

Effects of Pregnancy-Induced Psychological and Emotional Factors on the Occurrence of Preeclampsia/Eclampsia (PE-E) and Haemorrhage

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Abstract

Preeclampsia/eclampsia (PE-E) and haemorrhage are the topmost causes of maternal and perinatal deaths the world over. This study assessed the effects of pregnancy-induced psychological and emotional factors on the occurrence of PE-E and haemorrhage. The study was a prospective cohort involving all pregnant women >28 weeks of gestation reporting for antenatal care (ANC) in seven Hospitals in the Eastern Region of Ghana. The study redesigned the Revised Cognitive Therapy Scale (CTS-R) to suit this study using a five-point score scale. The results show that the predictor variables; fear, anger, sadness, disgust, love, hate, tension, anxiety, depression, and dejection, were all statistically significant and associated with PE-E and haemorrhage except joy, acceptance, and happiness. Pregnant women who experienced high (2) and highest (4) levels of fear had reduced odds of PE-E by 34% and 15.8%, respectively. Those who recorded low levels of love were 9.8 times the odds of PE-E, those with low (1), high (2), higher (3), and highest (4) levels of anxiety had reduced odds of PE-E by 22.2%, 37.3%, 21.3%, and 10% respectively. Pregnant women with low levels of psychological and emotional issues were about 3 times the odds of PE-E compared to those who were normal. In conclusion, the study shows a significant association between preeclamptic/eclamptic pregnant women and different levels of fear, anger, sadness, Love, hate, depression, dejection, anxiety, and tension. It is recommended that Ghana Health Service should institute case specific psychological and emotional counselling as part of ANC services to manage needy cases to avert the effects on pregnancy and birth outcome.

Keywords: *Eclampsia, Emotional effect, Ghana, Haemorrhage, Pregnancy, Preeclampsia, Psychological effect.*

Introduction

Globally, an estimated 295,650 pregnant women died from pregnancy and childbirth-related complications in 2017 [1]. In 2017, an average of 810 pregnant women died every day, with about 94% occurring in low- and middle-

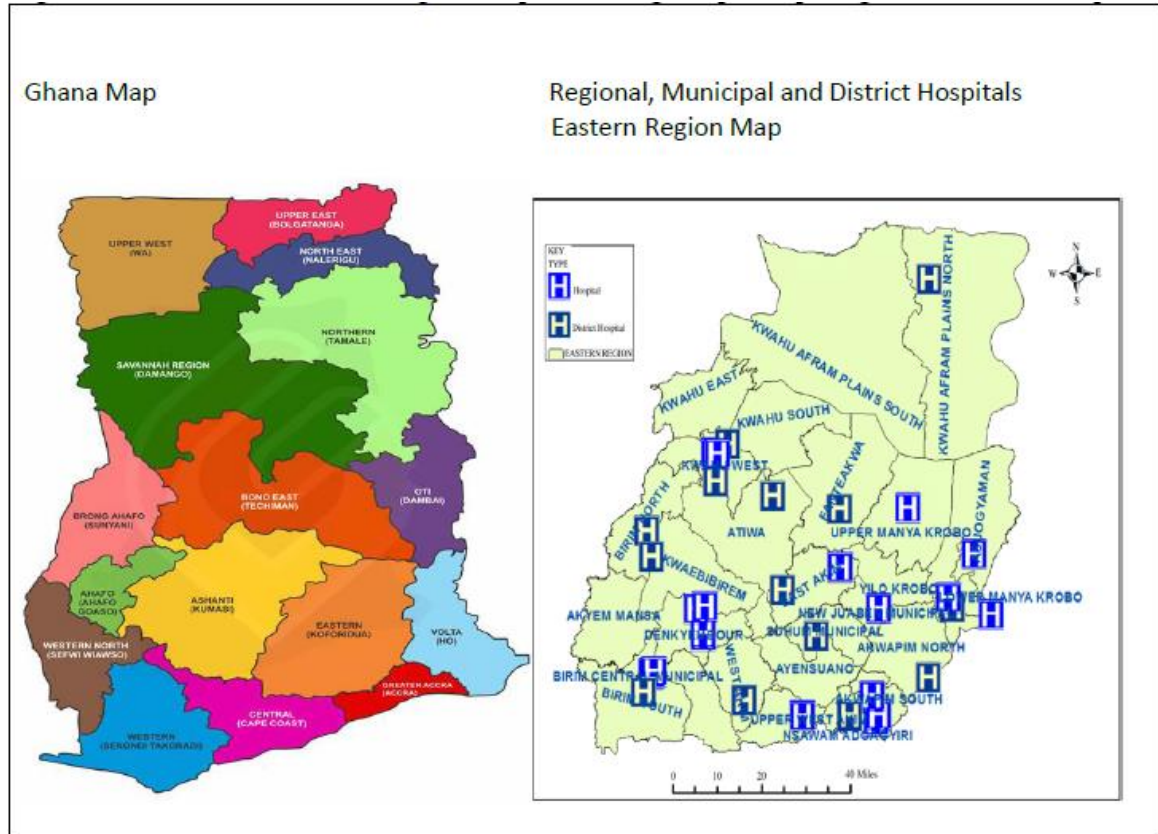
income countries [1]. Haemorrhage, and hypertensive diseases, including PE-E are attributable to over half of all maternal mortalities globally in 2018 [2]. Preeclampsia [PE] has a unique impact on neonatal and maternal health, currently as one of the topmost causes of maternal and perinatal deaths in the

world [2-3]. The cause of PE is still not clearly known, but it is linked to instability in placentation during the first trimester of pregnancy, in addition to widespread inflammation and gradual endothelial damage [2]. The psychological and emotional stress in pregnancy is important because of the effects on placental, fetal, and overall child growth and development [4]. Evidence shows that the development of PE-E and haemorrhage are occasioned by different lifestyles, including environmental, emotional, socio-economic, and dietary risk factors [4]. It is also particularly important to note that the circumstances causing the development of PE-E and haemorrhage are country-dependent [4]. Findings explain that inadequate dietary habits in addition to other socio-economic indicators, predispose the individual pregnant woman to the development of preeclampsia (PE) [4]. This indicates that PE has various risk factors across the divide, and the approaches to remedy the situation must be innovative and specific [5]. Additional interventions towards improving maternal health will require evidence in socio-economic, emotional, epidemiological, and psychological to reduce maternal morbidity and mortality [6]. Haemorrhage, and eclampsia were among the direct, contributory factors to maternal deaths [7-8]. Studies have identified other contributory factors to the causes of maternal morbidities [9-10], and most of these maternal morbidities are associated with low socio-economic status coupled with other determining factors [11]. Several studies on interventions to reduce maternal mortality have been conducted in Ghana [12-14]. However, none has endeavoured to identify the psychological and emotional factors contributing to the development of PE-E and haemorrhage among pregnant women [15].

This study was designed to determine the association between psychological and emotional factors to the development of PE-E and haemorrhage in the Eastern Region of Ghana.

Methods

The Eastern Region is one of the 16 administrative regions of Ghana with an estimated population of 2.9 million [15]. The region shares common boundaries with the Greater Accra, Central, Ashanti, Brong Ahafo, Oti, and Volta Regions of the country. With a growth rate of 2.1%, the population is estimated to increase to 4.5 million by 2040. Presently, 49.2% of the population are males, while females represent 50.8%. The age structure of the region indicates that the proportion of the population aged 0 - 14 (under 15 years) is 38.4%, while those aged 15 - 64 and 65+ are 55.9% and 5.7%, respectively. The region occupies a total landmass of approximately 19,323 sq. km, which makes it the sixth-largest region of the country in terms of land size. It has a population density of 136.3 people per sq. km and is 43.4% urban with an annual urban growth rate of 3.7% [16]. Regarding the economy, the labour force participation rate for the population aged 15- 64 is almost 74.2%. The study was conducted in New Juaben South Municipality at the Eastern Regional Hospital, Koforidua, Nsawam Adoagyiri Municipality (Nsawam Government Hospital), Birim Central Municipality (Oda Government Hospital), Akwapim North District (Tetteh Quarshie Memorial Hospital at Mampong), Suhum Municipality (Suhum Government Hospital), Denkyemboor District (St. Dominic Hospital), and Asamankese Government Hospital at West Akim Municipality.



Source: Ghana Statistical Service, 2022

Figure 1. Map of Eastern Region showing the Participating Districts and Hospitals, Ghana

Study Design

We conducted a prospective cohort study involving all third trimester (≥ 28 weeks of gestation) pregnant women reporting for ANC in seven Hospitals in the Eastern Region of Ghana. We adopted the existing CTS-R [17] and theories of Basic Emotions [18] and redesigned it to suit this study using a five-point score scale ranging from 0 (lowest) to 4 (highest). We applied the scale in assessing the level of fear, anger, joy, sadness, acceptance, disgust, happiness, love, hate, tension, anxiety, depression, and dejection experienced by pregnant women and the association with the occurrence of PE-E and haemorrhage. The rating of the predictor variables was done once, and the pregnant women followed up until delivery. The predictor variables were translated into Twi, the main local language of the study area for easy understanding. Respondents who could understand English well were taken through the

questionnaire in English with simplified definitions adopted from [18].

Sampling

A simple random selection of seven Government Hospitals out of 17 was conducted in the Eastern Region. This was done by writing the names of all the Hospitals in the Region on pieces of paper and then mixed evenly, and seven selected randomly out of the seventeen. In the participating Hospitals, a numbered list of ANC attendants with gestational ages > 28 weeks from each Hospital was obtained from the ANC registers. The numbered list was captured on pieces of paper and dropped into a container, and properly mixed manually. Then, chits were randomly picked out of the container until the sample size was reached.

Recruitment of Research Assistants

The study recruited and trained 4 Midwives from each of the seven hospitals, 2 Public Health

Officers, 2 Nutrition Officers, and 2 Dieticians from the selected Hospitals` ANC clinics as research assistants. The research assistants reviewed the ANC registers to identify pregnant women who met the inclusion criteria of at least 28 weeks gestation. Qualified pregnant women were contacted, recruited and followed up monthly and bi-weekly until they delivered.

Recruitment of Study Participants

Study participants were recruited using the ANC register as the reference point and followed-up at every ANC visit for a maximum period of thirteen weeks until they delivered, and the outcomes of interest (records of PE-E and haemorrhage) were extracted from the medical records and through telephone calls when necessary.

Variables of Interest and Measurement

The variables of interest for measurement were coded as follows; 0 = None, 1= Low, 2= high, 3= higher, and 4= Highest. Respondents were asked through interviewer-administered questionnaire to rate their psychological and emotional risks as likely predisposing factors to PE-E and hemorrhage. The variables were measured at the point of contact and used to examine their risks in the range of 0 to 4 in

association with the occurrence of the variables of interest.

Pilot Test

We piloted (pretested) the data collection tool among pregnant women at a community hospital in the Birim Central Municipality of Ghana. This was done to validate and fine-tune the data collection tool to ensure the reliability of the data before its use.

Sample Size Determination

The sample size was calculated using established formulae [19]. This was done based on the prevalence of preeclampsia in the region. $N = Z^2 * P (1 - P) / d^2$, where N = sample size, Z = score for 95% Confidence Interval (1.96), P=The regional prevalence of preeclampsia was 32.9% $q=1-p$ (proportion of people without preeclampsia), d = Margin of error set at 5%, N = 339.

Using a loss to follow-up rate of 30% [20], and a non-response rate of 10% [21-23], the total sample size reached was 475. The estimated sample size was proportionately assigned to the seven selected hospitals within the Eastern Region of Ghana (Table 1). However, this study recorded a loss to follow-up rate of 6.3%, leaving only 445 respondents to work with.

Table 1. Participating Districts and their Estimated Sample Sizes

Municipality/District	Expected Pregnancy	Estimation of Sample size	Sample Size
Birim Central	3632	3632 x 475 33155	52
New Juaben South	6275	6275 x 475 33155	90
West Akim	5454	5454 x 475 33155	78
Akwapim North	4891	4891 x 475 33155	70
Nsawam Adoagyiri	4389	4389 x 475 33155	63
Suhum	4523	4523 x 475 33155	65
Denkyemhour	3991	3991 x 475 33155	57
Total	33155		475

Analysis

We entered the data into EPI Data software and transported it into IBM SPSS version 20 for editing and re-categorization. Thereafter, we transported the data into Stata Version 13.0 for the final analysis. We generated descriptive statistics in the form of frequencies and percentages. Pearson chi-square was conducted to determine the association between the outcome variables and the predictor variables. To determine the strength of association between

the outcome variables and the predictor variables, logistic regression was computed for each predictor variable against the outcomes. Afterward, we adjusted for extraneous variables that might cause the associations generated between the predictors and the outcomes. Multinomial logistic regression was finally conducted to determine the associations between the predictors and outcomes. We concluded and presented the results in frequencies, percentages, and odds ratios at 95% CI with P-value<5%.

Results

Table 2. Demographic Characteristics of Respondents

Characteristics	Freq.	Percent	P-value
Age			
10-19	19	4.3	0.564
20-29	211	47.5	
30-39	199	44.8	
40+	15	3.4	
Ethnicity			
Ewe	63	14.2	0.093
Asante	49	11.0	
Akyem	78	17.5	
Akuapem	101	22.7	
Krobo	28	6.3	
Others	126	28.3	
Educational Level			
Primary	133	29.9	0.066
Secondary/O`Level	195	43.8	
Tertiary	96	21.6	
No Formal Edu.	21	4.7	
Marital Status			
Married	304	68.3	0.375
Unmarried	139	31.2	
Separated/Divorced	2	0.5	
Religion			
Christian	392	88.1	0.046
Muslim	52	11.7	
Traditionalist	1	0.2	
Abortion			
No	330	74.3	0.951
Yes	114	25.7	
Miscarriage			

No	351	78.9	0.549
Yes	94	21.1	
Early Pregnancy (<15yrs)			
No	424	95.3	0.915
Yes	20	4.5	
Gestational Age			
28-32	159	36.6	0.407
33-37	201	46.3	
38-42	74	17.1	
Parity			
0-4	431	96.9	0.498
5-9	14	3.2	

From the socio-demographic characteristics in Table 2, 68.3% of respondents aged between 20-29 years were married and 43.8% had completed Secondary school level of formal education, and 22.7% belonged to the Akuapem ethnic group. The majority (88.1%) of the

respondents were Christians. The results show that 25.7% of the respondents had history of abortions, and miscarriages (21.1%). Also, 36.6% of the pregnant women were 28 to 32 weeks gestation, 46.3% from 33 to 37 weeks gestation.

Table 3. Distribution of Respondents Psychological and Emotional Predictor Variables and their Grades

Variable (Grade)	Frequency	Percent	P-value	Variable (Grade)	Frequency	Percent	P-value
Fear				Disgust			
No (0)	42	9.4	<0.000	No (0)	57	12.8	<0.000
Low (1)	35	7.9					
High (2)	110	24.7					
Higher (3)	81	18.2					
Highest (4)	177	39.8					
Anger				Happiness			
No (0)	43	9.7	0.065	No (0)	14	3.2	0.108
Low (1)	97	21.8					
High (2)	103	23.2					
Higher (3)	85	19.1					
Highest (4)	117	26.3					
Joy				Love			
No (0)	10	2.3	0.975	No (0)	27	6.1	0.123
Low (1)	13	2.9					
High (2)	54	12.1					
Higher (3)	99	22.3					
Highest (4)	269	60.4					
Sadness				Hate			
No (0)	46	10.3	0.003	No (0)	30	6.7	<0.000
Low (1)	49	11					
High (2)	90	20.2					

Higher (3)	89	20		Higher (3)	90	20.2	
Highest (4)	171	38.4		Highest (4)	209	46.9	
Acceptance				Tension			
No (0)	36	8.1	0.504	No (0)	41	9.21	<0.000
Low (1)	31	6.9		Low (1)	51	11.5	
High (2)	57	12.8		High (2)	83	18.7	
Higher (3)	105	23.6		Higher (3)	85	19.1	
Highest (4)	216	48.5		Highest (4)	185	41.6	
Depression				Anxiety			
No (0)	26	5.8	<0.000	No (0)	51	11.5	<0.000
Low (1)	27	6.1		Low (1)	52	11.7	
High (2)	63	14.2		High (2)	82	18.4	
Higher (3)	95	21.4		Higher (3)	77	17.3	
Highest (4)	234	52.6		Highest (4)	183	41.1	
Dejection				-	-	-	-
No (0)	15	3.4	<0.000	-	-	-	-
Low (1)	12	2.7		-	-	-	-
High (2)	44	9.9		-	-	-	-
Higher (3)	88	19.8		-	-	-	-
Highest (4)	286	64.3		-	-	-	-

Table 3 presents the distribution of respondents psychological and emotional variables above are graded from 0 to 4. The Table shows that, 39.8% of the respondents had the highest level of fear, 24.7% had a high level of fear, and 9.4% had no fears. In terms of anger, 26.3% had the highest level of anger, 19.1% higher level, while 9.7% had no anger. The majority (60.5%) of them experience the highest level of joy while 38.4% recorded highest level of sadness. About 49.0% reported having

experienced the highest level of acceptance while close to 42.0% experienced the highest level of disgust. The majority had experienced the highest level of happiness (64.5%), love (58.2%), hate (46.9%), tension (41.6%), anxiety (41.1%), depression (52.6%), and dejection (64.3%). Summarily, all the highest-level categories had the most responses ranging from 38.7% as the highest for fear to 64.3% for dejection, while the “no” grade had the least score (0).

Table 4A. Logistic Regression showing the Association between PE-E and the Predictor Variables

Preeclampsia/Eclampsia	COR	P-value	[95% CI	aOR	P-value	95% CI
Fear	Reference=0					
1	0.593	0.313	0.214-1.638	0.545	0.283	0.179-1.652
2	0.340	0.011	0.148-0.782	0.319	0.015	0.128-0.798
3	0.492	0.099	0.212-1.144	0.475	0.108	0.192-1.178
4	0.159	<0.000	0.067-0.373	0.141	<0.000	0.056-0.352
Anger	Reference=0					
1	0.803	0.633	0.326-1.979	0.649	0.374	0.251-1.682
2	0.854	0.728	0.352-2.076	0.782	0.602	0.309-1.974
3	0.745	0.536	0.293-1.891	0.647	0.378	0.246-1.704
4	0.277	0.014	0.099-0.775	0.214	0.005	0.074-0.623

Joy	Reference=0					
1	1.636	0.706	0.127-21.104	1.598	0.723	0.119-21.372
2	1.340	0.795	0.147-12.259	1.364	0.787	0.144-12.874
3	1.735	0.613	0.205-14.660	1.751	0.612	0.201-15.228
4	1.618	0.652	0.199-13.118	1.436	0.738	0.172-11.967
Sadness	Reference=0					
1	0.553	0.247	0.203-1.549	0.449	0.140	0.156-1.301
2	0.862	0.723	0.379-1.957	0.841	0.691	0.357-1.979
3	0.442	0.074	0.180-1.082	0.406	0.055	0.162-1.018
4	0.253	0.002	0.107-0.594	0.229	<0.001	0.095-0.556
Acceptance	Reference=0					
1	1.920	0.350	0.488-7.549	1.970	0.343	0.485-7.994
2	2.133	0.223	0.630-7.219	2.347	0.184	0.668-8.249
3	1.545	0.463	0.484-4.939	1.782	0.344	0.538-5.898
4	1.191	0.758	0.392-3.625	1.043	0.942	0.335-3.249
Disgust	Reference=0					
1	0.652	0.395	0.244-1.745	0.668	0.440	0.239-1.861
2	1.125	0.780	0.492-2.571	1.178	0.711	0.496-2.793
3	1.203	0.666	0.519-2.783	1.310	0.546	0.545-3.147
4	0.259	0.002	0.109-0.614	0.267	0.004	0.109-0.648
Happiness	Reference=0					
1	9.286	0.061	0.899-95.953	8.663	0.075	0.803-93.464
2	2.229	0.477	0.244-20.328	2.892	0.352	0.308-27.131
3	1.975	0.530	0.236-16.495	2.189	0.474	0.257-18.648
4	2.291	0.430	0.292-17.968	2.358	0.419	0.295-18.872

Note: Variables adjusted for: Age, parity, gestational age, marital status, and educational level

Table 4B. Logistic Regression showing the Association between PE-E and the Predictor Variables

Preeclampsia/Eclampsia	COR	P-value	[95% CI	aOR	P-value	95% CI
Love	Reference=0					
1	9.749	0.043	1.073-88.585	9.812	0.044	1.059-90.843
2	7.548	0.063	0.896-63.563	8.461	0.053	0.974-73.495
3	4.024	0.190	0.502-32.239	3.954	0.198	0.487-32.099
4	4.471	0.148	0.589-33.928	4.132	0.173	0.538-31.759
Hate	Reference=0					
1	0.786	0.659	0.269-2.295	0.770	0.647	0.253-2.349
2	1.237	0.665	0.476-3.201	1.197	0.724	0.441-3.252
3	0.507	0.178	0.188-1.363	0.503	0.190	0.179-1.407
4	0.182	<0.001	0.068-0.488	0.175	<0.001	0.063-0.488
Tension	Reference=0					
1	0.203	0.002	0.074-0.557	0.208	0.003	0.073-0.591
2	0.237	<0.001	0.101-0.558	0.229	0.002	0.092-0.571
3	0.343	0.009	0.153-0.769	0.391	0.028	0.169-0.904
4	0.081	<0.000	0.034-0.192	0.078	<0.000	0.032-0.192
Anxiety	Reference=0					

1	0.222	0.002	0.084-0.587	0.208	0.002	0.075-0.573
2	0.374	0.012	0.173-0.809	0.309	0.005	0.135-0.707
3	0.213	<0.000	0.089-0.508	0.179	<0.000	0.073-0.445
4	0.100	<0.000	0.045-0.225	0.082	<0.000	0.035-0.193
Depression	Reference=0					
1	0.146	0.008	0.035-0.607	0.127	0.006	0.029-0.559
2	0.626	0.323	0.247-1.585	0.437	0.107	0.160-1.195
3	0.219	0.002	0.085-0.564	0.177	<0.001	0.064-0.490
4	0.079	<0.000	0.031-0.203	0.061	<0.000	0.022-0.165
Dejection	Reference=0					
1	0.667	0.638	0.123-3.617	0.878	0.885	0.151-5.103
2	0.667	0.532	0.187-2.379	0.645	0.520	0.169-2.449
3	0.933	0.907	0.292-2.988	0.977	0.969	0.289-3.289
4	0.150	<0.001	0.047-0.482	0.153	0.002	0.046-0.511

Note: Variables adjusted for: Age, parity, gestational age, marital status, and educational level

As shown in Table 4A & B, respondents with high (2) and the highest (4) levels of fear are statistically significant ($P= 0.011$, $CI= 0.148-0.782$, $P< 0.000$, $CI= 0.067-0.373$) at 95% CI. Thus, respondents experiencing high (2), and highest (4) levels of fear have reduced odds of getting PE-E by 34% and 15.9%, respectively. It is also noticed that respondents with the highest level of anger (4) are significantly associated with the occurrence of PE-E. Those with the highest level of anger (4) had reduced odds of getting PE-E by 27.7% as against those experienced no anger.

Also, experience of the highest level of sadness (4) is statistically significant at 95% confidence interval ($P<0.002$) with reduced odds of developing PE-E by 25.3%. Love as an emotional factor, shows an association at low level (1): those who had low grade of love were 9.8 times the odds of developing PE-E. It can also be seen that hate is statistically significant at level 4 (Highest): respondents who were rated with the highest (4) level of hate, reduced their odds of developing PE-E by 18.2%. Likewise, disgust is significantly associated with the development of PE-E, and pregnant women who were disgusted at the highest level (4) had 25.9% reduced odds of developing PE-E compared to those who were not disgusted during pregnancy.

Again, dejection at the highest level (4), which is statistically significant ($P<0.001$), and associated with the occurrence of PE-E. It shows on the Table that respondents who had the highest level of dejection had reduced odds of developing PE-E by 15%. The logistic regression output on the Table above reveals that respondents who reported having experienced tension in all the grades, 1 to 4, showed statistical significance at 95% CI. Respondents who experienced low (1), high (2), higher (3), and highest (4) levels of tension reduced their odds of PE-E by 20.3%, 23.7%, 34.3%, and 8.1%, respectively.

From Table 4B, all the levels of anxiety reported are all statistically significant at 95% CI. Respondents with low (1), high (2), higher (3), and highest (4) levels of anxiety have reduced odds of developing PE-E by 22.2%, 37.4%, 21.3%, and 10%, respectively. The Table shows that respondents who recorded depression scores low (1), higher (3), and highest (4) have a corresponding decreased odds of developing PE-E by 14.6%, 21.9%, and 7.9%, respectively.

After adjusting for age, parity, gestational age, marital status, and educational level in table 2.0, fear grades 2 and 4, anger grade 4, sadness grade 4, disgust grade 4, love grade 1, hate grade 4, tension grades 1 to 4, anxiety grades 1 to 4, depression grades 1, 3 and 4, and dejection grade

4, were statistically significant at 95% CI. Thus, pregnant women who experienced fear grades 2 and 4 in the adjusted odds ratio had 31.9% and 14.1% reduced odds of developing PE-E respectively compared to those who were not afraid. Those who had anger grade 4 had 21.4% reduced odds, those with sadness grade 4 had 22.9% reduced odds, and those disgusted at grade 4 had 26.7% reduced odds of developing PE-E compared to those with none (0). However, pregnant women who had love grade 1 were about 10 times (aOR, 9.8) the odds of developing PE-E compared to those without love in the adjusted odds ratio. On the other hand, pregnant women who reported hatred at grade 4 (highest), had 17.5% reduced odds of developing PE-E compared to those who did not report

hatred. Pregnant women who had some level of tension in all the grades (1 to 4) had 20.8%, 22.9%, 39.1%, and 7.8% reduced odds of developing PE-E for tension grades 1, 2, 3, and 4, respectively compared to those who were not tensed. Similarly, pregnant women who experienced the different levels of anxiety had 20.8%, 30.9%, 17.9%, and 8.2% reduced odds of developing PE-E for anxiety grades 1, 2, 3, and 4, respectively. Those who have been depressed at level 1, 3, and 4, reduced their odds of developing PE-E by 12.7%, 17.7%, and 6.1%, respectively. Pregnant women who suffered dejection at level 4 reduced their odds of developing PE-E by 15.3% compared to those who were not.

Table 5. Logistic Regression showing the Association between Selected Psychological and Emotional Factors and Haemorrhage

Haemorrhage	COR	P-value	95% CI	aOR	P-value	95% CI
Anger	Reference = 0					
1	4.295	0.173	0.527-35.022	5.113	0.132	0.611-42.799
2	3.063	0.302	0.365-25.679	2.965	0.327	0.338-26.028
3	1.537	0.714	0.155-15.227	1.998	0.559	0.196-20.363
4	0.730	0.800	0.065-8.266	0.913	0.942	0.079-10.582
Acceptance	Reference = 0					
1	2.414	0.481	0.208-27.983	2.407	0.489	0.200-28.949
2	2.642	0.394	0.283-24.627	2.427	0.445	0.249-23.635
3	0.679	0.755	0.059-7.727	0.307	0.412	0.018-5.159
4	2.241	0.444	0.284-17.679	2.215	0.456	0.273-17.939
Love	Reference = 0					
1	4.105	0.237	0.396-42.584	4.455	0.218	0.413-48.029
2	0.667	0.778	0.039-11.139	0.653	0.771	0.037-11.520
3	2.337	0.433	0.279-19.554	2.391	0.430	0.274-20.861
4	0.936	0.951	0.114-7.683	1.010	0.993	0.120-8.482
Anxiety	Reference = 0					
1	0.979	0.974	0.266-3.608	0.809	0.771	0.195-3.355
2	0.472	0.281	0.121-1.846	0.453	0.273	0.110-1.864
3	0.504	0.326	0.129-1.975	0.464	0.286	0.113-1.901
4	0.206	0.022	0.053-0.796	0.191	0.020	0.047-0.774

Note: Variables adjusted for: Age, parity, gestational age, marital status, and educational level

The logistic regression showing crude odds ratios in Table 5 shows no statistically significant relationship between the psychological and emotional factors and

haemorrhage except anxiety grade 4 (P=0.022). Similarly, after adjusting for age, parity, gestational age, marital status, and educational level, only anxiety grade 4 shows statistical

significance at 95% confidence interval (P=0.020). However, the crude odds ratio in the predictor variable, anger, shows that pregnant women who reported anger at levels 1 and 2 had about 4 and 3 times respectively the odds of developing haemorrhage even though none was statistically significant. A similar observation is made in the adjusted odds ratio where those who reported anger grades 1 and 2 were 5 times and about 3 times (aOR, 2.97) respectively the odds of developing haemorrhage, though statistically insignificant. Also, pregnant women who indicated that their acceptance level both at home and in their marital life was pegged at grade 1 (low), 2 (high), and 4 (highest) were all about double the odds of developing haemorrhage compared with those who were not

accepted as part of the family even though these too were not statistically significant. Furthermore, pregnant women who reported receiving love at grade 1 both at home and in their marital life were about 4 times the odds of developing haemorrhage both in the crude odds ratio and adjusted compared with those without love. But not statistically significant. Anxiety among pregnant women and its relationship with haemorrhage was statistically significant at grade 4 (P=0.022). This shows that pregnant women who were anxious level 4 both at crude and adjusted odds ratios reduced their odds of developing haemorrhage by 20.6% and 19.1%, respectively, compared with those who were not anxious.

Table 6. Logistic Regression Indicating the Association between PE-E and Psychological and Emotional Categories

Psychological& Emotion Category	Odds Ratio	P-value	95% Confidence Interval
Reference = Normal			
Low	2.873	0.001	1.514-5.451

The results from the Table show that pregnant women with psychological and emotional issues were categorised into low and normal. Those

who reported low levels of psychological and emotional issues were about 3 times the odds of developing PE-E compared to the normal.

Table 7. Multinomial Logistic Regression Comparing Psychological and Emotional Factors and the Occurrence of PE-E and Haemorrhage

Outcome of delivery	Coef.	P-value	95% Conf. Interval
Preeclampsia/Eclampsia	Reference = Normal		
Fear	-.131	0.342	-.401 .139
Anger	.117	0.427	-.172 .406
Joy	.250	0.187	-.121 .621
Sadness	-.063	0.642	-.329 .203
Acceptance	-.133	0.280	-.374 .108
Disgust	-.066	0.606	-.315 .184
Happiness	.178	0.337	-.185 .540
Love	.149	0.340	-.158 .457
Hate	-.179	0.238	-.475 .118
Tension	.119	0.523	-.247 .486
Anxiety	-.358	0.043	-.704 -.011
Depression	-.395	0.022	-.732 -.058
Dejection	.049	0.783	-.302 .400
Haemorrhage	Reference = Normal		

Fear	-.061	0.781	-.491 .369
Anger	-.169	0.455	-.613 .275
Joy	-.053	0.831	-.540 .434
Sadness	-.241	0.261	-.661 .179
Acceptance	.312	0.191	-.156 .781
Disgust	-.236	0.206	-.601 .129
Happiness	.142	0.647	-.466 .751
Love	-.206	0.342	-.629 .218
Hate	-.083	0.739	-.572 .405
Tension	.859	0.004	.271 1.446
Anxiety	-1.033	0.000	-1.546 -.520
Depression	-.063	0.811	-.583 .456
Dejection	.563	0.100	-.107 1.234

The multinomial logistic regression output shows statistical significance for anxiety and depression in association with PE-E. Similarly, significance levels were shown for comparison between tension and anxiety in association with the development of haemorrhage. The results in Table 7 show that for every 1 unit increase in anxiety and depression among pregnant women who developed PE-E, there is a corresponding -0.358 and -0.395 times decrease respectively in the risk of developing PE-E, compared to those who were normal. Also, for every 1 unit increase in tension and anxiety among pregnant women who developed haemorrhage, there is a corresponding 0.859 and -1.033 times increase and decrease respectively in the risk of haemorrhage compared to those who were normal.

Discussion

The findings show that there is a significant association between preeclamptic/eclamptic pregnant women with high (2) and highest (4) levels of fear at 95% CI similar to the findings of [24] on the NuMomM2b study which was conducted among nulliparous pregnant women across 8 U.S sites. This study shows that pregnant women experiencing high (2), and highest (4) levels of fear have reduced odds of getting PE-E by 34% and 15.9%, respectively. This means some level of fear (2) at one point or the other in pregnancy is protective against the

occurrence of PE-E. However, as the rate of fear increases, the protection level also decreases, which may lead to an increase in the risk of PE-E. We also found out that pregnant women with the highest level of anger (4) were associated with the occurrence of PE-E, which is in conformity with the findings of a study conducted elsewhere [25]. Anger is an indication of the extent of socio-economic, family and other effects that can lead to frustrations [26]. Those with the highest level of anger (4) were 0.277 times the odds of PE-E compared to those without anger. As a person becomes angry, the neurotransmitter chemicals, catecholamines, are released, increasing the energy levels. This leads to the angry craving to act immediately to protect the individual. This may be what is causing the protective effect observed in this study. After adjusting for age, parity, gestational age, marital status, and educational level, anger grade 4 was still statistically significant at 95% CI. Those who were reported to have had anger grade 4 had 21.4% reduced odds compared to those with none. However, the protective effect of the pregnant women with anger is in contrast with the findings of this study [27] where their study explained that ill-fated behaviours of relations around the pregnant women may cause undesirable emotions, and this can lead to the development of PE-E. This is why the study conducted elsewhere [28] argued that supportive care for the pregnant women will help improve

the health of both mother and child. Basically, the effects of unrestrained anger may lead to increased anxiety, high blood pressure and headache. However, anger can seldom be a helpful and beneficial emotion, if used properly and that may also be responsible for the protective effect observed in this study.

Pregnant women with the highest level of sadness (4) had 25.3% reduced odds of PE-E which also agrees with the findings of a similar study [25]. This study [25] was conducted at the community level among pregnant women and other caregivers in Maputo and Gaza Provinces of southern Mozambique. The protective state of the pregnant women with sadness is in contrast with the findings of [25] where they found that unfortunate behaviours of the people surrounding the pregnant women may cause negative emotions and subsequent development of PE-E. Sadness is a panic/grief which includes endorphins, corticotrophin releasing factor, and cortisol. All these may have an effect, thus contributing to the observations in this study [17]. This current study was conducted in seven hospitals among pregnant women >28 weeks gestation. This is the reason behind the two studies. Study findings show an association between the experience of sadness, anger, and anxiety and increased risk of cardiovascular disease which is related to PE-E [27]. This is in conformity with the findings in this study and therefore, effective psychological soothing mechanisms must be implemented at the ANC and maternity clinics to take care of pregnant women's needs.

Love as an emotional factor shows a significant association at low level (1) with the occurrence of PE-E, which is in consonance with the findings of similar studies [28]. After adjusting for age, parity, gestational age, marital status, and educational level, love grade 1 remained statistically significant at 95% CI. We determined that pregnant women who had the low grade of love were 9.75 times the odds of developing PE-E. This means the emotional factor, love, is very significant and should be

showered on pregnant women in abundance to reduce the risk of developing PE-E. Love consist of the feelings shown to others in terms of closeness, bonding, and warmth. This may lead to romance and sexual consummation. In pregnancy, this may lead to improved self-satisfaction with improved pregnancy outcomes [29]. Therefore, a low level is likely to affect the mood, affection, bonding, and overall pregnancy outcome and that may be why there is increased odds of PE-E at low levels.

Disgust may contribute to anxiety which also leads to obsessive disorder and may cause post-traumatic stress syndromes [30] which is likely to lead to maternal health complications. In this study, disgust is shown to be significantly associated with the development of PE-E, with 25.9% reduced odds of developing PE-E compared to those who were not disgusted during pregnancy. According to Curtis, disgusted persons at the highest level of the scale may show certain behavioural issues [31]. This is contrary to the findings observed in this study. The reason for the difference observed may be associated with how the studies were conducted. Curtis conducted a review whereas this current study was a prospective cohort study among pregnant women >28 weeks in seven hospitals in the Eastern Region of Ghana.

In this study, hate showed a statistically significant effect on PE-E at level 4 (Highest). However, it gives a protective effect on PE-E among pregnant women in this study with 17.5% reduced odds of developing PE-E compared to those who did not report hatred. A study conducted by Cohen and Pressman explained the complex nature of both positive and negative emotions which clearly stated that some negative emotions may have a positive link with biological health and the vice versa [32]. Hate is a harmful act towards a person which has negative impacts on the victims, and this can negatively affect the overall health status of the individual [33]. According to Sternberg, hatred can be examined using the duplex theory and analyzed from the psychological point of

thinking. The first point of the duplex theory indicates that “hatred is psychologically related to love” [34]. Hatred is the expression of a strong, undesirable actions towards the receiver of the hatred. It is therefore a combination of thoughts and sentiments [35]. Deep sense of thoughts towards the effect the hater may bring upon the victim is likely to bring about tension and fear which may also lead to increase in blood pressure. However, the findings in this study are rather contrary to the findings stated above. Therefore, the extent of hate reported by the pregnant women in this study may not necessarily be a negation of intimacy, passion and commitment as espoused by Sternberg and that may be the reason why the study found a protective effect in association with PE-E.

Again, dejection at the highest level (4) was statistically significant ($P < 0.001$) with an association with the occurrence of PE-E. Pregnant women who reported to have been dejected at level 4 reduced their odds of developing PE-E by 15.3% compared to those who were not. After adjusting for age, parity, gestational age, marital status, and educational level, dejection grade 4 was still statistically significant at 95% CI. A study conducted by Lane and colleagues in UK showed that dejection was associated with increased anxiety and anger scores [36]. This means, an increase in anxiety and anger due to the dejection may lead to increased blood pressure with its attendant effects on pregnancy outcomes. This is rather contrary to the findings in this study partly due to study locations with different environmental conditions and study designs.

This study showed that pregnant women who reported having experienced tension in all the grades, 1 to 4, showed statistical significance at 95% CI and that pregnant women who experienced low (1), high (2), higher (3), and highest (4) levels of tension reduced their odds of PE-E by 20%, 23.7%, 34.3%, and 8% respectively. Tension is an accumulation of pressure within a vessel, such as blood pressure leading to stress and bottled-up emotions cause

anxiety. This may lead to tension headache. A qualitative study conducted in rural Southwestern Uganda on perceptions on preeclampsia and eclampsia among senior, older women, revealed that marital tension was associated with PE-E [37]. This is consistent with the findings in this study. The reasons for the variation in the findings are due to the fact that this study is a quantitative study as compared to a qualitative study conducted in Uganda.

All the levels of anxiety reported in this study were statistically significant at 95% CI. This finding agrees with that of [29]. The results showed that pregnant women with low (1), high (2), higher (3), and highest (4) levels of anxiety had reduced odds of developing PE-E by 22.2%, 37.3%, 21.3%, and 10% respectively. This means anxiety may not be a risk factor to developing PE-E. This is in contrast with the findings of [38] where they explained that pregnant women with anxiety disorder had 2.86 times increased risk of PE in unadjusted RR and 2.12 times in adjusted RR compared to the normal. Dopamine and serotonin regulate the emotional state of anxiety [39]. Anxiety can minimise the capacity to use cognitive ways of managing stress which may lead to reduced risk of PE-E [40] as observed in this study. The peptide corticotropin-releasing factor (CRF) plays a special role in anxiety [18], which may be contributing to the protective effects observed in this study. Pregnant Women who recorded low (1), higher (3), and highest (4) forms of depression had a corresponding decreased odds of developing PE-E by 14.5%, 21.8%, and 7.9%, respectively. This is also in consonance with the findings conducted in other studies [41]. Apart from the logistic regression, the multinomial logistic regression output also shows statistical significance for predictor variable anxiety in association with PE-E by revealing that for every 1 unit increase in anxiety among pregnant women who developed PE-E, there is a corresponding 0.358 times decreased risk of PE-E. This is also in consonance with the findings

of the study [41] in the Netherlands which showed that anxiety scores were significantly correlated with PE-E [41].

Antenatal care mothers who recorded depression scores low (1), higher (3), and highest (4) had a corresponding decreased odds of developing PE-E by 14.5%, 21.8%, and 7.9% respectively. Those who reported to have been depressed at level 1, 3, and 4 reduced their odds of developing PE-E by 12.7%, 17.7%, and 6.1% respectively. Depression is a medical condition with important physiological variations such as anorexia, constipation, insomnia, fatigue, lethargy, gastrointestinal disturbances, and dizziness [42]. All these can affect the eating habit of the individual and may negatively affect pregnancy outcome. Study findings have shown that PE has been associated with psychological problems in pregnant women up to seven years after pregnancy. Experiencing depression can affect the individual's thoughts, behavior, motivation, feelings, and sense of well-being in relation to medical care [43]. After adjusting for age, parity, gestational age, marital status, and educational level, depression grades 1, 3 and 4, were statistically significant at 95% CI. Women who developed PE-E experienced more depressive symptoms compared to those who were normal [44]. This is contrary to the findings contained in this study. The female's cohort study is a four year follow-up study which was conducted in The Netherlands compared to 13 weeks follow-up in this current study. This may be the reason for the variation in the findings. A long-term follow-up study conducted in Groningen; The Netherlands showed that depression scores were significantly correlated with PE-E with a Cronbach's alpha of .80 for depression subscale [44]. The reason for the variation in the findings is due to the difference in study areas with different socio-economic backgrounds of the study participants involved and the type of study conducted. This current study was a health facility-based prospective cohort study conducted in Ghana as against a

long-term follow-up study conducted in The Netherlands.

The pregnant women who reported low levels of psychological and emotional issues were about 3 times the odds of developing PE-E compared to the normal category. This means in order to reduce pregnant women's risk of PE-E, there is the need to put in measures that will eliminate their psychological and emotional issues. Studies have shown that pregnant women with PE-E are more likely to suffer psychosocial stress [45] when faced with these emotional issues. Psychological and emotional issues were determined, and it showed that critical key factors such as poverty may lead to the observed psychosocial and emotional stress and poor pregnancy outcomes in pregnancy [24].

The logistic regression shows no statistically significant relationship between the psychological and emotional factors and haemorrhage except anxiety grade 4. Similarly, after adjusting for age, parity, gestational age, marital status, and educational level, only anxiety grade 4 showed statistical significance at 95% confidence interval ($P=0.022$). This shows that pregnant women who were reported to have had anxiety level 4 (highest) both at crude and adjusted odds ratios reduced their odds of developing haemorrhage by 20.6% and 19.1% respectively compared with those who were not anxious. The protective effect observed in this study is quiet in contrast with the findings of other studies [46] where the effects of sadness and anxiety may cause impaired endothelial cell function leading to the development of atherosclerosis which can lead to PE-E and this can also lead to haemorrhage.

The multinomial logistic regression output shows statistical significance for predictor variables anxiety and depression in association with PE-E. Additionally, significance levels were shown for comparison between predictor variables tension and anxiety in association with the development of haemorrhage. According to a study [47], the emotional and psychological factors, anxiety and depression in pregnancy

were found to be risk factors in maternal health. Anxiety was found to be associated with reduced gestational age which has negative consequences for foetal neurological growth and birth outcomes [47]. These may have a special link with tension and anxiety leading to the association with haemorrhage observed in this study.

Conclusion

The study shows that there is a statistically significant association between pregnant women with PE-E and haemorrhage and different levels of fear, anger, sadness, Love, hate, depression, dejection, anxiety, and tension.

The pregnant women who reported low levels of psychological and emotional issues were about 3 times the odds of developing PE-E compared to the normal category. We recommend that Ghana Health Service should institute psychological, psychosocial, and emotional counselling as part of ANC services in order to manage pregnant women who may need them to avert the effects on pregnancy and birth outcome.

Ethical Consideration

Ethical approval was given by the ethics review committee of the Ghana Health Service (GHS-ERC: Number, 007/05/21). Pregnant women who participated in the study signed consent forms before taking part in the study. Confidentiality and privacy of the data collection were assured, and anonymity was maintained throughout the study. Also, approval was obtained from the Eastern Regional Health

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Directorate and all the participating Hospitals before the data collection.

Consent for Publication

Not applicable

Availability of Data and Materials

All the data associated with this work are available from the corresponding author.

Funding

The authors bore the cost of funding this study.

Authors' Contributions

JAA conceived the study and designed the study together with AA, AO, and IS. JAA implemented the study and conducted data collection. JAA and IS analyzed the data, and JAA wrote the first draft. All authors proofread and edited the manuscript. AA, AO, MW, and FD critically revised the draft for important intellectual content. All authors read and approved the final manuscript.

Acknowledgement

We thank the Regional Director of health services (RDHS) and the medical superintendents of the seven hospitals for their cooperation and approval for us to conduct this study. Many thanks to all the research assistants for their dedication and high sense of professionalism and commitment to quality data collection process. Thank you!

Competing Interests

The authors declared that there was none.

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