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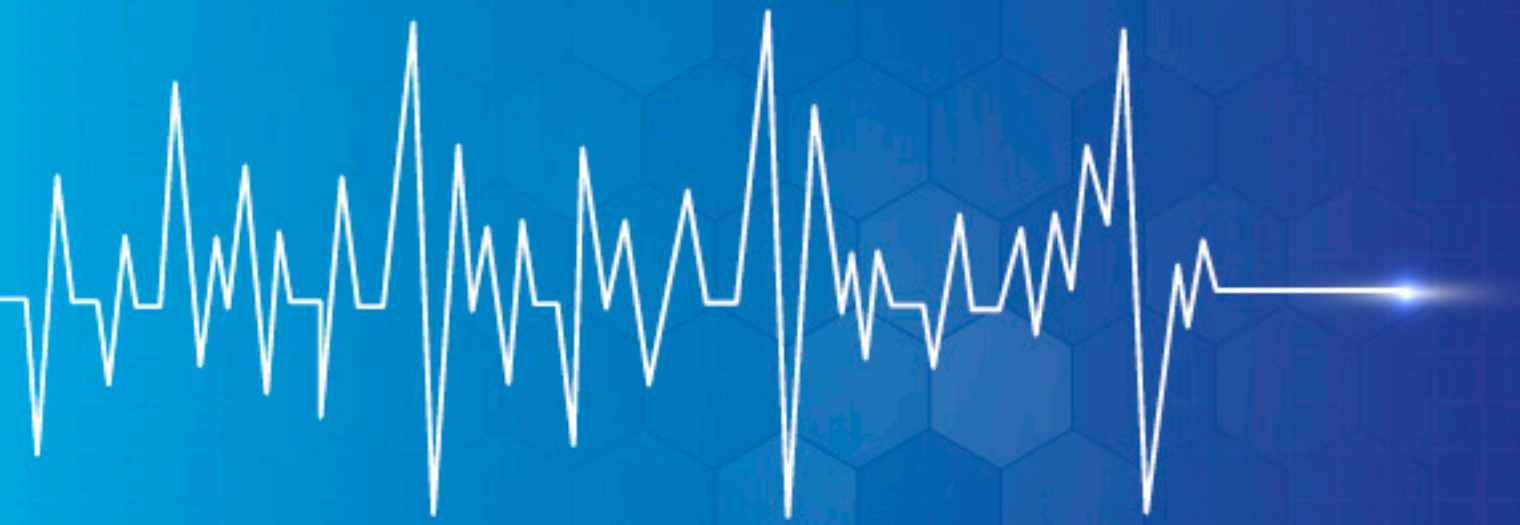

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Pregnancy-Related Complications and Their Socioeconomic Determinants among Low-Income Women in Bangladesh

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ABSTRACT

Obstetrics complication as a result of pregnancy is a significant socio-cultural health issue in low socio-economic environments especially in Bangladesh where social-economic deprivation and poor circumstances of accessing high-quality maternal healthcare are still widespread. This paper focuses on the commonality of the pregnancy related complications and the socioeconomic factors of these among the low income women in Bangladesh through a cross-section design. Five hundred pregnant women who were recruited in the community and facility based settings and in various districts were used to collect the data. Data of socio-demographic status, education, occupation, marital status, access to healthcare facilities and conditions during pregnancy, such as anemia, hypertensive disorders, and pregnancy infections, were collected by means of structured interviews and antenatal documentation. The descriptive statistics, a bivariate analysis, and a multivariate logistic regression model were used to determine factors related to pregnancy-related complications as well as sensitivity and interaction analyses. The results show that majority of the participants had one or more pregnancy-related complications. Education levels of the mothers and the occupation status became major risk factors with women who had low or incomplete levels of education having higher odds of complications especially anemia. A job in the service line of work was linked to a lower risk of complications. The associations of hypertensive disorders with social vulnerability were also more pronounced with separated or divorced status of marriage whereas the severe complications had less strong associations with characteristic socioeconomic factors in the individual, implying the impact of health system and emergency care variables. Altogether, the paper presents the paramount importance of socioeconomic and structural factors to maternal health.

INTRODUCTION

Maternal health is a very critical public health issue all over the world, especially in low-income populations in which pregnancy related complications still play a significant role in maternal morbidity and mortality (Karim *et al.*, 2025). In spite of the progress experienced throughout the world over the past decades in terms of maternal mortality reduction, one can still recognize preventable complications during pregnancy, delivery, and the postpartum period with disproportionately high levels among socioeconomically disadvantaged women (Chaves Cerdas, 2025). International health agencies have demonstrated that most maternal deaths happen in low- and lower-middle-income nations and this is a manifestation of underlying disparities in quality healthcare, nutrition, education, and social security (Akib *et al.*, 2025). Pregnancy complications like anemia, hypertensive disorders, obstetric bleeding, pregnancy infection as well as gestational diabetes not only put the mother at risk of poor health but also negatively influence the fetal and neonatal outcomes, hence keeping the health and poverty cycles intergenerational.

There is a particular set of structural, economic, and social factors that violate populations of low-income individuals making them vulnerable to negative pregnancy outcomes. Poor access to antenatal health services, lack of qualified health professionals, substandard healthcare infrastructures and financial barriers usually frustrate early detection of pregnancy complications and their treatment (Collier *et al.*, 2025). There is also poor maternal nutrition, high rate of chronic infections, early marriage, high parity and reproductive health knowledge among others that intensify the situation during pregnancy (Rahman *et al.*, 2025). Sociocultural beliefs and inadequate health services often compound such difficulties and this is because gender inequality, sociocultural beliefs and weak health systems serve to undermine the efforts of supporting safe motherhood in resource limited settings (Schwaerzer, 2025). Consequently, they appear to increase women of low income status to develop preventable complications and reduce their likelihood of attaining adequate and timely healthcare attention.

Even though certain policies and international efforts have stressed the need to improve maternal health, there is still a lot of missing information on which factors, in particular, should underlie pregnancy complications among low-income communities (Haque *et al.*, 2020). The available evidence also indicates that socioeconomic

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status, educational achievement, household income, employment status, and access to healthcare services are a determining factor in influencing maternal health outcomes. The fact remains though that the extent and interplay of these factors differ depending on contexts and therefore empirical evidence needs to be provided depending on the context (Hossain *et al*., 2023).

Cross-sectional studies are a significant methodological question to investigate the prevalence of the pregnancy complications and their factors at a given time. Such designs are especially useful when there is low-income situation where longitudinal information collection is limited due to the scarcity of resources (Collier *et al*., 2025). Cross-sectional research has the ability to produce important information on risk patterns and health service utilization by taking a snapshot of maternal health conditions and other associated socioeconomic and demographic factors (Zhao *et al*., 2024). Such insights are to be required in the identification of high risk groups, formulation of preventive strategies and resource allocation in the maternal health programs.

The research problem that needs to be addressed in this study is a result of the awful burden of pregnancy complications in low-income women and the fact that there is very little comprehensive and context-specific evidence elucidating the determinants behind these complications (Wilson, 2024). Adverse outcomes are still common even in the context of current maternal health interventions, which implies that the current measures used are not effective enough in solving the sophisticated socioeconomic and healthcare-related issues affecting maternal health (Uddin *et al*., 2025). In the absence of sound empirical evidence, the policymakers and health practitioners encounter difficulties in the formulation of effective, equitable, and sustainable interventions to meet the needs of the vulnerable populations.

The core purpose of the given study is to estimate the rate of pregnancy-complications among the women belonging to low-income groups and to analyze the socioeconomic, demographic and healthcare-related variables related to the given complications through the use of the cross-sectional study design (Safdar *et al*., 2025). In particular, the research is expected to establish a list of frequent pregnancy complications, the distribution of the latter within major socioeconomic factors, and the dependence of this relationship with the access to maternal healthcare services and unfavorable pregnancy outcomes (Zhang & Wei, 2021). Through the production of evidences based on an empirical data, this study is expected to contribute to the current spheres of literature on maternal health and facilitate the establishment of specific interventions that would help to decrease the risks associated with pregnancy in economically disadvantaged women.

By selecting a specific issue on the maternal health of low-income groups, this research demonstrates that it is crucial to at least consider structural disparities and enhance the health systems to improve pregnancy outcomes. This outcome will significantly contribute to the understanding of the same by the practitioners working in the field of health in humanity as well as discoursing policymakers and scientists who are dedicated to promoting maternal health equity and attaining sustainable improvements in maternal and neonatal outcomes.

LITERATURE REVIEW

Theoretical Perspectives on Maternal Health and Pregnancy Complications

The social determinants of health and health systems frameworks are typically used to study maternal health outcomes in terms of the interplay of socioeconomic factors, access to healthcare, and the nature of individual health behaviors. Social determinants of health theory believes that health risks and outcomes are greatly influenced by income, education, occupation as well as living conditions, especially to the vulnerable communities (Kluivers *et al*., 2025). When applied to the context of maternal health, this framework identifies the risks of exposure to the development of pregnancy-related complications due to poverty, food insecurity, low education levels, and substandard living conditions which limit access to nutrition, access to timely healthcare and information about their health (Leng *et al*., 2025). Also, the health systems model highlights the importance of service accessibility, care quality, accessibility, and postpartum care continuity in the treatment and prevention of pregnancy complications (Misu *et al*., 2025). All these theoretical frameworks ultimately indicate that the complications of pregnancy among low-income groups are not merely a biomedical phenomenon, but it is entrenched within the larger social and structural categories.

The other theoretical approach of interest is the life-course approach which focuses on the cumulative life-long exposures to disadvantage in a woman that has an effect on reproductive health. Malnutrition in early life, teen pregnancy, pregnancy re-hospitalization, and poor access to preventive care are some of the factors that increase pregnancy vulnerability (Khan *et al*., 2025). This is a view to support the necessity to investigate the health outcomes of mothers in the wider context of the socioeconomic and reproductive lives of women especially in low-income environments where cumulative disadvantage is a common eventuality.

Prevalence and Types of Pregnancy Complications in Low-Income Populations

Empirical research always indicates that the likelihood of complications arising during pregnancy is higher among the members of the low-income groups than high-income ones. The most frequent complications reported are maternal anemia, pregnancy hypertension, obstetric bleedings, gestational diabetes, infections and preterm childbirth (Carmichael *et al*., 2025). Anemia has been discovered to be among the commonest conditions, mostly in low-resource setting, where nutritional shortage and parasitic infections are rife. Hypertensive disorders, such as pre-eclampsia and eclampsia, are identified to

cause most of the maternal morbidity and mortality and are often worsened with late diagnosis and poor antenatal care (Hguig *et al*., 2025).

A number of studies carried in the low-income and middle-income countries also show that a significant proportion of pregnancy complications are never noticed until it is too late because of the low rate of antenatal care use. The lack of skilled healthcare professionals, deficient screening, and referral processes contribute to the development of additional risks of negative outcomes even more (Perkins, 2025). It is also evidenced that female members of the low-income population are at a higher risk of having several concurrent complications, which further endangers the health of both babies and their mother.

Socioeconomic Determinants of Pregnancy Complications

There is an extensive mass of literature that underscores the close relationship between the socioeconomic status and the pregnancy outcomes. Low household income, lower levels of education, joblessness, and unstable living conditions have been reiterated to contribute towards high risks facing pregnancy complications. This is because education is also very important in determining health literacy, health seeking behavior, and compliance to the recommendation of antenatal care (Akhter, 2025). Less educated women will not identify early symptoms of concerns with their pregnancy and will wait longer before seeking medical assistance.

The income earned by households has a direct impact on the purchasing power or the amount of money needed to afford healthy food, transportation to health care institutions and out-of-pocket health services. Lack of funds sometimes results in late or partial antenatal care exposing individuals to the risk of complications that may remain undetected (Mallipeddi *et al*., 2025). The empirical research also reveals that a woman who works in informal or other physically demanding labor in pregnancy is also at the high risk of adverse outcomes, especially in an environment where there are no occupational health safeguards.

Access to Maternal Healthcare Services

The core factor in the outcome of pregnancy of low-income population is access to quality maternal healthcare services. Various researchers have established that the level of antenatal care cover is closely linked to increased pregnancy complications (Talukder, 2020). Lack of qualified health practitioners, and medical resources in rural and underserved regions also contribute to the lack of good healthcare delivery to mothers (Tsamantioti & Razaz, 2025). It has been indicated that utilization is not optimal among low-income women, even in situations when the services of the antenatal care provider are offered, because of a sociocultural factor, ignorance, and mistrust towards the healthcare systems (Sakib *et al*., 2025). The practice of late beginning of antenatal care and less than recommended visits is a prevalent trend in empirical studies (Kim *et al*., 2025).

Nutritional Factors and Maternal Health Outcomes

Maternal nutrition is considered by far a critical factor that determines the outcome of pregnancies. Research studies always indicate greater undernourishment, deficiencies of micronutrients and poor weight gain during pregnancy among women in low-income groups (Joshi, 2025). Poor nutritional conditions result in increased vulnerability to anemia, infections, and hypertensive conditions, not mentioning the negative effect of such conditions on possibly the fetus in terms of growth and development. Nutritional risks are also increased due to food insecurity, having low dietary diversity and cultural practices of diet among the general population during pregnancy (Walker & Goje, 2025). Although the role of maternal nutrition has been acknowledged, empirical literature suggests that nutritional interventions have not been well incorporated into the routine antenatal care in low-resource communities (Ahmad *et al*., 2025).

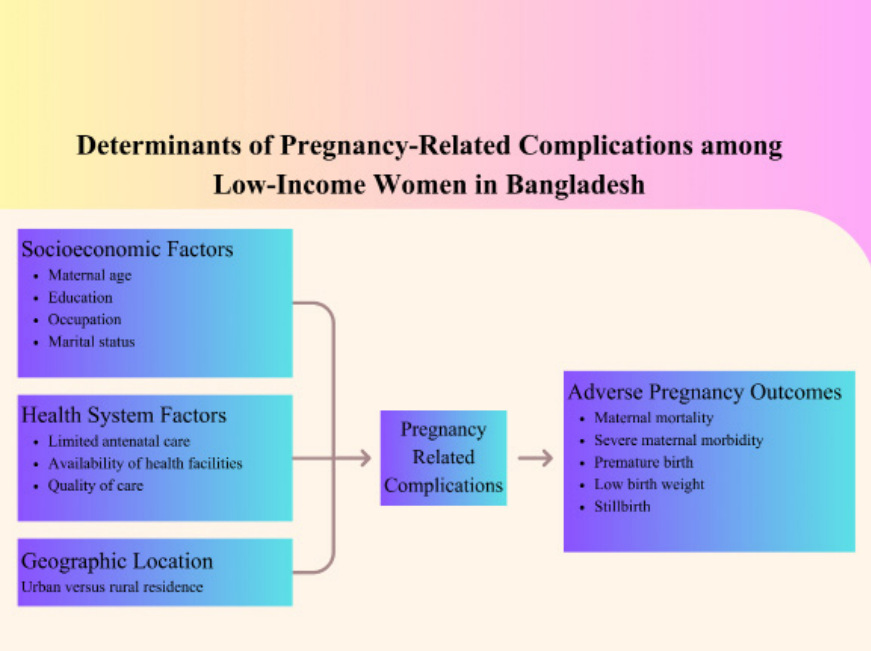
Gaps in Existing Literature

Even though current literature contains useful information about pregnancy complications and their antecedents, there are multiple critical gaps in this area. To begin with, the majority of the research concentrates on singular risk factors without paying much attention to the synergization of socioeconomic, nutritional, and healthcare-associated factors. Second, the current studies are mostly based on facility-based data and consequently underestimate the actual magnitude of pregnancy complications in women with scarce healthcare access.

As well, although cross-sectional studies are regularly used, the methodological rigor, variables measurement, and methods of analysis vary, which impedes cross-study comparability's. There are few studies that provide analyses detailed enough to incorporate socioeconomic conditions, healthcare access, and pregnancy outcomes within a single analytical framework These gaps demonstrate the necessity of the designed cross-sectional studies that would systematize the prevalence and determinants of pregnancy complications among low-income women. Filling these gaps, the current research will be able to provide empirical data contributing to the understanding of maternal health issues in low-income groups and developing the evidence-based interventions that may be focused on preventing pregnancy-associated complications and improving health outcome among mothers.

Conceptual Framework

The conceptual framework depicts the connections between socioeconomic, geographic and health systems factors and pregnancy-complicated women in Bangladesh who have low incomes. The socioeconomic profiles, maternal age, education, occupation and marital status are theorized to be the determinants underlying



factors that predispose women to poor maternal health outcomes. Contextual influences that influence exposure to pregnancy-related risk are put in the geographic location and health system, including access to antenatal care, access to health facilities, and quality of care. Pregnancy complications are considered the main outcome of interest and are associated with negative pregnancy outcomes, such as severe cases of maternal morbidity and death. The framework offers a systematic platform of selecting variables and testing the hypothesis and the empirical analysis by identifying individual and systemic-level pathways that influence the maternal health conditions in low-income communities.

MATERIALS AND METHODS

The study design used is a cross-sectional study that investigated pregnancy-related problems and factors in low-income pregnant women in Bangladesh. The research was carried out in the chosen health institutions and the community in various districts. Eligible individuals were pregnant women who were low-income earners who received antenatal care services in the study areas or in the study suggesting communities during the period of the study. Recruitment was done systematically through antenatal care registers and community-based recruitment through the assistance of local health workers. The data were gathered with the help of professionalized, pre-tested questionnaire for face-to-face interviews, which was enhanced by checking the antenatal care cards and medical records, in case they were present. Details of socio-demographic factors, obstetric history, antenatal care, nutrition, and pregnancy related complication were collected.

The major outcome variables were conditions related to pregnancy such as anemia, high blood pressure conditions and infections. They were independent variables that comprised of maternal age, education, occupation, marital status, study setting and geographic location. Statistical software was used in the analysis of data. The characteristics of the participants were summarized with the help of the descriptive statistics, and the bivariate and multivariate analyses of the logistic regression were performed to define the factors related to pregnancy-related complications. The institutional review board in Bangladesh gave approval to this study in regard to ethical matters. Informed consent was signed by all the participants before the data collection and the group participant information was not revealed to anybody.

RESULTS AND DISCUSSION

This part shows the critical results about the prevalence and determinants of pregnancy-related complications among low-income women in Bangladesh and explains them using the literature at hand. The findings of the descriptive, bivariate and multivariant analyses are addressed to show their implications on public health.

Table 1: Prevalence of Pregnancy-Related Complications

n	Yes	Prevalence Percent
500	294	58.8

Table 1 shows the general prevalence of pregnancy-related complications among the participants of the study. In overall prevalence, 294 of 500 pregnant women that were analyzed had reported at least one pregnancy related complication or were diagnosed with this type of complication, which resulted in a general prevalence of 58.8 percent. This implies that over fifty percent of low-income population women had tainted health pension during pregnancy.

The prevalence of the pregnancy-related complications is observed to be very significant in the present study

which indicates the high maternal health burden on the low income population in Bangladesh. The prevalence of 58.8 percent indicates that a significant number of women are exposed to pregnancy complications; and it could be indicative of continuous socioeconomic withdrawal, inaccessibility to good quality antenatal care, and poor nutrition among women who are economically disadvantaged. Scholarly research in low and middle-income environments has also indicated a relatively high rate of prevalence, specifically in the case of women who lack access to maternal health services and have low health literacy (Chen *et al*., 2025). The results highlight the persistence of the low-income pregnant women to preventable health risks, even after the efforts by the country and the world on providing maternal health outcomes. Such prevalence also highlights the importance of specific interventions that should be prioritized to address the problem of early risk detection, enhanced access to antenatal care, and combined nutrition and social support initiatives in the communities with low incomes.

Table 2: Socio-Demographic Characteristics by Pregnancy-Related Complication Status

Characteristic	level	No	Yes	p test
n		206	294	
Age Years (mean (SD))		26.00 (5.30)	25.72 (4.84)	0.549
Marital Status (%)	Married	199 (96.6)	281 (95.6)	0.064
	Separated/Divorced	1 (0.5)	9 (3.1)	
	Widowed	6 (2.9)	4 (1.4)	
Education (%)	Higher (Diploma/University)	14 (6.8)	8 (2.7)	0.072
	Higher secondary (11–12)	17 (8.3)	37 (12.6)	
	No formal schooling	33 (16.0)	42 (14.3)	
	Primary (1–5)	46 (22.3)	81 (27.6)	
	Secondary (6–10)	96 (46.6)	126 (42.9)	
Occupation (%)	Day labourer	20 (9.7)	37 (12.6)	0.225
	Domestic worker	18 (8.7)	23 (7.8)	
	Garments worker	47 (22.8)	68 (23.1)	
	Housewife	86 (41.7)	124 (42.2)	
	Other	9 (4.4)	11 (3.7)	
	Service	18 (8.7)	11 (3.7)	
	Small business	8 (3.9)	20 (6.8)	
Setting (%)	Community	48 (23.3)	78 (26.5)	0.475
	Facility	158 (76.7)	216 (73.5)	
District (%)	Barishal	19 (9.2)	38 (12.9)	0.770
	Chattogram	28 (13.6)	39 (13.3)	
	Dhaka	24 (11.7)	35 (11.9)	
	Khulna	28 (13.6)	33 (11.2)	
	Mymensingh	21 (10.2)	29 (9.9)	
	Rajshahi	23 (11.2)	43 (14.6)	
	Rangpur	32 (15.5)	37 (12.6)	
	Sylhet	31 (15.0)	40 (13.6)	

Its results illustrated in Table 2 show that there was general similarity in the basic socio-demographic traits of women who had complications linked to pregnancy and those without complications. The finding that the differences based on age, marital status, education, occupation, study settings and district are not statistically significant implies that pregnancy-related complications were prevalent across the wide range of the socio-demographic subgroups of low-income population. The non-relationship between maternal age and complications related to pregnancy is based on the contradictory results of other research who raise risks in very young or old mothers. It can be noted, though, that the age range of the subjects, participation in this study was somewhat narrow, which might have restricted the possibility of acquiring age-specific differences. Other cross-sectional studies reported a similar result among the economically disadvantaged groups of population because socioeconomic and healthcare factors are more dominant than the age factor.

Though, the marital status was not significant, the fact that the percentage of separated or divorced women was higher in the case of those women who had complications could indicate social weakness, lack of social support, or instability at the economic level. Marital disruption can adversely influence the maternal health either by exposing the maternal health to psychosocial stress and less access to household resources, even in cases where no statistical significance exists (Hussein, 2025). The level of educational attainment exhibited a tendency of increased complication rates in women with less education with an interest in women having lower levels of education or no education at all. Although this correlation was not found to be statistically significant, the trend is the same with the available literature that revealed that low levels of education were related to less health literacy, late healthcare seeking, and worse pregnancy outcomes. A small proportion of highly educated women may have insufficient statistical power to detect significant differences.

There was also no significant correlation between occupation status pregnancy-related complications, even though women having an informal and physically demanding job, like day labor or garment work, were more common in cases of problems. This observation aligns with the earlier research to mention the susceptibilities of health to heavy labor, excessive working hours, and the insufficient security at the workplace during pregnancy within low-income contexts. The limited difference by setting of studies and district implies that pregnancy complications have no specific geography or service delivery settings within Bangladesh. This observation highlights the comprehensive problem of maternal health in the regions and supports the importance of country-wide interventions to enhance the quality of antenatal care, nutrition, and early detection of risk among women with a low income level.

Table 3: Bivariate Analysis of Maternal Age and Pregnancy-Related Complications

test	statistic	df	P value	mean no	mean yes
t-test: Age years by any complication	0.589685012	415.7801902	0.555722143	25.99514563	25.72108844

Table 3 represents the bivariate analysis that would check the relationship between maternal age and such pregnancy-related complications applying independent samples t-test. The average age of those women who stayed pregnant with no complication related to pregnancy was 25.99 years, and that of the rest who had at least one complication was 25.72 years. The bivariate t-test had a test statistic of 0.59 and 415.78 degrees of freedom. The mean age of the two was not significantly different ($p = 0.556$), which is evidence to show that there was no evidence of a relationship between maternal age and pregnancy complications at the bivariate level.

The bivariate test shows that among the low-income women under study, maternal age did not have any significant link to occurrence of pregnancy-related complications. This observation might be an indication that age in and by itself is not seen to be a determinant of poor pregnancy outcomes in this population. Even though maternal age is often mentioned as a biological risk factor of pregnancy complications especially those stemming among adolescent mothers and women of advanced maternal age, the non-relation observed in study could be an indication of the relatively small age range of the sample. Majority of the women fell on the normal range of reproduction which possibly lacked variability and lowered the chance of exhibiting age related differences.

Furthermore, it is not the biological factors related to age that usually occupy the leading role in the preferences of maternal health outcomes, the socioeconomic constraints, lack of access to quality antenatal care and nutritional deficiencies prevail especially in low-income settings like Bangladesh. The same findings have been reported in the previous research that was carried out in similar situations, and where the maternal age was not statistically significantly related to pregnancy complications even after other wider social and healthcare-related to pregnancy complications even after other wider social and healthcare related factors have been taken into account. The findings made as a result of this bivariate analysis suggest that more multivariate analyses are required to determine whether the maternal age is interactive with other factors, either parity, nutritional status, or use of healthcare in determining pregnancy related complications. These results support the relevance of holistic maternal health approaches that take into account both structural and service-related factors as opposed to risk profiling that is based on age.

Table 4: Multivariable Logistic Regression Analysis of Factors Associated with Pregnancy-Related Complications

term	AOR	std.error	statistic	p_value	CI_low	CI_high
(Intercept)	1.36	0.79	0.39	0.70	0.29	6.39
age_years	0.99	0.02	-0.29	0.77	0.96	1.03
educationHigher secondary (11–12)	4.38	0.55	2.70	0.01	1.53	13.30

educationNo formal schooling	2.41	0.51	1.71	0.09	0.90	6.87
educationPrimary (1–5)	3.37	0.49	2.46	0.01	1.30	9.24
educationSecondary (6–10)	2.45	0.47	1.89	0.06	0.99	6.50
occupationDomestic worker	0.64	0.44	-1.01	0.31	0.27	1.52
occupationGarments worker	0.84	0.35	-0.51	0.61	0.42	1.64
occupationHousewife	0.77	0.32	-0.83	0.41	0.41	1.42
occupationOther	0.74	0.55	-0.56	0.57	0.25	2.18
occupationService	0.28	0.50	-2.54	0.01	0.10	0.74
occupationSmall business	1.27	0.52	0.47	0.64	0.47	3.65
settingFacility	0.83	0.22	-0.82	0.41	0.54	1.28
districtChattogram	0.65	0.39	-1.10	0.27	0.30	1.39
districtDhaka	0.66	0.40	-1.04	0.30	0.30	1.45
districtKhulna	0.53	0.39	-1.63	0.10	0.24	1.13
districtMymensingh	0.65	0.42	-1.03	0.30	0.28	1.47
districtRajshahi	0.83	0.40	-0.47	0.64	0.38	1.80
districtRangpur	0.58	0.38	-1.44	0.15	0.27	1.21
districtSylhet	0.58	0.39	-1.42	0.15	0.27	1.22
marital_statusSeparated/ Divorced	7.42	1.08	1.86	0.06	1.31	139.75
marital_statusWidowed	0.41	0.68	-1.31	0.19	0.10	1.53

The findings of the multivariate logistic regression analysis of variables that were related to occurrence of pregnancy related complication were provided in table 4 as per the results. Adjusted odds ratios (AORs) along with 95 percent confidence interval (CI) as well as p-values are provided. The maternal age did not have significant association with complications in pregnancy once the other covariates had been factored (AOR = 0.99; 95% CI: 0.96-1.03; p = 0.771) which means that the maternal age did not play an independent role on the likelihood of experiencing complications.

The level of education was significantly correlated with complication during pregnancy. Such women who graduated with higher education (1112) were very likely to be having pregnancy related complications as compared to the reference education (AOR = 4.38; 95% CI: 1.5313.30; p = 0.007). On the same note, the women who received primary education (grade 1–5) were more significant to complications (AOR = 3.37; 95% CI: 1.309.24; p = 0.014). The type of secondary education (grades 610) and lack of formal schooling were both found to be more likely associated with the likelihood of complications, but these associations were not found to significantly exceed conventional levels of statistical significance (p=0.059 and p=0.087, respectively).

There were mixed associations between occupational status and occupation. The odds of infection with pregnancy-related complications were much lower in women who worked in service occupations than in the occupation of reference (AOR = 0.28; 95% CI: 0.10-0.74; p = 0.011). No significant relations were found in domestic workers, garments workers, housewives, small business workers, and other jobs. In the case of healthcare setting, the facility setting was not significantly related to pregnancy-related complications than community-based recruiting (AOR = 0.83; 95% CI: 0.54128; p = 0.410).

The administrative divisions as a geographic location did not significantly improve on pregnant-related complications. Though, there were some lower odds in various districts such as Khulna, Rangpur as well as Sylhet, none of these were found to be statistically significant at the 5 percent level. The marital status was marginally associated with pregnancy related complications. Divorced or separated women were more likely to develop complications in comparison to married women (AOR = 7.42; 95% CI: 1.31139.75; p = 0.062), although the difference was not found to be significant. Pregnancy related complication was not significantly related to widowed status (AOR = 0.41; 95% CI: 0.10153; p = 0.189).

Multivariate logistic regression model reveals education and occupational status as the most important variables that correlate with pregnancy related complications among the low-income earners in Bangladesh. Having accounted demographic variables and the possibility of confounders, there was no independent relation between maternal age and adverse pregnancy outcomes that lend more strength to the results of the bivariate analysis and a suggestion that biological age may have a minimal contribution to the adverse pregnancy outcomes in the population in the presence of the socioeconomic and contextual factors.

The level of education proved to be an important predictor of pregnancy complications. The increased

probability in women with the primary and higher secondary education might seem de counterintuitive, and the purpose of education is usually regarded to be protective of maternal health. Nevertheless, the result could be due to complicated contextual forces among low-income groups, in which incomplete education does not invariably relate to enhanced health literacy, monetary stability and dependability on quality health care. Low or middle-educated women might be further predisposed to do informal or manual labor, issue delayed medical assistance, or they might report a greater psychosocial pressure; all of which might elevate pregnancy risks. The same non-linear relationships between education and maternal health outcomes have been observed in other studies that were carried out in low-resource settings.

The much decreased risk of pregnancy-related problems in women with service jobs might indicate a possible buffering influence of even more secure employment. The jobs in the service sector can be linked to ease in earning better income, less physical work, increased health consciousness and utilizing more healthcare facilities. This observation lends importance to the role of quality of employment, as opposed to employment status alone, in determining the outcome of maternal health. The absence of any significant associations according to the study setting and geographic location suggests that the problem of pregnancy-related complications is worldwide among both population groups based on facility and community as well as in various parts of the country of Bangladesh. This observation indicates that low-income women face maternal health problems that are national in nature and not necessarily focused at a single area, and therefore requires some national initiatives to enhance the quality of antenatal care, nutrition, and early detection of complications.

Close association between the separated or divorced women indicates the possibility of the role of the social vulnerability and weakened support systems to the maternal health. Despite the inaccuracy of the large confidence interval, probably because of the limited amount of women belonging to this category, the high odds are in line with the published literature on the fact that marital disruption may impair access of women to financial, emotional, and health care resources in the course of pregnancy.

On balance, the results of this multivariate analysis underscore the fact that the occurrence of pregnancy related complications in low-income women in Bangladesh is highly determined by the socioeconomic and occupational factors, and not necessarily by demographic factors. These findings indicate the significance of combined maternal health programs emphasizing the quality of education, the state of employment and other social determinants in addition to enhancing clinical services.

Table 5: Multivariable Logistic Regression Analysis of Factors Associated with Anemia during Pregnancy

term	estimate	std.error	statistic	p.value	conf.low	conf.high
(Intercept)	0.36	0.84	-1.21	0.23	0.06	1.81
age_years	0.99	0.02	-0.48	0.63	0.96	1.03
educationHigher secondary (11–12)	4.12	0.63	2.25	0.02	1.29	16.04
educationNo formal schooling	5.23	0.61	2.71	0.01	1.71	19.80
educationPrimary (1–5)	4.73	0.59	2.62	0.01	1.61	17.40
educationSecondary (6–10)	3.91	0.58	2.36	0.02	1.38	14.07
occupationDomestic worker	0.70	0.43	-0.83	0.41	0.29	1.63
occupationGarments worker	1.07	0.34	0.21	0.83	0.56	2.08
occupationHousewife	1.02	0.31	0.08	0.94	0.56	1.88
occupationOther	0.59	0.55	-0.94	0.35	0.19	1.72
occupationService	0.47	0.50	-1.53	0.13	0.17	1.22
occupationSmall business	1.47	0.48	0.80	0.42	0.58	3.84
settingFacility	0.86	0.22	-0.69	0.49	0.56	1.32
districtChattogram	0.81	0.38	-0.54	0.59	0.39	1.70
districtDhaka	0.71	0.39	-0.89	0.37	0.33	1.51
districtKhulna	0.59	0.38	-1.36	0.17	0.28	1.26
districtMymensingh	0.80	0.40	-0.56	0.58	0.36	1.76
districtRajshahi	1.30	0.38	0.70	0.48	0.62	2.73
districtRangpur	0.89	0.37	-0.32	0.75	0.43	1.83
districtSylhet	0.80	0.37	-0.58	0.56	0.39	1.67

marital_statusSeparated/ Divorced	2.89	0.72	1.46	0.14	0.75	14.16
marital_statusWidowed	0.39	0.71	-1.31	0.19	0.08	1.48

The results of the multivariate regression model show that the most significant predictor of anemia in pregnant Bangladesh women who live in low-income neighborhoods is educational attainment. There were significantly greater odds of anemia in women who had no formal schooling and those with primary or secondary school education than in the reference group after age and occupation, study setting, geographic location and marital status had been adjusted. Such a robust and coherent correlation highlights the great importance of schooling as a determinant of maternal nutrition and health results. Poor educational attainment is very highly associated with decreased health literacy, poor awareness on nutritional needs when pregnant, and poorer compliance with iron folic acid supplementation. Less-educated women also have the possibility of becoming more economically insecure and exposed to food insecurity, which can increase their susceptibility to anemia even further. The increased risk even among women with higher secondary education indicates that even partial or indirect level of education may be inadequate towards alleviating the nutritional risks in low-income situations especially with structural poverty and inadequate access to quality services to maternal nutrition remaining.

The unrelatedness of the maternal age and anemia should be in consonance with the literature that has been performed by other researchers in resource-constrained facility where anemia is rife among the reproductive ages. This implies that age-related biological factors are not the cause of anemia in pregnancy in populations who have a low level of income but rather chronic nutritional deficiencies and socioeconomic status. The occupational status was not found to have any real importance in the prediction of anemia in this examination. Although other research has linked nutritional depletion with physically demanding or informal careers, no significant results were found here, possibly indicating the presence of overlapping socioeconomic disadvantages between the occupational groups or the lack of diversity in the nature of working conditions among low-income women. On the same note, the fact that the study settings did not show substantial differences implies that there is a gap in effective nutritional screening and supplementation of anemia between the populations served by facilities and those served by community based groups.

The absence of pronounced geographic difference implies that anemia among pregnant women is a universal public health issue in the regions of Bangladesh as opposed to existing within a limited locality. The present finding contributes to the requirement of the nationally direct actions aimed at the enhancement of maternal nutrition programs, but not actions specific to regions.

Table 6: Multivariable Logistic Regression Analysis of Factors Associated with Hypertensive Disorders during Pregnancy

term	estimate	Std error	statistic	P value	Conf low	Conf high
(Intercept)	0.01	1.69	-2.65	0.01	0.00	0.25
Age years	1.04	0.04	0.94	0.35	0.96	1.12
Higher secondary (11–12)	4.34	1.13	1.30	0.19	0.67	86.06
No formal schooling	0.20	1.48	-1.08	0.28	0.01	5.54
Primary (1–5)	0.97	1.12	-0.02	0.98	0.15	19.22
Secondary (6–10)	1.29	1.08	0.24	0.81	0.23	24.51
Domestic worker	1.28	0.86	0.29	0.77	0.23	7.58
Garments worker	0.61	0.81	-0.62	0.54	0.12	3.30
Housewife	1.32	0.68	0.41	0.68	0.39	6.07
Other	6.33	0.88	2.09	0.04	1.13	39.70
Service	1.08	1.01	0.08	0.94	0.12	7.84
Small business	1.51	0.90	0.46	0.65	0.24	9.38
Facility	1.18	0.47	0.35	0.72	0.50	3.15
District Chattogram	1.90	0.78	0.82	0.41	0.43	10.20
District Dhaka	1.28	0.84	0.30	0.77	0.25	7.45
District Khulna	2.93	0.77	1.40	0.16	0.70	15.49
District Mymensingh	2.43	0.79	1.13	0.26	0.55	13.08
District Rajshahi	1.37	0.81	0.39	0.70	0.29	7.62
District Rangpur	0.27	1.20	-1.08	0.28	0.01	2.34

District Sylhet	0.62	0.90	-0.53	0.59	0.10	3.85
Separated/Divorced	6.95	0.81	2.39	0.02	1.25	32.87
Widowed	0.00	1147.39	-0.01	0.99		6.08

Table 6 showed that maternal age or education level was not significantly related to hypertensive disorders during pregnancy because of the low-income population. This is an indication that biological age and formal education alone might not be sufficient to understand the risk profile of hypertensive disorders which seems to be comprised of many dynamic factors in interaction among stress, nutrition, comorbidity and healthcare facility, among others. The large number of women in the category ofother occupational groups was significantly higher and could possibly be because of the unmeasured occupational characteristics, which are irregular employment, high levels of psychosocial stress or fluctuating income that were previously observed to increase blood pressure and poorer pregnancy outcomes. Nevertheless, the confidence interval is very broad which means that there is a high uncertainty and this result should be viewed with skepticism.

The high correlation between separated or divorced marital status with hypertensive disorders illustrates the possibility of psychosocial stress and lack of social support in the progress of pregnancy related blood pressure. Separated or divorced women have increased emotional stress, financial instability, and Chorionic villus curtains to regular antenatal care, which are some of the established factors that lead to hypertensive disorders in pregnancy. Other low resource environments have recorded similar associations between marital disruption and poor maternal health outcomes. The lack of any major geographic variations may indicate that hypertensive disorders of low-income pregnant women are not limited to a certain part of Bangladesh, but they are a common societal problem. The results of this finding emphasize the use of enhanced periodic blood pressure screening, early diagnosis, and treatment of hypertensive disorders at all the levels of maternal healthcare provision.

On the whole, the findings reveal that social vulnerability, especially in terms of marital status and unstable working conditions, can become of more vital significance in hypertensive disorders in pregnancy compared to the conventional demographic variables. These results justify the importance of integrating maternal health interventions, which include psychosocial support and follow-ups especially to socially vulnerable women in addition to regular clinical care.

Table 7: Multivariable Logistic Regression Analysis of Factors Associated with Infections during Pregnancy

term	**estimate**	**std.error**	**statistic**	**p.value**	**conf.low**	**conf.high**
(Intercept)	0.59	1.00	-0.54	0.59	0.08	3.99
Age years	0.98	0.03	-0.64	0.53	0.93	1.03
Higher secondary (11–12)	1.74	0.66	0.84	0.40	0.51	7.03
No formal schooling	0.81	0.66	-0.32	0.75	0.23	3.29
Primary (1–5)	1.73	0.61	0.91	0.36	0.57	6.51
Secondary (6–10)	0.73	0.60	-0.53	0.60	0.24	2.70
Domestic worker	1.19	0.52	0.33	0.74	0.42	3.29
Garments worker	1.07	0.42	0.15	0.88	0.48	2.47
Housewife	0.69	0.39	-0.95	0.34	0.33	1.53
Other	0.56	0.84	-0.69	0.49	0.08	2.47
Service	0.13	1.09	-1.91	0.06	0.01	0.73
Small business	0.85	0.61	-0.26	0.80	0.24	2.72
Facility	0.87	0.29	-0.47	0.64	0.50	1.55
District Chattogram	0.75	0.47	-0.61	0.54	0.30	1.90
District Dhaka	0.74	0.49	-0.61	0.54	0.28	1.94
District Khulna	0.67	0.49	-0.82	0.41	0.25	1.75
District Mymensingh	0.34	0.59	-1.80	0.07	0.10	1.05
District Rajshahi	0.55	0.49	-1.22	0.22	0.21	1.43
District Rangpur	0.68	0.48	-0.80	0.42	0.26	1.74
District Sylhet	0.55	0.49	-1.24	0.21	0.21	1.42
Separated/Divorced	0.80	1.10	-0.20	0.84	0.04	4.82
Widowed	1.52	0.84	0.50	0.62	0.22	6.83

Table 8: Interaction Model of the combined impact of Educational achievement and Study setting on Pregnancy related complications.

term	estimate	std.error	statistic	p.value	conf.low	conf.high
(Intercept)	1.91	1.04	0.62	0.53	0.24	15.44
Age years	0.99	0.02	-0.32	0.75	0.96	1.03
Education Higher secondary (11–12)	2.89	1.04	1.03	0.30	0.37	23.94
Education No formal schooling	1.55	0.97	0.45	0.65	0.22	10.99
Education Primary (1–5)	2.00	0.92	0.75	0.45	0.31	13.01
Education Secondary (6–10)	1.97	0.88	0.77	0.44	0.33	11.87
Setting Facility	0.52	1.00	-0.66	0.51	0.07	3.80
Occupation Domestic worker	0.64	0.44	-1.00	0.32	0.27	1.52
Occupation Garments worker	0.83	0.35	-0.55	0.58	0.41	1.62
Occupation Housewife	0.76	0.32	-0.84	0.40	0.40	1.42
Occupation Other	0.73	0.55	-0.58	0.56	0.25	2.16
Occupation Service	0.28	0.50	-2.56	0.01	0.10	0.73
Occupation Small business	1.26	0.52	0.44	0.66	0.46	3.62
District Chattogram	0.66	0.39	-1.05	0.29	0.30	1.42
District Dhaka	0.66	0.40	-1.03	0.30	0.30	1.45
District Khulna	0.54	0.40	-1.56	0.12	0.25	1.17
District Mymensingh	0.67	0.42	-0.96	0.34	0.29	1.52
District Rajshahi	0.83	0.40	-0.46	0.65	0.38	1.81
District Rangpur	0.58	0.38	-1.40	0.16	0.27	1.23
District Sylhet	0.58	0.39	-1.41	0.16	0.27	1.23
Separated/Divorced	7.44	1.08	1.86	0.06	1.31	140.37
Widowed	0.41	0.68	-1.31	0.19	0.10	1.54
Higher secondary (11–12) : setting Facility	1.79	1.22	0.48	0.63	0.16	20.15
No formal schooling : setting Facility	1.86	1.15	0.54	0.59	0.19	18.50
Primary (1–5) : setting Facility	2.05	1.09	0.66	0.51	0.24	18.39
Secondary (6–10) : setting Facility	1.37	1.05	0.30	0.76	0.17	11.39

Table 8 indicated that the association between maternal education level and pregnancy complications between facility big geographic differences in the model of interaction also contributes to the fact that pregnancy-related complications of low-income women are already a systemic problem of Bangladesh. Differences in complications in pregnancy are similar in both environments, as opposed to those being exacerbated or alleviated by the point of care or recruitment environment. The implications of this result on the maternal health interventions are significant. Although the assumption of facility-based antenatal care makes the setting and lack of disparities to have been lower based on the effects of enhanced access to clinical services, the outcomes show that the weaknesses of education levels do not disappear with the location. This implies that contact at the facility is possibly not powerful enough to counterbalance the social and behavioral disadvantages at large, with low educational achievement. There is a need therefore to have comprehensive strategies that merge health education, counselling as well as support on social grounds on the antenatal services.

The persistent protective relationship between women in service professions strengthens the past developments in models thus demonstrating that stable workplace and mitigated physical or psychosocial stress enhance the maternal health outcomes. In contrast, the report of high but inexact odds at all times amid separated or divorced

women indicate the possible role of social vulnerability and lack of support groups in increasing the health risks in pregnancy. The absence of a strong geographic difference in the model of interaction also contributes to the fact that pregnancy related complications of low-income women are already a systemic problem of Bangladesh but not a situation dependent on the region. This confirms why the country-wide policy strategies cannot be secured solely through the local interventions. On the whole, the interaction analysis supports conclusions of the research by proving that the educational differences in pregnancy-related complications are strong in the service delivery scenarios. These results imply the need to consider social determinants of maternal health in combination with multisectoral strategies that go beyond care access.

Table 9: Sensitivity Analysis of Factors Associated with Severe Pregnancy-Related Complications

term	estimate	std.error	statistic	p.value	conf.low	conf.high
(Intercept)	0.47	0.91	-0.83	0.41	0.08	2.73
Age years	0.99	0.02	-0.30	0.77	0.95	1.04
Higher secondary (11–12)	2.22	0.60	1.33	0.18	0.72	7.77
No formal schooling	0.63	0.62	-0.75	0.45	0.19	2.27
Primary (1–5)	1.59	0.56	0.84	0.40	0.57	5.24
Secondary (6–10)	0.82	0.55	-0.37	0.71	0.30	2.64
Domestic worker	1.38	0.48	0.67	0.50	0.54	3.54
Garments worker	0.99	0.39	-0.03	0.97	0.46	2.18
Housewife	0.81	0.36	-0.58	0.56	0.40	1.69
Other	1.85	0.60	1.02	0.31	0.54	5.96
Service	0.31	0.71	-1.63	0.10	0.06	1.14
Small business	1.12	0.54	0.21	0.83	0.38	3.19
Setting Facility	0.99	0.26	-0.03	0.97	0.60	1.67
District Chattogram	0.87	0.43	-0.32	0.75	0.38	2.03
District Dhaka	0.80	0.44	-0.50	0.62	0.33	1.92
District Khulna	0.80	0.44	-0.50	0.62	0.33	1.92
District Mymensingh	0.64	0.48	-0.93	0.35	0.25	1.62
District Rajshahi	0.68	0.44	-0.88	0.38	0.29	1.61
District Rangpur	0.57	0.45	-1.26	0.21	0.23	1.37
District Sylhet	0.48	0.45	-1.64	0.10	0.19	1.15
Separated/Divorced	2.96	0.69	1.56	0.12	0.70	11.41
Widowed	0.95	0.84	-0.06	0.95	0.13	4.24

The sensitivity analysis that was limited to the severe outcomes of pregnancy reveals that associations observed in primary models have been weakened in case of attention to more serious outcomes. Upon which the poor associations with the majority of sociodemographic, occupational, and geographic factors appear to have no statistically significant relationships, which may indicate that the severe complications in question may be not so much patterned by individual-level socioeconomic factors as by the overall category of pregnancy-related complications. The absence of correlation with maternal age also supports the results of previous studies and indicates that age is not a major factor of severe pregnancy-related complications in low-income women in the sample. This could be indicative of comparatively homogenous age group of the subjects and preeminence of structures and health system determinants in defining serious maternal events.

The educational attainment, which was found to have a strong relationship with anemia and total pregnancy complications in the previous models, became statistically significant only during the sensitivity analysis. This observation indicates that although education deprivation increases susceptibility to common or moderate pregnancy complications, extreme complications can manifest, in acute events of clinical occurrence that does not necessarily relate to education. Cases of emergency obstetrics like severe hemorrhage or eclampsia usually lie on the need to have emergency care as opposed to socioeconomic gradients.

Equally, occupational status failed to show significant effect on severe complications though the estimates are always lower in women working in service occupations which replicate earlier models. Although this trend is not significant, it would suggest the protection effect of more stable or less physically demanding working conditions which would be investigated in larger samples. The lack of meaningful differences due to the study

setting would suggest that extreme consequences of pregnancy complications exist between the population that is under the facility and population that is trainable in the community. This observation reveals how facility contact can solely prevent severe maternal outcomes and how early detection, appropriate referral systems, and readiness to emergency obstetric care can be an essential part of the whole spectrum of the health system.

Severe complications may also be geographically homogeneous, indicating that its occurrence is not local, but nationwide, there is an issue in the quality of maternal health services, the efficiency of referrals, and the ability to respond to an emergency. The high and non-significant estimates of separated or divorced females are in line with the prior models and might be due to the social vulnerability and the lack of support despite the wide confidence values that show lack of precision.

Altogether, the sensitivity analysis confirms the strength of the main conclusions made in the study and suggests that the determinants of severe pregnancy-related complications could be not the same as those of more frequent maternal health issues. These discoveries form the basis of the need to enhance emergency obstetric services, promote timely referrals, and health systems to be ready to mitigate severe maternal morbidity, as well as expanded social and preventive engagements.

Table 10: Evaluation of Multicollinearity on Basis of Variance Inflation Factors.

term	VIF
Age years	1.06
education	1.13
occupation	1.22
setting	1.05
district	1.21
Marital status	1.05

Table 10 shows the findings of the variance inflation factor (VIF) analysis that was done to determine the existence of multicollinearity among the independent variables that were included in the multivariate regression models. All the predictors had a low VIF, which ranged between 1.05-1.22. Particularly, the maternal age had a VIF of 1.06, education level had a VIF of 1.13, occupational status had a VIF of 1.22, study setting had a VIF of 1.05, district had a VIF of 1.21 and marital status had a VIF of 1.05. All the VIFs were much lower than what is generally regarded as the thresholds of multicollinearity.

The VIF analysis reveals that multicollinearity was not an issue of concern in the regression analysis models employed to conduct this study. The values of VIF that are significantly lower than the standard cut off of 5 (as well as the more conservative one of 10) indicate that the independent variables were not too strongly correlated with each other. This gives credence to the constant and consistency of the estimated regression coefficients of all multivariable and sensitivity analyses. The fact that there is no multicollinearity is especially noteworthy considering the addition of a number of socioeconomic and context-specific factor, including education, occupation, marital status, and geographic location, which are subject to a high rate of correlation in low-income populations. The VIF values were low thereby, suggesting that most of the predictors provided a new information in the models and the amounts of the findings observed were not the results of duplication and overlap of prexisting variables. These results enhance the suitability of the regression findings in Tables 4 to 9 and bolster the faith in the elucidation of the paragraphs that are adjusted among socioeconomic variables and pregnancy-related complications. The VIF analysis helps to verify whether the analytical tool used in the study was robust and hence the conclusions made using the multivariable models are reliable.

CONCLUSION

This paper has brought to light a high rate of pregnancy related complications in women with low income in Bangladesh, which underscores the continued maternal health problems in resource limited environments. The educational level and some socio-economic status were determined as significant predictors of typical pregnancy-related complications, especially, anemia, whereas such aspects as occupational stability and social vulnerability had special impacts. Conversely, the presence of severe pregnancy related complications demonstrated lesser correlations with individual level features, indicating more prominent influences by the factors of the health system and the emergency care. Its implication is the necessity of concerted effort in maternal health interventions encompassing both a better quality of antenatal care and focus on nutritional and other interventions in each instance, as well as identifying and providing targeted assistance to socially and economically disadvantaged women. As part of curbing maternal morbidity and poor pregnancy outcomes in low-income populations in Bangladesh, early detection and referral systems and emergency obstetric care continue to be strengthened.

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