences in childhood were as follows: serious substance abuse in a close family member, serious mental disorder in a close family member, physical illness, sexual abuse and physical abuse; (2) for adverse experiences in adulthood: domestic

**Table 1** Mann-Whitney *U* test between those diagnosed with CMD and those with no CMD on the MSPSS subscales

| | CMD (SD) | No CMD (SD) | Mean difference (SE) | 95% CI | *U* |
|---|---|---|---|---|---|
| MSPSS | | | | | |
| Social support significant other | 25.43 (3.92) | 26.67 (3.12) | 1.24 (.31) | .63–1.86 | 24.63* |
| Social support family | 21.65 (5.50) | 24.57 (3.97) | 2.92 (.42) | 2.09–3.74 | 21.11* |
| Social support friends | 20.92 (5.14) | 24.11 (3.97) | 3.19 (.40) | 2.40–3.98 | 19.69* |

$p \leq .001$

*MSPSS* Multidimensional Scale of Perceived Social Support, *CMD* common mental disorders, *SD* standard deviation, *SE* standard error, *CI* confidence interval

violence, serious spousal substance abuse and financial difficulties; (3) for prior history of depression, a dichotomous question from the MINI Plus was used; (4) for social support, all three subscales of the MSPSS were used: social support from a significant other, family and friends; (5) for symptoms of common mental disorders, the EPDS and all three subscales of the DASS-42 were used. Prior history of depression and adverse experiences were significantly associated with symptoms of antenatal common mental disorders. Adverse experiences in both adulthood and childhood were associated significantly with prior history of depression. Social support showed significant negative association with symptoms of common mental disorders, but prior history of depression and adverse experiences showed non-significant negative association with social support. No significant interactional effect was found. The model showed a good fit. The WLSMV was 148.920 ($df = 96$), $p < .786$, CFI = .971, TLI = .963, RMSEA = .033 (90% CI .022–.043; $p \leq .05 = .998$), and WRMR = .817.

## Discussion

Our analysis clarifies the relationship between antenatal common mental disorders, adverse experiences, prior history of depression and social support. We found significant associations between common mental disorders and the following adverse experiences in childhood: serious physical illness in close family members, serious substance abuse in a close family member, serious mental disorder in a close family member, poverty,

**Table 2** Comparison between those diagnosed with CMD and no CMD on categorical measures of prior history of depression and adverse experiences in childhood and in adulthood

| | No CMD | CMD | $\chi^2$ | OR (95%CI) |
|---|---|---|---|---|
| Prior history of depression ($n = 219$) | 73 (25.3%) | 146 (66.1%) | 85.10*** | 5.76 (3.92–8.46) |
| *Adverse life events in childhood* | | | | |
| Serious physical illness in close family members ($n = 97$) | 45 (15.6%) | 52 (23.4%) | 5.03* | 1.66 (1.06–2.59) |
| Poverty ($n = 133$) | 61 (21.1%) | 72 (32.4%) | 8.36** | 1.79 (1.20–2.67) |
| Being bullied ($n = 135$) | 60 (20.8%) | 75 (33.8%) | 10.95*** | 1.95 (1.31–2.90) |
| Serious substance abuse in close family member ($n = 144$) | 61 (21.1%) | 83 (37.4%) | 16.44*** | 2.23 (1.51–3.30) |
| Physical illness ($n = 81$) | 28 (9.7%) | 53 (23.9%) | 18.94*** | 2.92 (1.79–4.81) |
| Serious mental illness in close family member ($n = 130$) | 50 (17.3% | 80 (36.0%) | 23.23*** | 2.69 (1.79–4.06) |
| Sexual abuse ($n = 114$) | 41 (14.2%) | 73 (32.9%) | 25.32*** | 2.96 (1.92–4.57) |
| Physical violence ($n = 64$) | 15 (5.2%) | 49 (22.1%) | 32.66*** | 5.17 (2.81–9.51) |
| *Adverse experiences in adulthood* | | | | |
| Serious mental illness in close family member ($n = 176$) | 85 (29.8%) | 91 (41.7%) | 7.71** | 1.69 (1.16–2.44) |
| Sexual assault ($n = 50$) | 17 (5.9%) | 33 (15.1%) | 11.67** | 2.82 (1.52–5.21) |
| Divorce ($n = 231$) | 109 (38%) | 122 (55.5%) | 15.33*** | 2.03 (1.42–2.90) |
| Domestic violence ($n = 77$) | 23 (8%) | 54 (24.8%) | 26.75*** | 3.76 (2.23–6.37) |
| Financial difficulties ($n = 118$) | 41 (14.4%) | 77 (35.8%) | 31.21*** | 3.32 (2.15–5.12) |
| Serious substance abuse in spouse ($n = 93$) | 28 (9.9%) | 65 (30.1%) | 33.17*** | 3.94 (2.42–6.40) |

*$p \leq .05$, **$p \leq .005$, ***$p \leq .001$

*n* number of participants experiencing adverse experiences, *CMD* common mental disorders, $\chi^2$ a Chi-squared test, *OR* odds ratio, *CI* confidence interval

**Table 3** Summary of the binary logistic regressions with regard to contribution of the categorical measures of adverse experiences in childhood to CMD

| | B(SE) | Wald | Exp(B) | 95% CI for Exp(B) | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| Model 1 | | | | | |
| Constant | − 1.08 (.15) | | | | |
| Serious substance abuse in close family member | .47 (.22) | 4.43* | 1.59 | 1.03 | 2.46 |
| Serious mental illness in close family member | .48 (.23) | 4.24* | 1.62 | 1.02 | 2.57 |
| Serious physical illness | .71 (.28) | 6.57** | 2.03 | 1.18 | 3.48 |
| Sexual abuse | .63 (.24) | 6.57** | 1.87 | 1.16 | 3.03 |
| Physical violence | 1.02 (.34) | 8.84** | 2.76 | 1.41 | 5.40 |
| Nagelkerk $R^2$ | .18 | | | | |
| Chi$^2$ | 74.26 ($df$ = 8)*** | | | | |

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$ (two-tailed test)

*CMD* common mental disorders, *B* the coefficient for the constant, *SE* standard error, *Wald* the Wald Chi-square test, *Exp(B)* odds ratio, *CI* confidence interval, *df* degrees of freedom

physical illness, being bullied, sexual abuse and physical abuse. Of these events, parental maladjustment (serious mental illness, serious substance abuse), maltreatments (physical abuse, sexual abuse) and having experienced serious physical illness significantly predicted antenatal common mental disorders. When looking at adverse experiences in adulthood, we found significant associations between common mental disorders and serious mental disorders in a close family member, sexual assault, divorce, domestic violence, financial difficulties and serious spousal substance abuse. Having experienced domestic violence, financial difficulties and having had a spouse with serious substance abuse significantly predicted common mental health symptoms during pregnancy. Although studies have shown some of these associations previously, e.g. between domestic violence and antenatal common mental health problems (Alvarez-Segura et al. 2014; Howard et al. 2014), little has been reported about the influence of the psychopathology of the spouse on antenatal distress, as Biaggi et al. (2016) pointed out in their review. Similarly, the strong association between depressive symptoms, childhood abuse and a family history of psychiatric illness during the lifespan have been reported elsewhere (Alvarez-Segura et al. 2014; Biaggi et al. 2016; Robertson-Blackmore et al. 2013; Wosu et al. 2015), but little focus has been directed to other kinds of adverse childhood events, such as serious physical illness. Our study therefore adds valuable information to the literature on the influence of adverse experiences on mental health during pregnancy.

When looking at the relationship between adverse experiences and severity of symptoms of common mental disorders, together with history of depression and social support, we gained more insight. In contrast to older studies, we found that adverse experiences in childhood did not affect the severity of symptoms of common mental disorders directly. However, these adverse experiences in childhood did have a significant association with prior history of depression and adverse experiences in adulthood. History of depression had a strong association with symptoms of common mental disorders, as did adverse experiences in adulthood, which also had a strong association with history of

**Table 4** Summary of the binary logistic regression with regard to contribution of the categorical measure of adverse experiences in adulthood to CMD

| | B(SE) | Wald | Exp(B) | 95% CI for Exp(B) | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| Constant | − 1.01 (.15) | | | | |
| Domestic violence | .70 (.31) | 5.26* | 2.02 | 1.11 | 3.69 |
| Serious substance abuse in spouse | .92 (.26) | 12.44*** | 2.52 | 1.51 | 4.21 |
| Financial difficulties | .81 (.24) | 11.20** | 2.25 | 1.40 | 3.62 |
| Nagelkerk $R^2$ | .17 | | | | |
| Chi$^2$ | 68.12 ($df$ = 6)**** | | | | |

*$p \leq .05$, **$p \leq .005$, ***$p \leq .001$ (two-tailed test)

*CMD* common mental disorders, *B* the coefficient for the constant, *SE* standard error, *Wald* the Wald Chi-square test, *Exp(B)* odds ratio, *CI* confidence interval

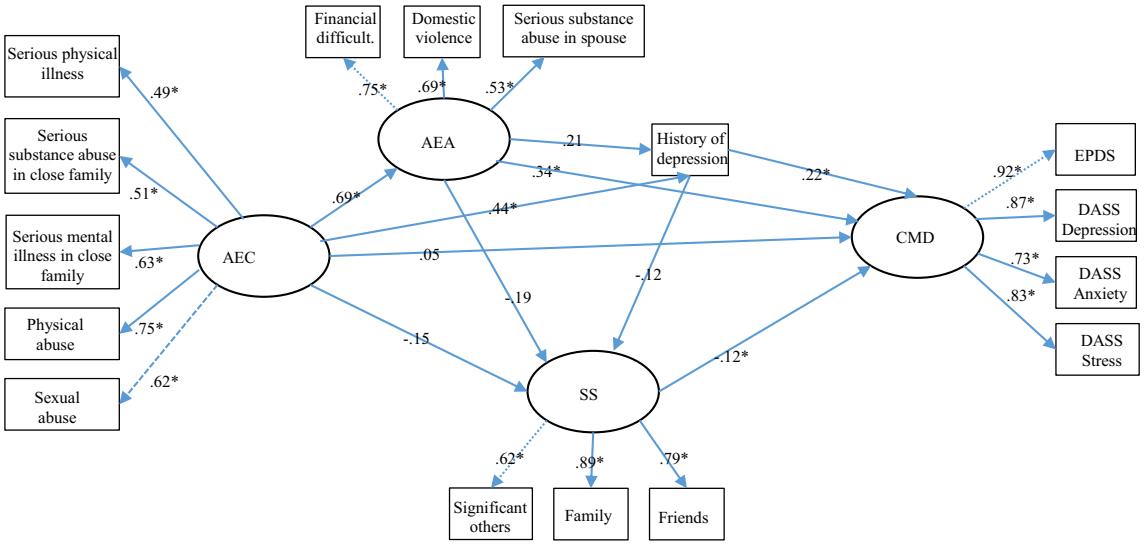


**Fig. 1** Model of the association between adverse experiences in childhood (AEC), adverse experiences in adulthood (AEA), history of depression, social support (SS) and symptoms of common mental disorders (CMD) measure with the EPDS and the DASS subscales

depression. It has long been known that prior history of depression is one of the strongest risk factors for antenatal common mental disorders (Lancaster et al. 2010). The association between adverse life experience in childhood and in adulthood has also been established (Widom et al. 2008), but we are the first to show that adverse life experiences in childhood are not per se a risk factor for antenatal common mental health problems, but rather, as has been established in other studies, a risk factor for mental health problems in general (Kessler et al. 2010) and adverse experiences in adulthood (Cannon et al. 2010).

When analysing the role of social support, we found a significant negative association with symptom severity, indicating that a lack of perceived social support does affect severity of symptoms prenatally. Adverse experiences and prior history of depression did show a negative association with social support, although it did not reach significance and consequently no interactional effects were found.

There are some limitations to our study. Retrospective measures of adverse experiences are susceptible to recall bias, though this may also lead to underreporting of incidents (Hardt and Rutter 2004). In addition, Robertson et al. (2004) pointed out that depressed women may report less social support than they are objectively experiencing.

The study has important clinical implications. We suggest that where healthcare providers aim to identify women at risk for antenatal common mental disorders, they consider history of depression and lack of social support as potential risk factors. As domestic violence is clearly an important risk factor for mental health difficulties, all maternity professionals should be trained to ask about domestic violence and respond safely and non-judgementally as recommended in international guidance (National Institute for Health and Clinical Excellence (NICE) 2014; World Health Organization 2013). This study also suggests that it is important to know about the partner's substance abuse. Therefore, a comprehensive assessment of pregnant women with CMD needs to include sensitive enquiry not only about the woman herself, but also about the partner's health and use of substances including alcohol, drugs and smoking, all of which could also impact on other members of the family in addition to the woman herself. It may further be concluded that although adverse childhood experience is a distal risk factor, pregnancy is not a time of particular susceptibility to common mental health problems as a result solely of adverse life events in childhood.

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**Authors' contributions** Linda Bara Lydsdottir, Halldora Olafsdottir and Jon Fridrik Sigurdsson designed the study and wrote the protocol. Linda Bara Lydsdottir, Hjalti Einarsson and Halldora Olafsdottir contributed in acquisition of data. Linda Bara Lydsdottir, Louise Howard, Jon Fridrik Sigurdsson and Thora Steingrimsdottir contributed to the interpretation of data. Linda Bara Lydsdottir undertook the statistical analysis and wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript. This manuscript has not been published and is not under consideration for publication elsewhere.

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grants had no further role in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the paper for publication. Louise Howard is supported by the National Institute for Health Research South London and Maudsley NHS Foundation Trust specialist Biomedical Research Centre for Mental Health. All other authors declare that they have no conflicts of interest.

## Compliance with ethical standards

**Ethics** Approval for the study was received from the Icelandic National Bioethics Committee (ref. no. 05-107-S1) and the Icelandic Data Protection Authority (ref. no. S2589). When pregnant women attended the antenatal clinics at the beginning of their pregnancy (weeks 12–16), they received information about the study from the midwives, who also invited them to participate. If the women agreed to participate they signed an informed consent. Parental consent was required for women under the age of 18. If the women were in need of psychiatric treatment, they were referred to appropriate treatment at the Mental Health Services at Landspitali–The National University Hospital of Iceland.

**Conflict of interest** The authors declare that they have no conflicts of interest.

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