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ORIGINAL ARTICLE

Postnatal depressive symptoms in women with and without antenatal depressive symptoms: results from a prospective cohort study

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Abstract

Evidence exists that the risk factors for depression in the antenatal and postnatal period may differ, but only a handful of studies looked at depression longitudinally. The aims of this study were (1) to estimate the prevalence of postnatal depressive symptoms in Kuwait where data about postnatal depression are scarce and identify its determinants and (2) to compare these risk factors between women who had experienced antenatal depressive symptoms and those that did not. Data collected in the TRansgenerational Assessment of Children's Environmental Risk (TRACER) Study in Kuwait were used in this analysis. The sample was restricted to the 1348 women who answered the Edinburgh Postnatal Depression Scale (EPDS) both antenatally and postnatally. The prevalence of postnatal depressive symptoms, defined by an EPDS score ≥ 10, was 11.7%. Overall, antenatal depressive symptoms were the strongest determinant of postnatal depressive symptoms. Multivariable logistic regression analysis showed that in women with depressive symptoms in pregnancy, having a lower household income was the most significant risk factor for postnatal depressive symptoms. Among women without antenatal depressive symptoms, those who had lower income, were Kuwaitis, experienced other problems in pregnancy such as perceived stress, PTSD symptoms and social isolation, and those who delivered a boy had higher odds of postnatal depressive symptoms. Antenatal depressive symptoms and other psychosocial characteristics can predict postnatal depressive symptoms. Therefore, maternal mental health issues should be detected during the antenatal period and support should be provided in order to lower the risk of postnatal depression and its sequelae.

Keywords Antenatal depressive symptoms · Postnatal depressive symptoms · Pregnancy · Mental health · Kuwait

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Introduction

Postnatal or postpartum depression is arguably the most common complication of childbearing affecting even up to 60.8% of the mothers in some populations, according to a recent review study (Norhayati et al. 2015). It could occur any time within a year of delivery and it may last anywhere from a few weeks to several months (Stewart et al. 2003). Postnatal depression is a serious problem, and among other things, it affects the health of the child, the health of the mother, including the fact that it increases the mother's risk of chronic or recurrent depression, and the mother-child relationship (Brummelte and Galea 2016).

Several psychosocial factors have been proposed as being associated with higher susceptibility to developing postnatal depression in epidemiologic studies. Evidence suggests that history of depression prior to pregnancy as well as depression in pregnancy (antenatal depression), which is relatively

common, are major risk factors for developing postnatal depression (Leigh and Milgrom 2008; Underwood et al. 2016; Chojenta et al. 2016). Antenatal depression has a prevalence varying from 5 to 30% in developed countries (Pereira et al. 2011). It has been linked with unhealthy activities in the antenatal period and with adverse pregnancy and birth outcomes (Zuckerman et al. 1989; Berle et al. 2005; Rahman et al. 2007; Grote et al. 2010; Fransson et al. 2011; Bindt et al. 2013; Grigoriadis et al. 2013; Hu et al. 2015; Szegda et al. 2016). Epidemiologic studies have identified a range of socio-demographic and pregnancy-related risk factors of antenatal depression. Among others, these include maternal anxiety, life stress, history of depression, lack of social support, unintended pregnancy, lower income, lower education, unemployment, being single, or not having a good relationship with the father, and being a member of an ethnic minority (Da-Silva et al. 1998; Marcus et al. 2003; Lancaster et al. 2010; Shakeel et al. 2015; Vigod et al. 2016).

Prenatal anxiety, stressful life events, and parenting stress were also cited as significant predictors of postnatal depression (O'hara and Swain 1996; Beck 2001; Abdollahi et al. 2014). Moreover, unhealthy relationships of the mother with people in her environment were shown to be associated with developing postnatal depression (Özbaşaran et al. 2011; Siu et al. 2012; Ramasubramaniam et al. 2014; Djoda Adama et al. 2015; Tachibana et al. 2015; Chi et al. 2016).

A number of socio-demographic factors have also been identified to be associated with postnatal depression. Firstly, a variation of postnatal depressive symptoms among women of different ethnicities has been reported (Underwood et al. 2016). Also, women who have a lower family income or financial problems have a greater risk for postnatal depressive symptoms (Djoda Adama et al. 2015; Chi et al. 2016; Jin et al. 2016). Furthermore, postnatal depressive symptoms have been shown to be more common in women with a lower educational background or women who were unemployed (Kheirabadi et al. 2009; Chi et al. 2016; Corrêa et al. 2016). In regard to the role of maternal age, the findings are inconsistent (Kheirabadi et al. 2009; Bener et al. 2012; Khalifa et al. 2016).

Despite the fact that postnatal depression is a major public health issue, it is often overlooked. In many countries, such as Kuwait, mental health issues, including depression, are perceived as a stigma and mental health services are not usually incorporated in the primary health care system but they are often provided by different specialized institutions, something that increases further the fear of social stigma (Almazeedi and Alsuwaidan 2014). We have previously found that antenatal depressive symptoms in this population are common with one in five women experiencing such symptoms in pregnancy (Pampaka et al. 2018). Redshaw and Henderson (2013) further proposed that the risk factors for postnatal depression are different among women who had antenatal depression compared to women who did not, though only a few studies have followed women from pregnancy to the postpartum period to examine and compare the determinants of depression during pregnancy and after pregnancy. The aims of this study are to estimate the prevalence of postnatal depressive symptoms and identify the factors associated with them, using a sample of pregnant women enrolled in the TRansgenerational Assessment of Children's Environmental Risk (TRACER) Study as described in AlSeaidan et al. (2016). In addition, we wanted to explore whether the risk factors associated with postnatal depressive symptoms are in fact different in women who had depressive symptoms during pregnancy compared to those who did not. Identifying the potential determinants of postnatal depressive symptoms and their link with antenatal depressive symptoms is important in designing successful prevention and intervention programs, especially in this area of the world where postnatal depression is usually inadequately addressed.

Methods

Study design and participants

This is a secondary analysis of data collected in TRACER, a prospective birth cohort which received ethical approval from the institutional review boards of the Harvard T.H. Chan School of Public Health and the Dasman Diabetes Institute. A written consent from the woman and her partner was required before enrolment. The participating health centers, which included public hospitals in the six governorates of Kuwait and three private clinics, also gave permission for recruitment. Women were eligible to participate in the study if they were 18 to 45 years old, were fluent in Arabic or English, and had a singleton pregnancy. This study was conducted between May 2012 and August 2015 and is described in more detail in AlSeaidan et al. (2016).

A total of 2478 women were enrolled in this study. For this analysis, the sample was restricted to the 1916 women who completed the antenatal depressive symptom section of the Stress Questionnaire during their second or third trimester. Out of these women, 1798 were followed to delivery and 450 were further excluded because of not having information about postnatal depressive symptoms, thus reducing our sample to 1348 women (Fig. 1). The sample included both Kuwaitis and non-Kuwaitis, who attended both public and private hospitals, reflecting the heterogeneity in the population of Kuwait.

The majority of the women were enrolled in TRACER in the second trimester and were followed until after delivery. A series of questionnaires was administered in this period. The three questionnaires relevant to this study's goals include the Baseline, the Stress, and the Postnatal questionnaires. The Baseline Questionnaire was administered at enrolment, in

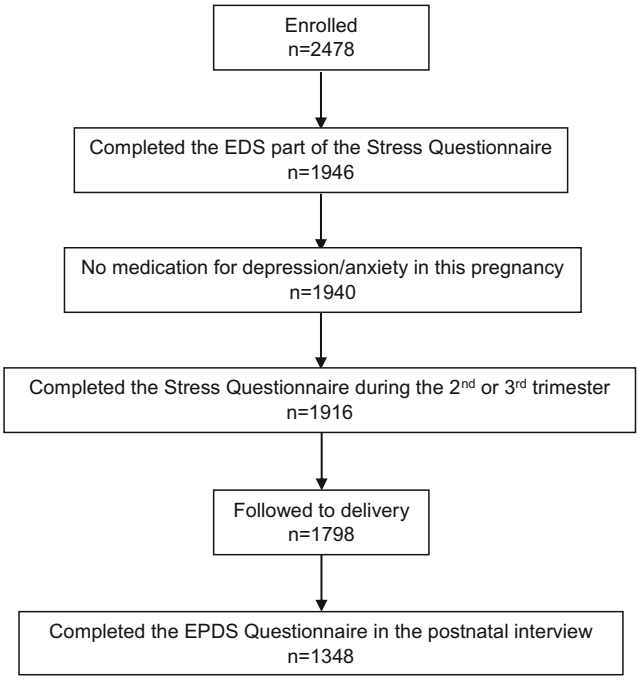

Fig. 1 Flow chart showing the selection of the sample for this analysis

either the second or third trimester, and examined demographic factors and medical history. The Stress Questionnaire was administered at a visit subsequent to enrolment or by a phone interview, and in the sample used in this analysis, this occurred at a mean gestational age of 29.0 ± 6.0 weeks. This questionnaire assessed several mental and physical health indicators before and during pregnancy, including antenatal depressive symptoms (Edinburgh Depression Scale). If a woman was recruited during the third trimester of her pregnancy, the Baseline and Stress questionnaires were both administered at the time of enrolment. A postnatal phone interview was conducted after delivery to obtain information about the birth date and birth weight of the baby. During the same interview, a questionnaire was used to evaluate postnatal depressive symptoms. The majority of women (95%) completed the postnatal phone interview within 15 weeks after delivery.

Measures

Antenatal and postnatal depressive symptoms

The Edinburgh Postnatal Depression Scale (EPDS) was used to assess the presence of depressive symptoms (Cox et al. 1987). The same measure was also used to assess antenatal depressive symptoms and it is referred to as Edinburgh Depression Scale (EDS). This measure has 10 items, each scoring from 0 to 3. There are different cut-off points for depressive symptoms, but since the EDS and EPDS were not validated in this population, we used a cut-off of ≥ 10 to define depressive symptoms in the antenatal and postnatal period. This was recommended by the State Perinatal Mental Health Reference Group of Western Australia (Department of Health, Government of Western Australia 2006) as the cut-off for the Arabic version of the EDS and EPDS, and it has been used in studies of multi-ethnic populations (Nasreen et al. 2010; Shakeel et al. 2015).

Mental health indicators

The Stress Questionnaire included sections that assessed childhood emotional neglect, experience of lifetime traumatic events, pregnancy-related anxiety, perceived stress, post-traumatic stress disorder (PTSD) symptoms, and support from the social network. These constructs were used to create categorical variables to describe the psychosocial profile of the participating women. More information about these constructs is provided in Pampaka et al. (2018).

Other variables

Other variables considered in this analysis included age, nationality, employment status, education level, household income, parity, pre-pregnancy BMI, self-reported history of depression prior to pregnancy, and the sex of the newborn. The self-reported date of the last menstrual period, the date of childbirth, and the birth weight were used to compute small for gestational age (SGA) and large for gestational age (LGA). Small for gestational age was defined as a birth weight less than the 10th percentile for the gestational age according to the World Health Organization birth weight percentiles for gestational week, whereas LGA was defined as a birth weight more than the 90th percentile (World Health Organization 1995, 2000) .

Statistical analysis

We calculated the prevalence of postnatal depressive symptoms with the corresponding 95% confidence intervals. Crude logistic regression models were used to compare the baseline characteristics of women with and without postnatal depressive symptoms and to identify determinants of postnatal depressive symptoms. Hierarchical logistic regression analysis was performed to examine the simultaneous effect of several potential risk factors; first, we included only the socio-demographic characteristics evaluated at baseline; then, we added antenatal depressive symptoms and other mental health indicators; and finally, we added adverse pregnancy outcomes, such as SGA and LGA, and the sex of the baby. In addition, we carried out a stratified analysis to investigate whether the predictors of postnatal depression were different among women who had antenatal depressive symptoms compared to those women who did not. To further examine the association of antenatal and postnatal depressive symptoms,

we utilized the non-parametric Spearman correlation test with EPD and EPDS scores as continuous measures. Analysis was performed using SAS 9.3 (SAS Inc., Cary, NC, USA), and all tests were two-sided with a p value < 0.05 used to determine statistical significance.

Results

Overall

The mean maternal age at recruitment was 29.0 ± 5.1 years. The majority of women in the sample were non-Kuwaitis (74.8%) and more than half (64.7%) had a monthly family income of 800 KWD or less (~ 2770 USD). The EPDS questionnaire was administered at a median time of 6 weeks (IQR: 3–9) postnatally. The median EPDS score was 2 (IQR: 0–6) and the prevalence of postnatal depressive symptoms in the overall sample was 11.7% (95% CI: 10.0–13.5). Among Kuwaitis, the prevalence was 14.1% (95% CI: 10.6–18.3) and in non-Kuwaitis 10.8% (95% CI: 9.0–12.9).

The baseline characteristics of the participants, overall and separately for those with an EPDS score greater than or equal to 10, as well as the unadjusted ORs are presented in Table 1. Having a lower family income and delivering a boy were significant predictors of postnatal depressive symptoms. Among mental health indicators investigated, depressive symptoms in pregnancy have the strongest effect in predicting postnatal depressive symptoms with OR = 7.07 (95% CI: 4.97–10.07), followed by perceived stress, PTSD symptoms, self-reported history of depression prior to pregnancy, pregnancy-related anxiety, social isolation, and experience of lifetime traumatic events (Table 2).

Hierarchical logistic regression models were used to model the probability of having postnatal depression (Table 3). In model 1, depressive symptoms were more common among women who had a household income of < 1600 KWD, had a pre-pregnancy BMI of 25–30 kg/m^2 and those who had self-reported depression prior to pregnancy. On the other hand, non-Kuwaiti and nulliparous women had lower odds of postnatal depressive symptoms compared to Kuwaiti and parous women, respectively. When mental health indicators were added in the model (model 2), antenatal depressive symptoms, PTSD symptoms, and social isolation in pregnancy were significant risk factors for the presence of postnatal depressive symptoms, and nationality and household income remained significant. When model 2 was further adjusted for pregnancy outcomes and the sex of the infant (model 3), delivering a boy was found to be significant but no other changes were observed. Given the results of models 2 and 3, antenatal depressive symptoms are the strongest determinant of postnatal depressive symptoms, followed by social isolation.

Antenatal and postnatal depressive symptoms

The scores obtained from the EDS and the EPDS questionnaires were significantly correlated with a moderate association (Spearman $r = 0.46$, $p < 0.01$). In this sample, 13.2% had antenatal depressive symptoms only, 5.2% had postnatal depressive symptoms only, and 6.5% had experienced both sets of symptoms, while the rest did not have depressive symptoms at all, either antenatally or postnatally.

We evaluated the risk factors of postnatal depressive symptoms separately in women who had antenatal depressive symptoms and those women who did not. We used all the variables examined in model 3 above, i.e., demographic, mental health indicators, and pregnancy outcomes. The significant risk factors for each stratum are demonstrated in Table 4. Among women who had antenatal depressive symptoms, those having a lower household income, i.e., < 400 KWD or 400–800 KWD per month, had higher odds of developing postnatal depressive symptoms, after adjusting for the other covariates. In women without depressive symptoms in pregnancy, household income was also associated with postnatal depressive symptoms while being non-Kuwaiti was protective. Women who had higher levels of perceived stress, PTSD symptoms, and who felt more isolated were at a greater risk of postnatal depressive symptoms. Moreover, in this group, depressive symptoms were more common in women who delivered a boy (OR = 2.92; 95% CI: 1.63–5.26).

Discussion

We found that the prevalence of postnatal depressive symptoms in Kuwait was 11.7%, based on an EPDS score of 10 or greater. This is lower compared to studies conducted in other countries of similar culture in the region of the Gulf; using the same tool and the same cut-off point, the prevalence of postnatal depression in United Arab Emirates was 16.8% (Hamdan and Tamim 2011) while in Qatar, the prevalence using a cut-off of 12 or greater was 17.6% (Burgut et al. 2013). A proposed explanation for the lower prevalence observed is that Kuwait may offer a better quality of life for families and has a lower cost of living compared to the neighboring countries. However, our estimated prevalence is in agreement with rates reported elsewhere such as in a cohort of low medical risk pregnant women in Canada (Davey et al. 2011) as well as with the pooled rate reported in the meta-analysis of O'Hara and Swain (1996). Similar to previous studies, the prevalence of postnatal depressive symptoms was lower than that of antenatal depressive symptoms described in our previous work (Underwood et al. 2016; Pampaka et al. 2018).

The presence of antenatal depressive symptoms was the strongest predictor of postnatal depressive symptoms. This is

Table 1 Baseline characteristics and postnatal depressive symptoms—frequencies and crude ORs

	Overall		EPDS ≥ 10		Crude OR	
	n	%	*N*	%	OR	95%CI
Demographic characteristics						
Age group						
< 25	317	23.5	43	13.6	1.17	0.77–1.77
25–30	514	38.1	61	11.9	1	–
30–35	336	25.0	35	10.4	0.86	0.56–1.34
> 35	181	13.4	18	9.9	0.82	0.47–1.43
Nationality						
Kuwaiti	340	25.2	48	14.1	1	–
Non-Kuwaiti	1008	74.8	109	10.8	0.74	0.51–1.06
Employment status						
Employed	613	45.5	66	10.8	1	–
Housewife	613	45.5	75	12.2	1.16	0.81–1.64
Unemployed	121	9.0	16	13.2	1.26	0.70–2.27
Education						
Up to Middle/secondary	426	31.6	57	13.4	1.27	0.90–1.80
Higher education	921	68.4	100	10.9	1	–
Household Income (KWD)						
< 400	403	30.7	59	14.6	*2.02*	*1.12–3.67*
400–800	447	34.0	45	10.1	1.32	0.72–2.43
800–1600	271	20.7	35	12.9	1.75	0.93–3.30
≥ 1600	192	14.6	15	7.8	1	–
Perinatal characteristics						
Parity						
0	424	31.5	41	9.7	0.75	0.52–1.10
≥ 1	922	68.5	115	12.5	1	–
Pre-pregnancy BMI (kg/m^2)						
< 18.5	31	2.3	4	12.9	1.33	0.45–3.95
18.5–25	570	42.4	57	10.0	1	–
25–30	443	33.0	60	13.5	1.41	0.96–2.07
≥ 30	299	22.3	36	12.0	1.23	0.79–1.92
SGA						
No	1217	93.1	137	11.3	1	–
Yes	90	6.9	12	13.3	1.21	0.64–2.29
LGA						
No	1002	76.7	114	11.4	1	–
Yes	305	23.3	35	11.5	1.01	0.68–1.51
Sex of the baby						
Girl	636	47.2	60	9.4	1	–
Boy	712	52.8	97	13.6	*1.51*	*1.08–2.13*

Results in italics indicate statistical significance at a p value <0.05

consistent with other studies which identified antenatal depressive symptoms as a determinant of postnatal depressive symptoms (Hamdan and Tamim 2011; Koutra et al. 2014). Chojenta et al. (2016) found that women with antenatal depression have an odds of experiencing postnatal depressive symptoms nine times greater than that of women who did not have depression in pregnancy. Hamdan and Tamim (2011) argued that depression during pregnancy may continue to the postnatal period and suggested that screening for depression should be performed both before and after delivery.

Our study is one of the few that examined depressive symptoms in the perinatal period longitudinally. Different risk factors for postnatal depressive symptoms were identified for women with and without depressive symptoms in pregnancy. Other

Table 2 Mental health and postnatal depressive symptoms—frequencies and crude ORs

	Overall		EPDS ≥ 10		Crude OR	
	n	%	*N*	%	OR	95%CI
Risks before pregnancy						
Childhood emotional neglect						
Least neglected (5–7)	559	41.5	69	12.3	1	–
Moderately neglected (8–10)	347	25.7	27	7.8	*0.60*	*0.38–0.96*
Most neglected (11–25)	442	32.8	61	13.8	1.14	0.79–1.65
Traumatic events						
0–1	488	36.2	42	8.6	1	–
2–5	412	30.6	36	8.7	1.02	0.64–1.62
6 or more	448	33.2	79	17.6	*2.27*	*1.53–3.39*
Prior depression						
No	1317	97.9	148	11.2	1	–
Yes	29	2.1	8	27.6	*3.01*	*1.31–6.92*
Pregnancy related						
Antenatal depressive symptoms						
No	1083	80.3	70	6.5	1	–
Yes	265	19.7	87	32.8	*7.07*	*4.97–10.07*
Pregnancy-related anxiety						
No	1165	86.4	113	9.7	1	–
Yes	183	13.6	44	24.0	*2.95*	*1.99–4.36*
Perceived stress levels						
Lower (0–4)	470	35.1	26	5.5	1	–
Moderate (5–7)	519	38.7	55	10.6	*2.02*	*1.25–3.29*
Higher (8–16)	351	26.2	75	21.4	*4.64*	*2.90–7.43*
PTSD symptoms						
No	877	65.1	56	6.4	1	–
Yes	471	34.9	101	21.4	*4.00*	*2.82–5.67*
Coping during pregnancy						
Social network						
Most integrated	108	8.0	10	9.3	1	–
Moderately integrated	224	16.6	23	10.3	1.12	0.51–2.45
Moderately isolated	784	58.2	79	10.1	1.10	0.55–2.19
Most isolated	231	17.2	45	19.5	*2.37*	*1.15–4.91*

Results in italics indicate statistical significance at a p value <0.05

studies found that women who develop postnatal depression have different characteristics compared with women who develop both antenatal and postnatal depression (Redshaw and Henderson 2013; Brummelte and Galea 2016; Underwood et al. 2016). For example, Underwood et al. (2016) found that women with antenatal depression would also develop postnatal depression if they had higher perceived stress and difficult relationship or family environment. In our study, the only significant factors associated with postnatal depressive symptoms among women with antenatal depressive symptoms were the family income, while this was not the case for women with no antenatal depression symptoms. Instead, perceived stress, PTSD symptoms, and lack of social support from the woman's network were predictive of postnatal depressive symptoms. These findings suggest that even if the mother does not have depressive symptoms in pregnancy, she is at a greater risk of developing depressive symptoms postnatally if other features of her mental well-being are poor during the antenatal period. From a public health perspective, these results highlight the importance of mental health screening in pregnancy. Detecting women with a poor psychosocial profile early in pregnancy and supporting them by providing personal psychological support will improve the mental well-being of women not only during pregnancy but also after delivery. Moreover, encouraging women to join antenatal group classes where they can discuss their pregnancy and their fears with specialists but

Table 3 Hierarchical multivariable logistic regression models for the presence of postnatal depressive symptoms

	Model 1[a] ($n = 1308$)		Model 2[b] ($n = 1300$)		Model 3[c] ($n = 1263$)	
	OR	95% CI	OR	95% CI	OR	95% CI
Nationality						
Kuwaiti	1	–	1	–	1	–
Non-Kuwaiti	*0.34*	*0.19–0.59*	*0.46*	*0.25–0.87*	*0.44*	*0.23–0.83*
Household income (KWD)						
< 400	*5.37*	*2.31–12.45*	*3.56*	*1.43–8.84*	*3.56*	*1.41–8.96*
400–800	*3.33*	*1.51–7.34*	*2.51*	*1.06–5.92*	*2.65*	*1.11–6.31*
800–1600	*2.83*	*1.41–5.68*	*2.64*	*1.23–5.65*	*2.59*	*1.21–5.56*
≥ 1600	1	–	1	–	1	–
Parity						
0	*0.63*	*0.41–0.96*	0.68	0.42–1.10	0.68	0.41–1.10
≥ 1	1	–	1	–	1	–
Pre-pregnancy BMI (kg/m^2)						
< 18.5	1.21	0.40–3.71	1.13	0.34–3.78	0.98	0.29–3.33
18.5–25	1	–	1	–	1	–
25–30	*1.51*	*1.01–2.26*	*1.58*	*1.02–2.46*	1.42	0.90–2.24
≥ 30	1.07	0.66–1.75	1.10	0.64–1.88	1.06	0.61–1.84
Prior depression						
No	1	–	1	–	1	–
Yes	*3.17*	*1.33–7.53*	1.24	0.46–3.38	1.20	0.42–3.41
Antenatal depressive symptoms						
No			1	–	1	–
Yes			*4.00*	*2.59–6.18*	*3.83*	*2.46–5.97*
PTSD symptoms						
No			1	–	1	–
Yes			*1.82*	*1.18–2.79*	*2.05*	*1.31–3.18*
Social network						
Most integrated			1	–	1	–
Moderately integrated			1.51	0.62–3.69	1.35	0.52–3.46
Moderately isolated			1.64	0.73–3.69	1.73	0.74–4.01
Most isolated			*2.82*	*1.18–6.72*	*3.07*	*1.24–7.58*
Sex of the baby						
Girl					1	–
Boy					*1.55*	*1.04–2.32*
Hosmer-Lemeshow goodness of fit (p value)	0.21		0.43		0.34	
C-statistic	0.64		0.80		0.81	

Results in italics indicate statistical significance at a p value <0.05

[a] Model 1: adjusted for socio-demographic factors including age, job, and education

[b] Model 2: adjusted for the same factors of model 1 plus health indicators assessed during pregnancy (Stress Questionnaire) including experience of lifetime traumatic events, pregnancy-related anxiety, and childhood emotional neglect

[c] Model 3: adjusted for the same factors as model 2 plus pregnancy outcomes including small and large for gestational age

also with other pregnant women could help them reduce their stress and make them feel less isolated and more confident about childbirth and motherhood. By addressing mental health problems in pregnancy, the risk of postnatal depressive symptoms and their sequelae could be reduced significantly.

An interesting finding in our study was that delivering a boy was associated with having postnatal depressive symptoms, within the group of women who did not have antenatal depressive symptoms. Antenatal depressive symptoms acted as an effect-modifier of this association, as we did not observe

Table 4 Multivariable logistic regression models for postnatal depressive symptoms by antenatal depressive symptoms status

	Antenatal depressive symptoms[a] ($n = 238$)		No antenatal depressive symptoms[a] ($n = 1025$)	
	OR	95% CI	OR	95% CI
Nationality				
Kuwaiti	1	–	1	–
Non-Kuwaiti	*0.52*	*0.19-1.43*	*0.31*	*0.13–0.77*
Household income (KWD)				
< 400	*5.82*	*1.12–30.23*	3.30	0.97–11.19
400–800	*5.48*	*1.10–27.14*	2.13	0.71–6.42
800–1600	3.61	0.84–15.54	*2.75*	*1.09–6.91*
≥ 1600	1	–	1	–
Perceived stress levels				
Lower (score 0–4)	1	–	1	–
Moderate (score 5–7)	0.53	0.16–1.72	*2.00*	*1.01–3.96*
Higher (score 8–16)	0.61	0.21–1.73	*2.49*	*1.14–5.45*
PTSD symptoms				
No	1	–	1	–
Yes	1.50	0.72–3.15	*2.17*	*1.21–3.89*
Social network				
Most integrated	1	–	1	–
Moderately integrated	0.56	0.14–2.32	3.90	0.78–19.60
Moderately isolated	0.77	0.23–2.58	4.49	0.98–20.66
Most isolated	1.64	0.47–5.82	*6.76*	*1.33–34.35*
Sex of the baby				
Girl	1	–	1	–
Boy	0.71	0.38–1.32	*2.92*	*1.63-5.26*

Results in italics indicate statistical significance at a p value <0.05

[a] The models are adjusted for all other variables included in model 3, i.e., age, job, education, parity, BMI before pregnancy, history of depression prior to pregnancy, lifetime traumatic events, childhood emotional neglect, pregnancy-related anxiety, small and large for gestational age

a significant relationship among women who had antenatal depressive symptoms. Studies conducted in Sweden and France also observed that a boy increases the odds of postnatal baby blues and postnatal depression, respectively (De Tychey et al. 2008; Sylvén et al. 2011). Furthermore, Hall and Holden (2008) examined the assessment of cognition, emotion, and situation of postnatal women and found that mothers of infant boys had more negative appraisals. However, the existing evidence in regard to the influence of the sex of the baby on depression is controversial, as other epidemiologic studies showed that postnatal depression is more common among women who deliver a girl due to a cultural bias towards males (Adewuya et al. 2005; Xie et al. 2007; Jain et al. 2014; Hassanein et al. 2014). In some cultures, having a baby girl may create marital conflicts and women may receive less support after birth, which may in turn make women more susceptible to postnatal depression (Adewuya et al. 2005; Xie et al. 2007). Kitamura et al. (2006) and Kheirabadi et al. (2009) argued that it is the dissatisfaction with the sex of the infant that was associated with a higher risk of postnatal depression and not the sex per se. Further research is needed to examine not only the link between the sex of the infant and postnatal depressive symptoms but also of the role of antenatal depressive symptoms as an effect-modifier in this association.

There are some limitations in this work, which merit consideration. Firstly, only 70.1% of the women who answered the EDS antenatally also completed the EPDS postnatally. The women who did not complete the EPDS had not answered the postnatal questionnaire in general, so this loss to follow-up was not for the EPDS section specifically. Considering the role of bias, we compared the 450 who were followed to delivery but did not participate in the postnatal interview with the 1348 women included in this analysis; women who did not answer the EPDS after delivery were younger. Moreover, the percentage of unemployed and nulliparous women was greater among those who did not answer the questionnaire compared to those who did. Despite these differences, the prevalence of antenatal depressive symptoms and other mental health problems did not differ significantly in these two groups, suggesting that women who had depressive symptoms in pregnancy were

equally likely to answer the EPDS questionnaire postnatally. Other limitations include the small number of women who had developed antenatal and postnatal depressive symptoms, which reduces the power of some analyses and the lack of validation of the EPDS in Kuwait. The EPDS has not been validated in Kuwait per se but it has been validated and used in other populations of the region.

Among the strengths of this study are the relatively large sample size and its heterogeneous composition; the sample consisted of both Kuwaitis and non-Kuwaitis in a ratio that reflects the true population in Kuwait. Also, women were recruited from both public and private clinics throughout Kuwait, to further ensure that the sample is representative of the population of women. Moreover, the longitudinal nature of this cohort study and the collection of a relatively extensive list of variables allowed us to examine how the mental well-being of the mother before childbirth affects the prevalence of postnatal depressive symptoms. Future studies with larger sample sizes and longer follow-up are needed. One of the common risk factors for antenatal and postnatal depressive symptoms in our sample was the lower family income; we plan to use mediation analysis in a subsequent analysis to examine whether antenatal depressive symptoms are in the causal pathway of lower family income and postnatal depressive symptoms.

Conclusion

In summary, we found that one in nine women in Kuwait experiences depressive symptoms postnatally. In this sample, depressive symptoms in pregnancy were the strongest predictor of postnatal depressive symptoms. Among women who did not have antenatal depressive symptoms, other psychosocial parameters such as higher perceived stress, PTSD symptoms, and social isolation in pregnancy were found to be associated with the experience of postnatal depressive symptoms. These findings urge the need for screening and detecting maternal health issues during the antenatal period and addressing them effectively, in order to lower the risk not only of antenatal depression but also of postnatal depression and their sequelae.

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Compliance with ethical standards

This is a secondary analysis of data collected in TRACER, a prospective birth cohort which received ethical approval from the institutional review boards of the Harvard T.H. Chan School of Public Health and the Dasman Diabetes Institute. A written consent from the woman and her partner was required before enrolment. The participating health centers, which included public hospitals in the six governorates of Kuwait and three private clinics, also gave permission for recruitment.

Conflicts of interest All the authors wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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