ORIGINAL ARTICLE

Two-way interaction effects of psychosocial factors during pregnancy on maternal quality of life in Ibadan, Nigeria: A cross-sectional study

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ABSTRACT

During pregnancy, women are exposed to various psychosocial stressors that affect their quality of life, but few studies have looked at them additively in non-western contexts. This study aimed to assess the shared and unique contributions of perceived stress, financial strain, intimate partner violence, food insecurity, and social support to maternal quality of life. Data were gathered from a cross-sectional sample of 519 pregnant women who received antenatal care at various primary health care centers in Ibadan, Nigeria. Independent effects of and two-way interactions between psychosocial stressors in predicting maternal quality of life were explored using hierarchical linear regression. Higher scores for the main effects of food insecurity ($\beta = -0.52$, $p < 0.01$) and social support ($\beta = 0.11$, $p < 0.01$) were most strongly linked to a lower and better quality of life, respectively. Further, the two-way interaction effects were significant for financial strain in combination with intimate partner violence ($\beta = -0.18$, $p < 0.01$) and food insecurity in combination with social support ($\beta = 0.18$, $p < 0.01$) contributing to lower quality of life. The findings of this study were supported by the social determinants of health model, which recognizes that a person's socioeconomic environment and psychosocial state affect his or her health and life experiences. It is recommended that health care practitioners should incorporate assessments of clinical factors of gestation with those of psychosocial needs as part of routine antenatal care in order to develop appropriate women-centered interventions.

Key words:
pregnancy, quality of life, psychosocial, stress, health care, Nigeria

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INTRODUCTION

The gestation period can positively or negatively affect the life of a woman because it comes with various transformations that can be psychological, social, physical, or biological, and these changes that occur during pregnancy may impair a woman's quality of life (QoL). More studies on maternal gestational quality of life have been published recently, and the topic has grown in popularity. Significant clinical and non-clinical occurrences for women during pregnancy impact women's perceived QoL, which spans the biophysical and psychosocial domains[1,2.] The World Health Organization[3] defines quality of life as a person's viewpoint on their goals, aspirations, and standards in relation to their culture and core beliefs. Health-related quality of life (HRQoL) comprises a subjective evaluation of one's mental health, physical and psychological well-being, and physical activities[4]. In essence, health is the consequence of an interaction between a person and their environment.

The maternal mortality ratio in Nigeria is estimated to be about 512 per 100,000 live births[5], making it the highest in Africa and significantly higher than the global estimate of 223 per 100,000 live births in 2023[6]. While indicators of pregnancy outcomes, such as morbidity and mortality rates, are crucial, they are insufficient on their own, as population health evaluation should also include strategies to enhance individuals' quality of life. Most maternal deaths in Nigeria are reportedly attributable to avoidable obstetric causes[7]. However, various underlying environmental, economic, and sociocultural factors [collectively called social determinants of health] contribute to the disproportionately high maternal mortality rates[8]. The WHO[9] defines social determinants of health (SDH) as "the conditions under which people are born, grow, work, live, and age, as well as the set of forces and systems shaping the conditions of daily life."

Mechanisms by which SDH influences health outcomes can be explained from the social disadvantage perspective. This perspective suggests that people are subject to different risk factors based on their socioeconomic position. Socioeconomic status influences maternal health outcomes via individual-level factors (health status, behavioral, and psychosocial), environmental factors (community, family, and peer influences), and health system factors. Social determinants of health cause disparities in maternal QoL and adverse perinatal outcomes[10] and include stress induced by psychosocial factors, termed psychosocial stress[11]. Types of psychosocial stressors included major life events, trauma, stressful living situations and relationships, depression, anxiety, intimate partner violence (IPV), economic strain, food insecurity, and lack of social support[12-14].

Maternal health outcomes such as QoL may be affected by a web of complicated interactions between many SDH. For example, those at the bottom of the social hierarchy are likelier to have low income, struggle financially, and experience financial strain. One stressful experience or hardship is likely correlated with others, especially those associated with a lower maternal socioeconomic status. High intimate partner violence (IPV) rates, food insecurity, and insufficient social support have all been linked to lower socioeconomic status (SES) and poverty[15]. Burns et al.[16] observed that 75% of women experienced at least one stressful event during pregnancy in the United States of America. Data from Nigeria also shows that females were more likely to be food insecure and disempowered[17]. Psychosocial stress experienced during pregnancy is linked to adverse feto-maternal health outcomes such as having a preterm or low birth weight infant, maternal depression, hypertensive diseases, and

postpartum depression[18-21]. Thus, assessing and addressing these underlying social determinants of health imbalances may improve mother and newborn mortality, morbidity, and well-being.

While there is a sizeable literature on how psychosocial stress influences maternal health and birth outcomes, most studies are from Western and Eastern countries; there is still a scarcity of data from developing countries in sub-Saharan Africa, including Nigeria. Few studies have examined multiple stressors at a time or assessed whether differences in exposure to psychosocial stressors have interaction effects. Current understanding of how and what kinds of experiences of stress have consequences on maternal quality of life during pregnancy can be advanced by incorporating evaluations of several types of stress measures. Pregnant women who face food shortages, domestic abuse, or a lack of social support are more likely to develop postpartum depression, according to studies conducted in other African countries[22,23]. The situation calls for studies investigating accumulating and interacting maternal psychosocial stressors experienced during pregnancy. This study addresses this gap by examining the association of financial strain, food insecurity, domestic violence, low social support, and perceived stress on maternal QoL among pregnant women in Ibadan metropolis, Nigeria. In particular, this study evaluates these variables' joint and independent relationships on the maternal QoL.

METHODS

Study design and procedure

This research is a cross-sectional study of 519 pregnant women from five local government areas in Ibadan, south-west Nigeria (Ibadan North, Ibadan North West, Ibadan North East, Ibadan South West, and Ibadan South East) from March 14 to April 21, 2022. Seven primary health care centers (PHCs) offering antenatal care services were selected using purposive sampling. A 50% proportion, 5% margin of error, 10% non-response rate, and 95% confidence interval were used to calculate the required sample size. Eligible participants were women who went to routine appointments at the antenatal clinics of the PHCs, were 18 years and older, willing to participate, and could comprehend the nature of the study and the questions. Exclusion criteria included being under 18, having cognitive impairment, being pregnant in the first trimester, and having any known chronic medical condition or pregnancy complications.

Institutional review board approval and approval from the relevant local health authority and each participating health center were obtained before data collection. A k = 3 sample frame was used to enroll pregnant women in the study. With the help of the nurses, a participant was chosen randomly from a list of eligible women using the list of women who attended antenatal care on the days the researcher visited the study location. Then, every third woman on the list was approached. After being informed of the study protocols, each participant provided verbal informed consent. A structured, confidential, anonymous questionnaire was administered to eligible and willing respondents. The questionnaires were administered in a separate room at each site to protect the participants' privacy, with only the researcher and participant present.

Measures

Dependent variable

The Quality of Life-Gravidum (QoL-GRAV)[24] questionnaire comprises nine items scored on a five-point Likert scale (0-4). The questions assess different physical and psychological changes and life

satisfaction during pregnancy. All items in the instrument were reverse-scored to align with the scoring of the other instruments used in this study. Total scores ranged from 0 to 36, with a higher score indicating higher QoL (Cronbach's Alpha = 0.92).

Independent variables

The Perceived stress scale (PSS-4) assesses how individuals perceive stressful situations over the previous month[25]. Each question's responses were ranked on a 5-point Likert scale, with answers ranging from "never" (0) to "almost always" (4). The responses were averaged to produce a continuous measure of perceived stress (range 0-16), with higher scores indicating increased stress. (Cronbach's Alpha = 0.73). The Hurt, Insult, Threaten, and Scream (HITS) screening tool was used to evaluate intimate partner violence[26]. Participants used a 5-point frequency scale to express their responses: never (0), rarely (1), occasionally (2), fairly often (3), and frequently (4). An indicator of intimate partner violence is a score of 10 or above. (Cronbach's Alpha = 0.75). The Household Food Insecurity and Access Scale (HFIAS) consist of nine questions, each with a one-month recall span [27]. Participants rated the frequency of a corresponding event on a scale of 0 (rarely) to 3 (often). The total scale score ranged from 0 to 27. (Cronbach's Alpha = 0.92).

Financial strain[28] is a six-item adapted economic position scale that measures how much respondents struggle to pay for utilities, food, housing, child, and medical expenses. Responses ranged from 0 (not difficult) to 3 (very difficult). High scores indicated difficulties making ends meet. (Cronbach's Alpha = 0.81). Social support from family, friends, and intimate partners was ascertained using a seven-item Likert scale instrument scored from 1 (never) to 5 (always)[29]. A total score of 35 was possible and classed as 0–18 (low support), 19–24 (medium support), and > 24 (high support). The internal reliability of the scale for the current study is 0.89.

Demographic variables like maternal age, education, family income, employment status, pregnancy readiness, region, gestational age, and number of children were also collected. Age was measured continuously and also divided into three categories: "≤25", "25-34," and "≥ 35". Options for educational degrees included "primary," "secondary," and "tertiary." The estimated monthly family income (income level) was divided into three categories: "N50,000," "₦50,001-100,000," and ">₦100,000." Employment status was divided into "employed" and "unemployed" and family size into "1-5" and ">5". The participants' pregnancy was considered unplanned if the woman did not want it then or wanted it later. Gestational age was self-reported in weeks and categorized into the second and third trimesters. Parity was measured continuously and further divided into "0", "1-3," and "≥4".

Statistical Analysis

All statistical analyses were conducted using version 21 of the IBM SPSS software. The distribution of the participants' sociodemographic characteristics was examined using frequencies and percentages. A one-way Analysis of Variance was used to investigate significant mean differences between the predictor variables and maternal QoL scores. Next, a moderated hierarchical multiple linear regression using the 'enter" method was conducted to test how well the psychosocial stressors predicted maternal QoL. Sociodemographic variables were entered in Step 1, psychosocial stressors in Step 2, and the third step included the two-way interaction effects between the five predictor variables. The independent variables were centered before creating the interaction terms.

An interaction effect happens when two or more independent variables have additive (or multiplicative) effects on a single dependent variable. This means that one independent variable's impact varies with changes in another independent variable's value. In contrast, the "main effect" refers to the influence of a single independent variable on a dependent variable. A simple slope analysis was performed to ascertain the significance of the interaction. In the case of parallel lines, interaction is absent, whereas non-parallel lines indicate interaction. Statistical significance was defined as p-value < 0.05.

RESULTS

The sociodemographic profile of the sample is presented in Table 1. Married women were more than single women (86.9% vs. 13.1%). Most of the women were 25–34 years, were Muslims, working, had a secondary school education, and were in monogamous unions. The majority were in the third trimester (70.9%) and had between 1-3 children (63.4%). Over half earned ≤ ₦50,000 (US$1 is about 450.05 Naira).

Table 1. Description of participants' sociodemographic characteristics in selected primary health care centers of Ibadan metropolis, Nigeria (n=519)

Variables	Categories	Frequencies (%)
Maternal Age	<25	145 (27.9)
	25-34	303 (58.4)
	≥ 35	71 (13.7)
Marital status	Married	451 (86.9)
	Single	68 (13.1)
Religion	Islam	350 (67.4)
	Christianity	169 (32.6)
Education	Primary school	101 (19.5)
	Secondary school	275 (53.0)
	Tertiary	143 (27.5)
Maternal employment	Working	478 (92.1)
	Not working	41 (7.9)
Estimated Monthly income*	≤ ₦50, 000	272 (52.4)
	₦50, 001 – ₦100, 000	182 (35.1)
	≥ ₦100, 000	65 (12.5)
Family type	Monogamous	410 (79.0)
	Polygamous	109 (21.0)
Family size	1-5	334 (64.4)
	≥5	185 (35.6)
Gestation	Second trimester	151 (29.1)
	Third trimester	368 (70.9)
Parity	0	54 (10.4)
	1-3	329 (63.4)
	≥4	136 (26.2)
Quality of Life	Mean ± SD	24.44 (8.35)
	Range 5-35	

**Note: 453.88 Naira (₦) is equivalent to one USD*

Table 2 shows the overall quality of life differences by the dimensions of psychosocial stressors. The mean QoL was significantly lower for women who had experienced higher stress (*M*=29.80, *SD*=4.17; p<0.001) during pregnancy than those who perceived lower stress (*M* = 20.24, *SD* = 8.74; p<0.001). Moreover, women who reported lower financial strain (*M*=27.89, *SD*=6.18; p<0.001) and intimate partner violence (*M*=27.99, *SD*=5.89; p<0.001) and higher social support (*M*=29.15, *SD*=3.09; p<0.001) had significantly higher quality of life scores. Also, mean QoL scores steadily decreased as food insecurity increased.

Table 2. Significant differences of maternal QoL scores across the predictor variables in selected primary health care centers of Ibadan metropolis, Nigeria (n=519)

Variables	Categories	Frequencies (%)	QoL (Mean ±SD)	*P* value
Perceived stress	Low	228 (43.9)	29.80 (4.17)	<0.001
	High	291 (56.1)	20.24 (8.74)	
Mean ±SD: 8.00 (3.36)				
Financial strain	Low	219 (42.2)	27.89 (6.18)	<0.001
	High	300 (57.8)	20.43 (8.74)	
Mean ±SD: 7.88 (3.67)				
Intimate partner violence	Low	281 (54.1)	27.99 (5.89)	<0.001
	High	238 (45.9)	20.25 (8.87)	
Mean ±SD: 2.07 (2.48)				
Social support	Low	382 (73.6)	23.39 (8.82)	<0.001
	Medium	97 (18.7)	26.62 (6.67)	
Mean ±SD: 16.93 (4.25)	High	40 (7.7)	29.15 (3.09)	
Food insecurity	Secure	92 (17.7)	31.84 (1.32)	<0.001
	Mild	165 (31.8)	28.58 (3.77)	
	Moderate	198 (38.2)	21.09 (7.90)	
Mean ±SD: 8.00 (5.74)	Severe	64 (12.3)	13.50 (7.49)	

Independent t-test was conducted to assess differences in maternal QoL scores across psychosocial variables, and all tests were significant at p < 0.01. The overall average score was calculated to determine the cut-off point for all variables except social support and food insecurity. Participant scores lower than the average score represented low, while those above the average represented high.

The results of hierarchical multiple regression

Before running the hierarchical linear regression, multicollinearity assumptions were checked: the Tolerance and Variance Inflation Factors (VIF) values were within acceptable limits[30,31]. Among sociodemographic indicators, income and gestation were the most salient. In particular, higher income was related to higher QoL scores, while women in the third trimester recorded lower quality of life. In addition, women who wanted their pregnancy had better QoL than women who were not ready for the index pregnancy. Furthermore, women with more children and a larger family size indicated a lower QoL. In total, the sociodemographic variables accounted for 47% of the variance in the outcome.

As shown in Table 3, after adjusting for maternal sociodemographic characteristics in Step 1, food insecurity showed an inverse relation (β = − 0.52, *t* = -7.07, P < 0.01). In contrast, social support positively affected maternal QoL (β = 0.11, *t*= 3.47, P < 0.01). Both variables explained an additional 12% of the variance of the dependent variable. In step 3, it was noted that the interaction terms between financial strain and IPV (β= -.18, *t*= -3.23, p < 0.01) and of food security and perceived stress

(β= .18, *t*= 3.05, p < .01) significantly predicted maternal QoL. Figure 1 shows that participants with high financial strain reported lower levels of QoL when a high level of IPV was present, with a 26% variance in QoL contributed by both variables. In contrast, as financial strain decreases with lower levels of IPV, quality of life increases, with a 12% variance attributed to the interacting factors. The result further shows in Figure 2 that lower food insecurity and high social support increased maternal quality of life. Both variables account for a 37% variance in maternal QoL. On the other hand, higher food insecurity and low social support decreased maternal quality of life, with a 50% variance attributed to the interaction of both variables.

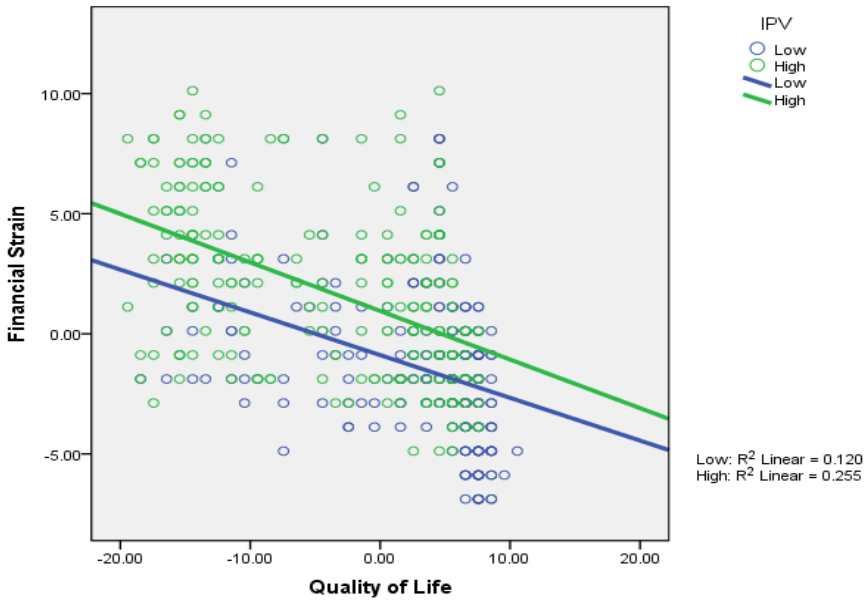

Figure 1. Two-way interaction effects of financial strain and IPV on maternal quality of life in selected primary health care centers of Ibadan metropolis, Nigeria (n=519)

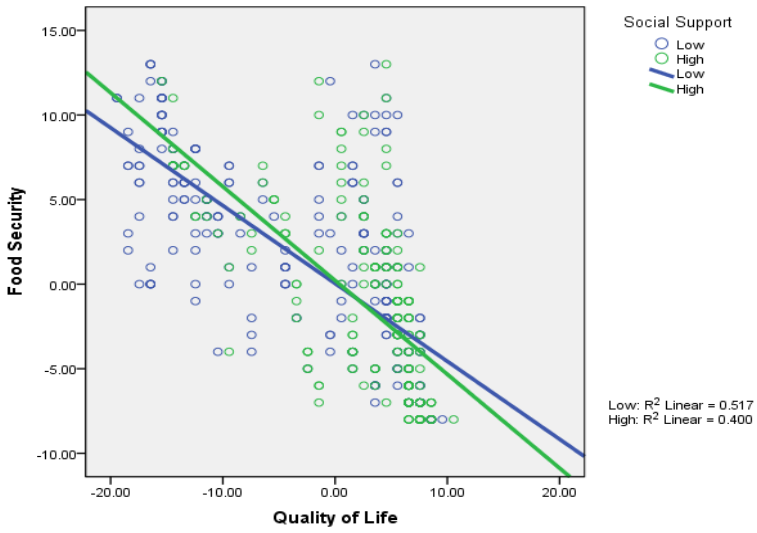

Figure 2. Two-way interaction effects of food insecurity and social support on maternal quality of life in selected primary health care centers of Ibadan metropolis, Nigeria (n=519)

Table 3. Hierarchical Multiple Regression predicting maternal quality of life in selected primary health care centers of Ibadan metropolis, Nigeria (n=519)

Predictors	**Step 1**		**Step 2**		**Step 3**	
	β	**p-value**	**β**	**p-value**	**β**	**p-value**
Sociodemographic characteristics						
Age	.08	0.075	.07	0.064	.07	0.056
Marital Status	-.06	0.037	-.03	0.152	-.02	0.131
Estimated monthly income	.25**	<0.001	-.08	0.085	-.09	0.064
Pregnancy Readiness	.10**	0.003	.06	0.051	.05	0.096
Gestation	-.43***	<0.001	-.27***	<0.001	-.25***	<0.001
Parity	-.10*	0.013	-.04	0.311	-.03	0.385
Family Size	-.07	0.054	.08	0.050	.08	0.045
Psychosocial variables						
Financial Strain			-.07	0.103	-.08	0.074
Food Insecurity			-.52***	<0.001	-.52***	<0.001
IPV			-.06	0.122	-.00	0.893
Perceived stress			-.01	0.826	-.02	0.562
Social Support			.11**	0.001	.11***	0.001
Interactions						
Financial strain x food insecurity					.06	0.367
Financial strain x IPV					-.18**	0.001
Financial strain x Perceived stress					.01	0.777
Financial strain x Social support					-.07	0.137
Food Insecurity x IPV					.01	0.843
Food Insecurity x Perceived stress					.02	0.647
Food Insecurity x Social support					.18**	0.002
IPV x Perceived stress					.03	0.817
IPV x Social support					-.04	0.400
Perceived stress x Social support					.01	0.783
R	.69		.77		.79	
R^2	.48		.60		.62	
Adjusted R^2	.47		.59		.60	
ΔR^2	-		.12		.03	
df	7, 511		12, 506		22, 496	
F	66.34**		61.79**		36.64**	
ΔF	-		29.51**		3.22**	

*Note: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; IPV: Intimate partner violence*

DISCUSSION

Social determinants establish individual vulnerability to poor health. Physiological, psychological, and social risk factors and inadequate support endanger a vulnerable pregnant woman. The current study estimated the individual and joint effects of perceived stress, financial strain, food insecurity, intimate partner violence, and social support experienced by a cross-sectional sample of pregnant women on maternal quality of life (QoL). Through the analysis of pairs of stressors, it was possible to determine whether multiple stressors could negatively affect a mother's quality of life during pregnancy. This information can be used to determine which women are most at risk of having unfavorable maternal and fetal outcomes.

Food insecurity and social support mainly affected prenatal QoL, while financial strain/IPV and food insecurity/social support showed interaction effects. The study findings aligned with the hypothesis that experiencing food insecurity and poor social support during pregnancy reduces QoL. According to the results of an Iranian study[20], pregnant women in the mild to severe food insecure groups had their overall QoL scores reduced by 5.2 to 14.11 points just by reducing household food security by 1 unit. Pregnancy can be physically and mentally taxing, and food insecurity can aggravate stress[32]. Numerous studies have shown a relationship between food insecurity and lower QoL and psychosocial effects, such as elevated levels of anxiety and depression[33,34]. Additionally, a different study found that pregnant women who lacked social support had higher rates of depressive symptoms and lower quality of life[35].

This study went beyond its primary goal of examining the main effects to investigate the possibility that different psychosocial stressors could interact to increase the risk for poor prenatal QoL. The results show that stronger social support and lower food insecurity jointly predicted a better QoL among the participants, suggesting that strong support networks are protective, especially in the presence of additional risk factors like food insecurity. Social support is closely tied to food security in lower-income countries like Nigeria. Many people must rely on informal social support networks in the case of socioeconomic crises because official state social security measures are inadequate[36]. Pregnant women experiencing food insecurity may benefit emotionally or practically from social support, which will help them better manage or cope with their circumstances and minimize its impact on their mental health. Membership and access to formal and informal groups increased social capital in a study conducted in Nigeria in 2011[37], which improved social welfare by decreasing poverty and food insecurity. The study finding suggests that having social support lessens the impact of economic hardship on food insecurity.

Although this study found no main effects of financial strain and IPV on prenatal QoL, the interaction between both variables was statistically significant. Earlier studies have identified that women experiencing economic hardship, food insecurity, unplanned pregnancies, or poor social support reported being more vulnerable to domestic violence during pregnancy[38,39]. There may be a link between prenatal poverty and adverse effects, such as inadequate nutrition, financial stress, poor prenatal care, a lack of social support for mothers, and adverse birth outcomes [40]. Mothers and their families may suffer additional financial burdens during pregnancy as they brace for increased childcare expenses. Pregnant

women may also lose income if their work conditions change due to their pregnant status.

According to Drentea & Reynolds[41], women endure higher financial strain than males, resulting in health complaints and low psychological well-being, contributing to additional economic gender inequality. Another impact of IPV is economic strain: an earlier study [35] discovered that females who experienced high-intensity IPV were more likely to experience financial difficulties. Research has demonstrated that pregnant women who encountered intimate partner violence (IPV) exhibited higher levels of depression during pregnancy and the postpartum period[42].

The findings from the study are supported by the social determinants of health model, which recognizes that a person's socioeconomic environment and psychosocial state affect his or her health and life experiences. The social determinants of health approach suggest that understanding and addressing pertinent social determinants can improve health outcomes and eliminate health disparities.

Strengths and Limitations

A particular strength of the current research was assessing the combined effects of the predictor psychosocial variables on prenatal QoL, which advanced the limited empirical examinations of these associations to date. The study also included both objective and subjective measures of maternal stress. However, this study has some limitations. First, this study used a cross-sectional sample size and a specific urban location, which may limit generalizability and causal relationships among the study variables, and cannot be determined. Future research should involve longitudinal investigations and a more diversified sample of respondents. Second, the study depends only on self-reported data, which could lead to common method bias. Future studies could integrate qualitative and quantitative methodologies to examine women's conceptualization of their psychosocial stressors experience to understand better how they interact. Furthermore, empirical studies investigating whether addressing psychosocial needs can be an effective intervention for enhanced prenatal QoL are recommended.

CONCLUSIONS AND RECOMMENDATIONS

The significance of evaluating prenatal QoL using various types of stress is highlighted by the findings of this study which shows that both exposures to stressful events and perceptions of distress predicted the study outcome, sometimes synergistically. Women's healthcare providers are uniquely positioned to provide further support in managing the subjective and objective sources of stress and its adverse health outcomes. As part of routine antenatal care, healthcare centers in Nigeria should incorporate assessments of clinical factors of gestation with those of psychosocial needs. The findings of this current study imply that food insecurity and financial pressure among pregnant women are associated with low maternal quality of life, highlighting the need to address socioeconomic factors as a cause of stress in women's lives. Complete medical and psychosocial profiles are needed to enhance pregnant women's health and ensure an optimal pregnancy for them and their newborns. Psychosocial factors such as domestic violence and inadequate social support also require attention as they are associated with low socioeconomic status. Lawmakers also need to acknowledge and address critical social determinants of health and promote social policies that guarantee economic stability, financial security, and appropriate psychosocial support resources for pregnant women in Nigeria to benefit their physical and

psychological health during this vulnerable state.

ABBREVIATIONS

QoL: Quality of life; IPV: Intimate partner violence; SDH: Social determinants of health.

ETHICS APPROVAL AND INFORMED CONSENT

The study protocol was approved by Redeemer's University's Ethical Review Board (REC/30/08/2021/RUN/11). All participants in the study provided informed consent.

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CONFLICTS OF INTEREST

The author declares no conflicts of interest.

AVAILABILITY OF DATA AND MATERIALS

All data pertaining to this study are available on reasonable request from the author.

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