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Effect of psychosocial stress on maternal complications during pregnancy: A cohort study

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Abstract

Aim: To determine the effect of psychosocial stress on maternal complications during pregnancy

Methods: A population based prospective cohort study was carried out in Sri Lanka from May 2001 to April 2002. Pregnant women were recruited on or before 16 weeks of gestation and followed up until delivery. The sample size was 774. The relevant exposure data were collected on average during the 12th and 28th week of gestation. Psychosocial stress was assessed using the Modified Life Events Inventory and the General Health Questionnaire 30 (GHQ 30). Maternal complications were defined as the presence of pregnancy induced hypertension or gestational diabetes or ante partum hemorrhage. Multiple logistic regression was applied and the results were expressed as odds ratios (OR) and 95% confidence intervals (95%CI).

Results: On multiple logistic regression analysis, experience of ≥2 life events during the second trimester [OR 3.0, 95%CI: 1.19, 7.64], GHQ score >5 during the second trimester [OR 3.24, 95%CI: 1.32, 7.93], body mass index >26.0 kg/m^2 [OR 1.25, 95%CI: 1.31, 9.27], pre pregnancy weight >51 kg [OR 1.23, 95%CI: 1.25, 9.33] and educational level up to grade 5 [OR 1.93, 95%CI: 2.0, 23.41] were risk factors for maternal complications during pregnancy.

Conclusions: Psychosocial stress during the second trimester, BMI >26 kg/m^2, pre pregnancy weight >51kg and low educational level were risk factors for maternal complications during pregnancy.

Keywords: cohort study, life change events, pregnancy complications, risk factors, stress, psychological.

Introduction

Some of the maternal complications are pregnancy induced hypertension/preeclampsia, gestational diabetes and antepartum hemorrhage. Reported prevalence of pregnancy induced hypertension was 6% to 8% for the USA [1] while for Asia it was 1.4%.[2] Prevalence of gestational diabetes was 2.5% in Canada [3] and the trend is increasing. [4]

Preeclampsia is a major contributor to maternal and fetal morbidity and mortality. Pregnancy induced hypertension leads to fetal complications such as pre-term births and fetal growth retardation.[5,6] It also leads to maternal morbidities including eclampsia, nephropathy, hepatic changes, HELLP syndrome, disseminated intravascular coagulation and maternal death.[7] Preeclampsia is also related to cardiovascular disease in later life.[8,9] Gestational diabetes mellitus leads to fetal complications including spontaneous abortions, stillbirths, preterm birth, fetal growth retardation, large for gestational age infants and congenital abnormalities.[3,10,11] Gestational diabetes mothers have high risk of developing diabetes in later life compared to non-gestational diabetes mothers. [12]

Identification of risk factors especially the modifiable ones for maternal complications are important for management of maternal complications. Psychosocial stress has been observed to be associated with maternal complications during pregnancy by several researches.[13,14,15] In addition several other risk factors have also been identified, which include smoking, obesity, increasing maternal age, primiparity, multiple pregnancy and previous history of pre-eclampsia.[16] To our knowledge no studies have been conducted in Sri Lanka to assess the influence of psychosocial stress on maternal complications during pregnancy. Hence this study was designed with the objective of studying the effect of psychosocial stress on maternal complications in terms of pregnancy induced hypertension/preeclampsia, and gestational diabetes mellitus.

Materials and Methods

A population based prospective cohort study was carried out in two Medical Officer of Health areas (MOH) of Gampaha District. The duration of the study was from May 2001 to April 2002. All pregnant mothers eligible to participate in the study were recruited on or before 16 weeks of gestation and followed up until delivery. Exclusion criteria were age <15 years, preexisting diabetes mellitus and hypertension and major psychiatric conditions. Details of this study have been published elsewhere.[17]

The study instruments consisted of a questionnaire, which included four main components, namely general information which included socio demographic and pregnancy related data, details on occupation and environmental exposures, Modified Life Events Inventory (MLEI) and General Health Questionnaire (GHQ 30). The first two components of the questionnaire were interviewer administered and the last two

self-administered and assessed the psychosocial status of the pregnant women. The GHQ is widely used to detect short-tem psychological disorders. The cut off for determining caseness was a total score of 6 or more. The GHQ has been translated into ten languages and it has been observed that the validity coefficients were, almost as high as that for the original language. There was no tendency for the GHQ to work less efficiently in developing countries than developed countries. Further gender, age and educational level were shown to have no significant effect on the validity of the GHQ.[18-24] MLEI modified for the purpose of the present study contained a checklist of 28 items of events identified as psychosocial stressors. It has been used by several authors to assess psychosocial stress during pregnancy.[25-27] We defined psychosocial stress as experience of two or more life events during the pregnancy.

Details pertaining to occupation in relation to duration of work, exposure to physical hazards such as heat, noise and radiation and chemicals and the use of personal protective equipment were inquired from those who were in paid jobs. Duration of different postures adopted at home in terms of walking, sitting, standing and sleeping were inquired from all mothers irrespective of whether they were in paid employment or not. The number of hours spent per day in each posture at the work place was inquired from mothers who were employed. In addition, the number of working days was taken into consideration in order to determine the number of hours spent per day in each posture.

All the above components of the questionnaire were administered at the time of recruitment to the study on average 12 weeks of gestation and thereafter the GHQ 30, MLEI and the questionnaire related on occupational and environmental exposures were administered at 28 weeks of gestation on average.

Maternal weight and height, hemoglobin percentage, presence of albumin and sugar in urine and blood pressure were carried out according to a standard protocol.

Maternal complications were defined as the presence of pregnancy induced hypertension or gestational diabetes after 28 weeks of gestation. Pregnancy induced hypertension was defined as an elevation of diastolic blood pressure of 90 mm Hg or more or systolic blood pressure of 140 mmHg or more at least on two consecutive occasions. Gestational diabetes was defined as the presence of diabetes mellitus as confirmed by the Consultant Obstetrician.

Statistical analysis included univariate logistic regression which was carried out to determine the odds ratio (OR) and 95% confidence interval (95%CI) for maternal complications associated with the exposures. Unconditional multivariate logistic regression was carried out to control the confounding factors. All variables which had a probability of <0.25 in the univariate analysis in addition to the variables which have biological plausibility were included in the multivariate model.[28] All variables were coded as 0 and 1. All eligible variables were entered into the model at once and then removed one by one if it was ineligible. Goodness of fit of the model was assessed using Hosmer and Lemeshow test. A two tailed probability of <0.05 was considered as significant.

The Ethics Review Committee of the Faculty of Medicine, University of Kelaniya Sri Lanka, granted ethical approval.

Results

The total number of women who attended the clinics during the period was 942. Forty five were not eligible (4.7%). Twelve were not willing to participate which gave a non-participant rate of 1.3%. Outcome data were not available for additional 51 women. The latter computes a loss to follow up rate of 5.7%. Finally a total of 834 women were available for the study.

The mean age of the women was 27.6 years (SD±5.5) whereas 89% were in the age group of 18 to 34 years. Ninety seven percent (97%) were Sinhalese since the study was carried out in a predominantly Sinhalese area. Seventy one percent (71%) had studied up to General Certificate Examination (Ordinary Level) where as only less than 1% were found to have no schooling at all. Four hundred and eight (46.6%) women were primiparous and 11 (1.5%) were grand multiparous. Three hundred and sixty (42%) had a body mass index (BMI) of <19.8 kg/m^2 and 91 (10.7%) a BMI of >26 kg/m^2. The mean hemoglobin (Hb%) level was 12.2 g/dl (SD±0.92) and 58 women (7%) had a Hb% of less than 11g/dl at the booking visit.

Nine twin and one triplet pregnancies were identified during the follow up and excluded. There were 42 abortions, four stillbirths and four mothers who suffered from heart diseases all of whom were excluded from the analysis. Thus the final sample size left was 774 for the first trimester analysis. Out of these, 32 (4.1%) women were suffering from maternal complications and of them 60% were suffering from pregnancy induced hypertension/preeclampsia. One hundred and eight women were not available for the second trimester interview with a non-response rate of 13.9%, which left 666 women for the analysis. Out of these, 30 (4.3%) were suffering from maternal complications.

Of the socio-demographic and maternal variables, low maternal educational level pre pregnancy weight of >51 kg and a BMI of >26.0 kg/m^2 had a statistically significant association with maternal complications (Table 1). With regard to the different postures adopted none had a significant association with maternal complications (Tables 2 and 3). Experience of ≥2 life events during the second trimester had a statistically significant association (<0.05) with maternal complications (Table 3) whereas the experience of the same in the first trimester was only marginally significant (0.07) (Tables 2). GHQ score >5 during second trimester also a statistically significant association with maternal complications (Tables 3). Neither of the other exposure variables considered were found to be associated significantly with maternal complications (Tables 1, 2, and 3).

For the multivariate analysis, 652 women were included in the final model. Hosmer and Lemeshow test for goodness of fit was observed to be satisfactory (p value=0.75). Number of events per variable was 5.6. Interactions were tested and it was not

statistically significant. There was no collinearity between variables. It showed that experience of ≥2 life events during second trimester was a risk factor for maternal complications [OR 3.0; 95%CI: 1.19, 7.64] adjusted for education, weight, BMI and GHQ 30. GHQ score of >5 during the second trimester was a risk factor for maternal complications [OR 3.24; 95%CI: 1.32, 7.93] adjusted for education, weight, BMI and life events. In addition BMI >26 kg/ m^2, pre pregnancy weight >51kg and low educational level were observed to be risk factors (Table 4).

Discussion

According to the findings of the study, psychosocial stress during second trimester, BMI >26 kg/m^2 pre pregnancy weight >51 kg and low educational level were risk factors for maternal complications.

The study results in terms of psychosocial stress are consistent with the results of three case control studies[13,15,29] and one cohort study[14]. Case control study conducted by Anorlu[29] reported that a stressful home environment [OR 1.97; 95% CI: 1.27, 3.69] as well as stressful work during pregnancy [OR 4.63; 95%CI: 2.65, 8.15] had an association with preeclamsia when adjusted for age, parity, educational status, occupation, family history of hypertension and weight. The second case control study conducted by Klonoff-Cohen[13] revealed a three-fold [95%CI: 1.2, 7.8] increase in risk for preeclampsia for women employed in high stress jobs and a two fold increase in risk [95%CI: 1.0, 4.3] for low stress jobs compared with non-working women after adjusting for confounding factors. The third case control study[15] had assessed the risk of preeclampsia and gestational hypertension among those who had been exposed to high job strain during the first 20 weeks of pregnancy. Women exposed to high job strain were observed to be more likely to develop preeclampsia [adjusted OR 2.1, 95%CI: 1.1, 4.1] than those exposed to low job strain. Even though high job strain increased the risk of gestational hypertension [adjusted OR 1.3, 95%CI: 0.8, 2.2] the results were not statistically significant.[15] A prospective cohort study conducted by Landsbergis[14] showed that gestational hypertension was associated with low decision latitude [standardized OR 2.4, 95%CI: 1.1, 5.2] and low job complexity [standardized OR 2.1, 95%CI: 1.0, 4.6] among women with lower status jobs. There was no association between gestational hypertension and higher status jobs [standardized OR 3.6, 95%CI: 0.9, 15.1]. Although these studies assessed occupational stress, they had not considered the stress related to the home environment. Neither of these studies had considered trimester specific effect of psychosocial stress on preeclampsia. An attempt has been made by Luke[30] to determine the association between factors at home and work with antenatal morbidity among employed pregnant women. The risk of antenatal morbidity was at its highest [adjusted OR 2.45, 95%CI: 1.32, 4.57] during the second trimester which may be attributed to the increased stress levels as observed in the same trimester.

Above mentioned studies[14,15,29,30] were in relation to different aspects of occupational stress and one limitation in the present study was non assessment of occupational

stress in depth. Therefore the fact that psychological stress/distress has a strong association with maternal complications warrant further research in relation to occupation related stress. We adopted the original MLEI by translating it into the Sinhala language after excluding irrelevant events in the context of local culture. However, there may be other aspects specific to the indigenous situation, which could impose an impact on psychosocial stress, which we have failed to include. This was considered as another limitation of this study.

Physiological stress has a role in the development of gestational diabetes and it may be possible that psychological distress too has a contribution of its own. However, since all the maternal complications were pooled together in the present study, commenting on individual conditions was not possible and also not appropriate. Each individual maternal complication considered by itself covers a vast area and further research is required before one could come to conclusions on this regard.

It was evident from the present study that paid employment and shift work and environmental exposures during first or second trimester had no association with maternal complications. Our findings are consistent with that of a historical cohort study[31] which reported that employment status of the women had no association with preeclampsia. However there are inconsistencies with regard to the results reported in three other studies. One study which was a retrospective cohort[2], which reported that working women had a two-fold risk of developing preeclampsia [95%CI: 1.4, 2.4]. The second one which was a case control study[13] too reported a two fold increase in risk of developing preeclampsia among working women [95%CI: 1.2, 4.6] compared with non-working women. The third one[32] showed that women working in retail occupations had a high risk of developing preeclapmsia/eclampsia than other working mothers.

In the present study no association was observed between any of the trimester specific posture variables. However one study[33] reported that women with higher energy expenditure had significantly higher incidence of pregnancy induced hypertension but not gestational diabetes. Luke[30] had also reported that antenatal morbidity was increased by fatigue [OR 3.77, 95% CI: 1.98, 7.18] and work plus home score [OR 1.55, 95% CI: 1.22, 1.97] after being adjusted for potential confounders.

The present study found that women with a pre pregnancy BMI of >26 kg/m^2 were observed to have a 3.5 risk of developing maternal complications after being adjusted for psychosocial stress, pre-pregnancy weight and low educational level. Our findings are consistent with the findings of two other studies[2,34] which showed that a BMI of >24.2 kg/m^2 and >22.2 kg/m^2 had a high risk of developing preeclampsia. The present study also showed that women with pre pregnancy weight of >51kg were 3.4 times at a higher risk of developing maternal complications after adjusting for psychosocial stress, BMI of >26 kg/m^2 and low educational level. Our findings are consistent with three other studies.[32,34,35] These studies showed that weight of >55kg,[32] >56kg[34] and >79kg[35] had a higher risk of developing preeclampsia after being controlled for the potential confounders.

Our study also showed that low educational status had a 6.8 times risk of developing maternal complications after having controlled for psychosocial stress, BMI and pre pregnancy weight. Our findings were consistent with the findings of two other studies,[31,32] whereas another two studies[2,29] had shown no evidence of low educational status being a risk factor for pre-eclampsia.

Although according to our findings women's age had an association with maternal complications in the univariate analysis, it became non significant after controlling for confounding factors. Our results were consistent with two studies[29,32] which showed that age was not a risk factor for preeclampsia. However two other studies[2,31] had shown that increasing maternal age was a risk factor for preeclampsia.

Parity was also not observed to be associated with maternal complications. In contrast to our finding, nulliparity have been shown to be a risk factor for preeclampsia in four other studies.[2,29,32,35]

Prevalence of cigarette smoking is very rare among Sri Lankan women. All women in the study sample were non smokers. Nevertheless, they are likely to be exposed to passive cigarette smoke either at home or the work place. The present study failed to show an association with preeclampsia and exposure to passive smoking either at home or workplace. There is inconsistency with regard to active smoking being a risk factor for preeclampsia where one study[32] had failed to show any association and two other studies [33,35] had shown a reduced risk of preeclampsia among smoking mothers.

Other known risk factors for preeclampsia were chronic hypertension and multiple pregnancy.[2,16,29,31] Existing hypertension and multiple pregnancies were excluded from the present study thereby removing any potential confounding effect of those factors on maternal complications.

This was a population based prospective cohort study where 744 pregnant women were included in the first trimester and followed up until the delivery. Loss to follow up is an inherent limitation of this study design and all possible steps have been taken during implementation of the study to reduce the loss to follow up rate. Despite above, the main advantage of this study design is the ability to determine the temporal association of the exposure status to the outcome.

Two maternal complications were considered as one outcome in this study, which is not the ideal as the etiological factors of these conditions might not be the same. However, in the present study pregnancy induced hypertension/preeclampsia represented 60% of all the maternal complications. Luke had also assessed the factors associated with maternal morbidity in terms of gestational diabetes, preeclampsia, birthweight, preterm birth and cesarean birth among employed pregnant women.[30] In the present study determination of maternal complications was based on the diagnosis made by the obstetricians. The ideal should be to have much more refined standardized techniques of diagnosis independent of the diagnosis made by the obstetricians. Even though the common definition of preeclampsia is based on the

presence of hypertension and protein urea, there is no consistency in the definitions described in the literature.[37]

In conclusion, psychosocial stress during second trimester was a risk factor for developing maternal complications. Further, BMI of >26 kg/m^2, a pre pregnancy weight of >51 kg and low educational status were risk factors. It is recommended that these variables be considered as high risk conditions which would enable to screen for those likely to develop maternal complications during pregnancy. Age, employment, physical activity or exposure to passive smoking had no association with maternal complications during pregnancy.

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Table 1: Unadjusted odds ratios for maternal complications by selected socio demographic and maternal variables

Exposure variable	MC Yes n[%]	MC No n[%]	OR	95% CI	P value
Maternal age >35 years	5[16]	46[6]	2.78	[1.02, 7.57]	0.04
Education ≤5grade	6[18.7]	32[43]	5.12	[1.96, 13.3]	<0.001
Maternal height ≤153cm	15[47]	373[51]	0.85	[0.41, 1.73]	0.65
Pre pregnancy weight >51kg	24[75]	276[37]	4.98	[2.20, 11.3]	<0.001
BMI >26.0 kg/m^2	13[41]	63[8]	7.22	[3.4, 15.3]	<0.001
Primipara	15[47]	344[46]	1.02	[0.50, 2.07]	0.95
Past history of LBW	3[9]	58[7.8]	1.22	[0.36, 4.12]	0.74
Haemoglobin <12g/dl	7[22]	246[35]	0.55	[0.23, 1.31]	0.18

MC: Maternal Complications, IPI: inter pregnancy interval, OR: Odds Ratio, 95% CI: 95% Confidence Interval

Table 2: Unadjusted odds ratios for maternal complications by first trimester exposures

Exposure variable	MC Yes n[%]	MC No n[%]	OR	95% CI	P value
Paid job: Yes	5[16]	178[24]	0.58	[0.22, 1.54]	0.28
Standing >2.5 hours/day	5[16]	216[29]	0.45	[0.17-1.18]	0.10
Walking >2.5 hours/day	11[34]	233[31]	1.14	[0.54, 2.40]	0.72
Standing and Walking ≥4 hours/ day	18[56]	461[62]	0.78	[0.38, 1.59]	0.49
Sitting <3.5 hours /day	9[28]	276[37]	0.65	[0.30, 1.44]	0.29
Sleeping ≤8 hours / day	14[44]	253[34]	1.53	[0.73, 3.07]	0.26
Shift work and occupational exposures	2[6]	74[10]	0.60	[0.14, 2.56]	0.49
GHQ Score >5	14[44]	263[35]	1.41	[0.69, 2.88]	0.34
MLEI Score ≥2	10[31]	137[18]	1.99	[0.92, 4.31]	0.07
Per capita monthly income ≤Rs. 1500	8[25]	187[25]	0.98	[0.43, 2.23]	0.97
Passive smoking: Yes	10[31]	149[20]	1.80	[0.83, 3.90]	0.13
Alcohol consumption: Yes	2[6]	22[3]	2.17	[0.49, 9.69]	0.30

MC: Maternal Complications, OR: Odds Ratio, 95% CI: 95% Confidence Interval

Table 3: Unadjusted odds ratios for maternal complications by second trimester exposures

Exposure variable	MC		OR	95% CI	P value
	Yes n[%]	No n[%]			
Paid job: Yes	2[6.8]	99[15]	0.40	[0.09, 1.72]	0.22
Standing >2.5 hours/day	3[10]	156[24]	0.35	[0.10-1.19]	0.09
Walking >2.5 hours/day	11[38]	208[32]	1.26	[0.58, 2.71]	0.55
Standing and Walking ≥4 hours/day	19[65]	429[67]	0.92	[0.42, 2.00]	0.83
Sitting <3.5 hours/day	15[52]	375[58]	1.53	[0.72, 3.23]	0.26
Sleeping ≤8 hours/day	9[31]	206[32]	0.94	[0.42, 2.11]	0.89
Shift work and occupational exposures	1[3]	31[4.8]	0.65	[0.08, 4.95]	0.68
GHQ Score >5	10[34]	111[17]	2.59	[1.16, 5.77]	0.01
MLEI Score ≥2	9[31]	84[13]	2.94	[1.29, 6.67]	0.01
Per capita monthly income ≤Rs. 1500	8[27]	139[21]	1.37	[0.59, 3.16]	0.46
Passive smoking: Yes	4[14]	74[11]	1.21	[0.41, 3.60]	0.72
Alcohol consumption: Yes	2[6.8]	14[2]	3.30	[0.71, 15.3]	0.12

MC: Maternal Complications, OR: Odds Ratio, 95% CI: 95% Confidence Interval

Table 4: Adjusted odds ratios for maternal complications during pregnancy by exposure variables

Exposure variable	β	SE	OR	95%CI	P value
Experience of ≥2 life events during 2nd trimester	1.10	0.47	3.0	[1.19, 7.64]	0.02
GHQ Score >5 during 2nd trimester	1.17	0.46	3.24	[1.32, 7.93]	0.01
BMI >26.0 kg/m^2	1.25	0.50	3.48	[1.31, 9.27]	0.01
Pre pregnancy weight >51kg	1.23	0.51	3.42	[1.25, 9.33]	0.02
Education ≤5grade	1.93	0.62	6.87	[2.0, 23.4]	0.002

β: Regression coefficient, SE: Standard Error, OR: Odds Ratio, 95% CI, 95% Confidence Interval