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MATERNAL AND SOCIOECONOMIC DETERMINANTS OF LOW BIRTH WEIGHT IN SRI LANKA

L. P. HIMALI* & H. D. SANDAREKA
Department of Economics and Statistics, Faculty of Social Sciences and Languages
Sabaragamuwa University of Sri Lanka, PO Box 02, Belihuloya

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ABSTRACT

Low birth weight remains a persistent public health challenge in Sri Lanka despite improvements in maternal and child healthcare services. This study examined the maternal, socioeconomic, healthcare, and environmental determinants associated with low birth weight using data from the 2016 Sri Lanka Demographic and Health Survey. A cross-sectional analytical design was employed using a nationally representative sample of 3,000 singleton live births with recorded birth weight information. Descriptive statistics were used to summarize sample characteristics, while chi-square tests and independent sample t-tests assessed associations between explanatory variables and birth weight outcomes. Binary logistic regression analysis was conducted to identify independent predictors of low birth weight and estimate adjusted odds ratios.

The findings showed that maternal education and antenatal care utilization were significant predictors of low birth weight. Mothers with higher educational attainment were significantly less likely to deliver low birth weight infants. Similarly, adequate antenatal care attendance significantly reduced the likelihood of low birth weight. Correlation analysis also demonstrated significant negative associations between low birth weight and maternal education and antenatal care visits. In contrast, maternal age, body mass index, place of residence, and household wealth index were not statistically significant in the adjusted regression model. The omnibus test confirmed that the logistic regression model was statistically significant.

The study concludes that maternal education and access to adequate antenatal care are the most important protective factors against low birth weight in Sri Lanka. Strengthening maternal health education and improving the quality and accessibility of antenatal care services, particularly among vulnerable populations, are essential for reducing the burden of low birth weight and improving neonatal health outcomes.

Keywords: Antenatal care, Low birth weight, Maternal education, Maternal health

1.0 BACKGROUND OF THE STUDY

Low birth weight, defined by the World Health Organization as a birth weight of less than 2,500 grams, remains a major public health concern worldwide due to its strong association with neonatal morbidity, mortality, impaired growth, and long-term health complications. It is widely recognized as one of the most important indicators of maternal health, fetal development, and the quality of healthcare systems. Globally, approximately 15 to 20 percent of all live births are classified as low birth weight, accounting for nearly 20 million births

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annually, with the highest burden concentrated in low- and middle-income countries, particularly in South Asia and Sub-Saharan Africa (UNICEF & WHO, 2019). Despite substantial advances in maternal and child healthcare, reducing the prevalence of low birth weight remains a major challenge in many developing countries.

Low birth weight has both immediate and long-term consequences for child survival and population health. Infants born with low birth weight are more vulnerable to neonatal complications such as respiratory distress, infections, hypothermia, feeding difficulties, and developmental delays. These infants also face a significantly higher risk of neonatal and infant mortality compared to infants with normal birth weight (Christian et al., 2013). Beyond infancy, evidence suggests that low birth weight is associated with impaired cognitive development, poor educational attainment, reduced economic productivity, and an increased risk of chronic non-communicable diseases such as hypertension, cardiovascular disease, and type 2 diabetes in adulthood (Barker, 1995; Blencowe et al., 2019). This relationship is supported by the fetal origins hypothesis, which proposes that adverse intrauterine conditions may permanently alter physiological development and increase susceptibility to disease later in life.

In South Asia, low birth weight remains particularly prevalent due to persistent maternal undernutrition, socioeconomic inequalities, inadequate healthcare access, and poor living conditions. Studies conducted across the region have consistently identified maternal nutritional deficiencies, anaemia, limited antenatal care utilization, adolescent pregnancy, and poverty as major contributors to adverse birth outcomes (Lee et al., 2013; Black et al., 2017). Social and environmental disadvantages often interact with biological risk factors, increasing the vulnerability of mothers and infants in resource-constrained settings.

Sri Lanka has achieved considerable progress in maternal and child health over the past several decades through the expansion of free healthcare services, high institutional delivery rates, and widespread antenatal care coverage. The country has maintained relatively low maternal and infant mortality rates compared to many other developing nations. However, low birth weight continues to remain a persistent public health issue. According to the Sri Lanka Demographic and Health Survey 2016, approximately 16 to 17 percent of new-borns are classified as having low birth weight, with only limited improvement observed over recent decades (Department of Census and Statistics, 2017). This persistent prevalence suggests that broader social, nutritional, and healthcare-related factors continue to influence pregnancy outcomes despite improvements in healthcare availability.

Maternal health and nutritional status play a critical role in determining fetal growth and birth weight outcomes. Previous studies conducted in Sri Lanka have identified maternal undernutrition, low pre-pregnancy body mass index, anaemia, inadequate gestational weight gain, and pregnancy-related complications as significant risk factors for low birth weight (Gunawardane et al., 2021; Ranathunga et al., 2024). Maternal age is also considered an important determinant, as teenage pregnancies and pregnancies among older women are associated with increased obstetric risks and adverse neonatal outcomes (WHO, 2018). Inadequate maternal nutrition during pregnancy can restrict fetal growth and contribute to intrauterine growth restriction, which is one of the leading causes of low birth weight.

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Socioeconomic conditions also strongly influence maternal and child health outcomes. Women from economically disadvantaged households often experience food insecurity, limited access to nutritious diets, poor living conditions, and reduced healthcare utilization, all of which may contribute to low birth weight. Maternal education has been consistently identified as a protective factor because educated women are more likely to possess greater health awareness, better nutritional knowledge, and improved healthcare-seeking behavior (Herath & Chandrasiri, 2020; Silva et al., 2021). Regional disparities between urban, rural, and estate sectors further contribute to inequalities in maternal healthcare access and pregnancy outcomes within Sri Lanka.

Healthcare utilization during pregnancy is another critical determinant of birth outcomes. Antenatal care services provide opportunities for early identification of pregnancy complications, nutritional counselling, disease prevention, and monitoring of fetal development. Although Sri Lanka reports high antenatal care coverage and skilled birth attendance, disparities remain in the quality, timing, and effectiveness of care received by pregnant women across different regions and socioeconomic groups (Perera et al., 2017). Inadequate antenatal care attendance may reduce opportunities for early intervention and increase the likelihood of adverse pregnancy outcomes, including low birth weight.

Environmental and lifestyle factors may also contribute to low birth weight, although these relationships are less extensively studied in the Sri Lankan context. Exposure to household air pollution, second-hand tobacco smoke, poor sanitation, and occupational or agricultural chemicals may negatively affect fetal growth and maternal health (Wijesinghe et al., 2019). Environmental health risks are often more pronounced among low-income and rural populations, where living conditions and occupational exposures may increase vulnerability during pregnancy.

The issue of low birth weight can be understood through the framework of the Social Determinants of Health, which emphasizes that health outcomes are shaped not only by biological factors but also by broader social, economic, and environmental conditions (Marmot & Wilkinson, 2019). Similarly, the Life Course Approach highlights that maternal health outcomes are influenced by cumulative exposures and experiences across an individual's lifespan, including childhood nutrition, education, and long-term socioeconomic conditions (Kuh et al., 2018). These perspectives emphasize that low birth weight is a multidimensional public health issue that requires integrated interventions extending beyond clinical healthcare alone.

Although several studies in Sri Lanka have examined factors associated with low birth weight, many have been limited to hospital-based settings or regional populations, restricting the generalizability of findings. In addition, limited research has examined the combined influence of maternal, socioeconomic, healthcare, and environmental factors using nationally representative data. There is also insufficient evidence regarding how disparities in healthcare access and socioeconomic conditions interact to influence birth outcomes across different population groups in Sri Lanka.

Given the continuing burden of low birth weight and its long-term consequences for child survival and population health, there is a need for comprehensive analysis using nationally

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representative evidence. Therefore, this study aims to examine the maternal, socioeconomic, healthcare, and environmental determinants associated with low birth weight in Sri Lanka using data from the 2016 Sri Lanka Demographic and Health Survey. By identifying the most significant predictors, the study seeks to contribute to evidence-based policy development and targeted public health interventions aimed at improving maternal and neonatal health outcomes in Sri Lanka.

Problem Statement

Low birth weight continues to be a major public health concern in Sri Lanka, despite the presence of a well-established maternal and child health system. The national prevalence remains around 15 to 17 percent, with little improvement over the past two decades (Department of Census and Statistics, 2017). This rate is slightly higher than the global average and reflects persistent gaps in addressing the underlying determinants (UNICEF & WHO, 2019). Infants born with low birth weight face a significantly higher risk of neonatal morbidity and mortality, delayed growth, and long-term health complications such as hypertension and diabetes (Blencowe et al., 2019; Barker, 1995). As a result, the continued high prevalence contributes to both immediate and long-term health and economic burdens.

Although low birth weight is influenced by a complex interplay of biological, maternal, socioeconomic, and environmental factors, the relative contribution of these determinants within the Sri Lankan context remains insufficiently understood. Maternal undernutrition, anaemia, and inadequate weight gain during pregnancy are well-documented risk factors (Ranathunga et al., 2024), yet these are closely linked to broader social and economic inequalities. Women from low-income households and rural or estate sectors are disproportionately affected, highlighting the role of structural disparities (Herath & Chandrasiri, 2020). Environmental exposures such as household air pollution and agrochemical use may further increase risk, but these factors remain under-researched (Wijesinghe et al., 2019).

Existing public health interventions primarily focus on maternal nutrition and antenatal care, but their effectiveness in addressing the combined influence of socioeconomic and environmental determinants remains limited. The lack of integrated, evidence-based strategies that consider these interconnected factors restricts meaningful reductions in low birth weight prevalence. Furthermore, there is limited local evidence examining how disparities in healthcare access and environmental conditions interact with maternal health to influence birth outcomes.

Therefore, there is a critical need to examine the influence of maternal, socioeconomic, healthcare, and environmental factors on low birth weight within Sri Lanka's specific context. Without such evidence, efforts to reduce prevalence are likely to remain fragmented and less effective, perpetuating cycles of poor maternal and child health.

Research Objective

The main objective of this study is to evaluate the impact of maternal, socioeconomic, healthcare, and environmental factors on the prevalence of low birth weight in Sri Lanka. The study aims to determine the distribution of low birth weight across different regions and

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population groups by analyzing relevant data sources. It seeks to assess the influence of maternal characteristics such as nutritional status, pre-existing health conditions, and maternal age on birth outcomes.

In addition, the study examines the role of socioeconomic factors, including income, education, and occupation, in shaping the risk of low birth weight. It also evaluates disparities in access to antenatal and prenatal healthcare services and their impact on birth weight outcomes, particularly among underserved populations. Furthermore, the study aims to identify environmental and lifestyle factors, such as exposure to pollution, poor sanitation, smoking, and alcohol use, that may contribute to the risk of low birth weight.

This research is guided by the hypothesis that maternal, socioeconomic, healthcare, and environmental factors are significantly associated with the prevalence of low birth weight. It assumes that poor maternal nutrition, anaemia, and inadequate antenatal care increase the risk, while lower socioeconomic status and limited access to quality healthcare further exacerbate this risk. By examining these determinants collectively, the study aims to generate evidence-based insights that can inform targeted interventions and policy strategies to reduce low birth weight and improve maternal and child health outcomes in Sri Lanka.

2.0 METHODS

2.1 Study design and Data Source

This study employed a quantitative research approach using a cross-sectional analytical design to examine the determinants of low birth weight in Sri Lanka. Secondary data were obtained from the Sri Lanka Demographic and Health Survey (SLDHS) 2016 conducted by the Department of Census and Statistics in collaboration with the Ministry of Health. The SLDHS is a nationally representative survey that provides comprehensive information on demographic characteristics, maternal and child health, reproductive health, nutrition, and household socioeconomic conditions across Sri Lanka.

The cross-sectional design was considered appropriate because it enabled the assessment of associations between maternal, socioeconomic, healthcare, and environmental factors and low birth weight using nationally representative data collected at a single point in time.

The sampling framework used in the survey followed a stratified multistage sampling technique to ensure national representation across urban, rural, and estate sectors. As a result, the dataset reflects diverse socioeconomic and geographic conditions within Sri Lanka.

2.2 Study Population and Sampling Procedure

The study population consisted of women aged 15 to 49 years who had delivered live singleton infants during the reference period of the survey and for whom birth weight information was available. Multiple births, including twins and triplets, were excluded because of their inherently higher risk of low birth weight and potential to distort associations. Records with missing or incomplete information for key variables were also excluded from the analysis.

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The Sri Lanka Demographic and Health Survey employed a stratified two-stage cluster sampling design to ensure national representation across urban, rural, and estate sectors. In the first stage, census enumeration areas were selected using probability proportional to size sampling. In the second stage, households were systematically selected from each cluster. Sampling weights provided within the DHS dataset were applied during analysis to account for unequal probabilities of selection and to ensure representativeness at the national level.

The final analytical sample included 3,000 mothers with complete information on birth weight and relevant explanatory variables.

2.3 Variables and Measurements

In this study, low birth weight serves as the dependent variable and is defined as a birth weight of less than 2,500 grams. The framework assumes that maternal health conditions directly influence fetal growth and development, while socioeconomic and environmental factors indirectly affect birth outcomes through their impact on maternal wellbeing, nutrition, and access to healthcare services.

Maternal factors include maternal age, body mass index, nutritional status, anaemia, and pregnancy-related health conditions. These variables influence intrauterine growth and pregnancy outcomes by affecting maternal physiological capacity and fetal development. Mothers with poor nutritional status, inadequate weight gain, or health complications during pregnancy are more likely to deliver low birth weight infants.

Socioeconomic factors include maternal education, household income, occupation, and place of residence. These variables influence access to nutritious food, health information, living conditions, and healthcare services. Maternal education is expected to improve health literacy, healthcare-seeking behavior, and nutritional practices, thereby reducing the likelihood of low birth weight.

Healthcare-related factors include the timing and frequency of antenatal care visits and access to prenatal healthcare services. Adequate antenatal care enables early identification and management of pregnancy complications, monitoring of fetal growth, and provision of nutritional counselling and medical support. Therefore, increased utilization of antenatal care services is expected to reduce the risk of low birth weight.

Environmental and lifestyle factors include exposure to tobacco smoke, household air pollution, sanitation conditions, and housing environment. These factors may affect maternal health and fetal development through increased exposure to infections, toxic substances, and poor living conditions during pregnancy.

The framework assumes that these maternal, socioeconomic, healthcare, and environmental factors collectively influence the probability of low birth weight in Sri Lanka. The relationships examined in this study are illustrated in Figure 01.

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2.4 Data Collection Procedures

The study relied entirely on secondary data obtained from the Sri Lanka Demographic and Health Survey 2016. Data collection for the original survey was conducted using standardized and pretested questionnaires administered by trained interviewers. Information related to maternal health, birth outcomes, healthcare utilization, and household conditions was collected through face-to-face interviews with eligible women.

The use of secondary data provided several advantages, including access to a large nationally representative sample, standardized data collection procedures, and high data reliability. All data used in the present study were anonymized prior to analysis to ensure participant confidentiality.

2.5 Statistical Analysis

Data analysis was conducted using statistical software. Descriptive statistics were initially used to summarize the characteristics of the study population. Frequencies and percentages were calculated for categorical variables, while means and standard deviations were computed for continuous variables.

Bivariate analyses were performed to examine associations between explanatory variables and low birth weight. The chi-square test was used to assess relationships between categorical variables and birth weight status. Independent sample t-tests were applied to compare mean differences between groups for continuous variables.

Pearson correlation analysis was conducted to evaluate the strength and direction of relationships between selected variables and low birth weight. Variables that showed statistical significance in bivariate analysis and variables identified as theoretically important from previous literature were included in the multivariate model.

Binary logistic regression analysis was employed to identify independent predictors of low birth weight and estimate adjusted odds ratios with corresponding 95 percent confidence intervals. The regression model assessed the effect of maternal, socioeconomic, healthcare, and environmental variables on the likelihood of delivering a low birth weight infant.

The logistic regression model can be expressed as:

$$\text{Log } (p/1-p) = \beta 0 + \beta 1X1 + \beta 2X2 + \cdots + \beta nXn$$

where p represents the probability of low birth weight and X1, X2, …, Xn represent the explanatory variables included in the model.

Model adequacy was evaluated using the omnibus test of model coefficients. Multicollinearity among independent variables was assessed using Variance Inflation Factor (VIF) statistics to ensure the absence of strong linear relationships between predictors. Statistical significance was assessed at the 5 percent significance level ($p < 0.05$).

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2.5 Ethical Considerations

Ethical standards were maintained throughout the study. The research utilized secondary data obtained from the Sri Lanka Demographic and Health Survey 2016, which had received ethical approval from the relevant national authorities and institutional review boards. The dataset was fully anonymized and contained no personally identifiable information. Therefore, no additional ethical approval or informed consent was required for the present analysis. Data were used strictly for academic and research purposes in accordance with institutional ethical guidelines.

3.0 RESULTS

This section presents the findings obtained from the analysis of the 2016 Sri Lanka Demographic and Health Survey dataset. The analysis was conducted to examine the influence of maternal, socioeconomic, healthcare, and environmental factors on low birth weight in Sri Lanka. A total of 3,000 mothers with complete birth weight and explanatory variable information were included in the study.

3.1 Frequency Analysis

• Body Mass Index (BMI)

The distribution of maternal body mass index indicates that the majority of mothers had a BMI within the normal range. Out of the total sample of 3,000 mothers, 2,127 individuals (70.9%) were classified as having a normal BMI. Meanwhile, 417 mothers (13.9%) were categorized as underweight, while 456 mothers (15.2%) were classified as overweight.

These findings suggest that although most mothers maintained a healthy nutritional status, a considerable proportion experienced either undernutrition or overweight conditions during pregnancy. Both underweight and overweight maternal conditions may adversely influence fetal growth and pregnancy outcomes.

• Antenatal Care Visits

The frequency distribution of antenatal care attendance showed that 1,808 mothers (60.3%) attended four or more antenatal care visits during pregnancy, meeting the minimum recommended level of prenatal care. In contrast, 1,192 mothers (39.7%) attended fewer than four antenatal visits.

Although the majority of mothers received adequate antenatal care, the relatively high proportion of women with insufficient antenatal visits indicates potential gaps in healthcare access, utilization, or awareness regarding maternal healthcare services.

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3.2 Descriptive Statistics

3.2.1 Body Mass Index

Descriptive statistics for maternal body mass index showed a mean value of 2.01 with a standard deviation of 0.539 and a variance of 0.291. The BMI values ranged from a minimum of 1 to a maximum of 3. The moderate standard deviation suggests a reasonable level of variation in maternal nutritional status within the study population, although most mothers were concentrated around the normal BMI category.

3.3 Antenatal Care Visits

For antenatal care visits, the mean value was 1.60 with a standard deviation of 0.489 and a variance of 0.240. The variable ranged from a minimum value of 1 to a maximum value of 2. The relatively small standard deviation indicates limited variability in antenatal care attendance patterns among mothers in the sample.

Table 01: Body Mass Index and Antenatal Care Visits

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
BODY_MASS_INDEX	3000	1	3	2.01	.539	.291
ANTENATAL_CARE_VISITS	3000	1	2	1.60	.489	.240
Valid N (listwise)	3000					

3.4 Correlation Analysis

Pearson correlation analysis was conducted to examine the relationships between selected independent variables and low birth weight.

• Low Birth Weight and Maternal Education

The results revealed a statistically significant negative correlation between maternal education and low birth weight ($r = -0.241$, $p < 0.01$). This indicates that higher levels of maternal education are associated with a lower likelihood of delivering low birth weight infants. Educated mothers are more likely to possess better knowledge regarding maternal nutrition, healthcare utilization, and healthy pregnancy practices, which may contribute to improved birth outcomes.

• Low Birth Weight and Body Mass Index

No statistically significant relationship was observed between maternal body mass index and low birth weight ($r = 0.000$, $p = 0.987$). This finding suggests that maternal BMI did not independently influence birth weight outcomes within the present sample.

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• Low Birth Weight and Antenatal Care Visits

A statistically significant negative correlation was identified between antenatal care visits and low birth weight ($r = -0.255$, $p < 0.01$). Mothers who attended a higher number of antenatal care visits were less likely to deliver low birth weight infants. Regular antenatal care may improve pregnancy outcomes through early detection of complications, nutritional guidance, and continuous maternal health monitoring

3.5 Chi-Square Analysis

Chi-square analysis was performed to assess the association between categorical explanatory variables and low birth weight.

The Pearson Chi-square statistic was 194.392 with 1 degree of freedom and a significance value of $p < 0.001$, indicating a statistically significant association between the categorical variables and low birth weight. The continuity correction, likelihood ratio, and linear-by-linear association tests also produced statistically significant results, further confirming the existence of a meaningful relationship between the variables examined.

In addition, the contingency coefficient value was 0.247 with a significance level of $p < 0.001$. This result indicates a moderate strength of association between the variables included in the analysis.

Overall, the chi-square findings suggest that selected maternal and socioeconomic characteristics are significantly related to birth weight outcomes in Sri Lanka.

Table 02: Chi-Square Results

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	194.392[a]	1	.000		
Continuity Correction[b]	193.328	1	.000		
Likelihood Ratio	194.087	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	194.328	1	.000		
N of Valid Cases	3000				

3.6 Independent Sample t-Test

Independent sample t-tests were conducted to compare mean differences between mothers of low birth weight infants and mothers of normal birth weight infants.

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• Maternal Education and Low Birth Weight

The analysis demonstrated a statistically significant difference in maternal education levels between the two birth weight groups ($p < 0.001$). Mothers of low birth weight infants had a lower mean education level (mean = 1.69) compared to mothers of normal birth weight infants (mean = 2.03).

This finding suggests that lower maternal educational attainment is associated with an increased risk of low birth weight.

• Wealth Index and Low Birth Weight

The mean wealth index for mothers of low birth weight infants was 3.02, compared to 2.99 among mothers of normal birth weight infants. However, the difference was not statistically significant ($p = 0.532$).

This indicates that household wealth status did not show a significant independent association with low birth weight within the study population.

• Antenatal Care Visits and Low Birth Weight

A statistically significant difference was observed in antenatal care attendance between the two groups ($p < 0.001$). Mothers of normal birth weight infants reported a higher average number of antenatal care visits (mean = 1.70) compared to mothers of low-birth-weight infants (mean = 1.45).

This finding highlights the importance of adequate antenatal care utilization in improving birth outcomes and reducing the likelihood of low birth weight.

3.7 Binary Logistic Regression Analysis

Binary logistic regression analysis was performed to identify independent predictors of low birth weight while controlling for potential confounding variables.

• Omnibus Test of Model Coefficients

The omnibus test of model coefficients indicated that the logistic regression model was statistically significant ($\chi^2 = 371.190$, df = 6, $p < 0.001$). This result demonstrates that the inclusion of the explanatory variables significantly improved the model compared to the null model without predictors.

• Model Summary

The model summary statistics showed a -2 Log Likelihood value of 3643.082, indicating an acceptable model fit. The Cox and Snell R^2 value was 0.116, while the Nagelkerke R^2 value was 0.158. This pseudo R-squared values suggest that approximately 11.6% to 15.8% of the variation in low birth weight was explained by the variables included in the model.

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Although the explanatory power of the model was moderate, such values are commonly observed in public health and epidemiological studies where multiple biological, social, and environmental factors contribute to health outcomes.

• Significant Predictors of Low Birth Weight

The regression analysis identified maternal education and antenatal care utilization as significant predictors of low birth weight.

Maternal education showed a statistically significant protective effect against low birth weight ($B = -0.767$, $Exp(B) = 0.464$, $p < 0.001$). Mothers with higher educational attainment were significantly less likely to deliver low birth weight infants compared to mothers with lower educational levels.

Similarly, antenatal care visits demonstrated a strong protective association with birth weight outcomes ($B = -1.098$, $Exp(B) = 0.334$, $p < 0.001$). Mothers who attended an adequate number of antenatal care visits had substantially lower odds of delivering low birth weight infants.

• Non-Significant Variables

Other variables included in the model, such as maternal age, body mass index, place of residence, and household wealth index, were not statistically significant predictors of low birth weight ($p > 0.05$). This suggests that these variables did not independently explain variations in birth weight after adjusting for other factors included in the model.

Overall, the logistic regression findings demonstrate that maternal education and antenatal care utilization are the most important determinants of low birth weight among the variables examined in this study.

Table 03: Results of the Logistic Model

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	MOTHER_EDUCATION	-.767	.060	163.740	1	.000	.464
	WEALTH_INDEX	-.010	.028	.126	1	.722	.990
	BODY_MASS_INDEX	-.006	.074	.007	1	.935	.994
	ANTENATAL_CARE_VISITS	-1.098	.081	184.916	1	.000	.334
	PLACE_OF_RESIDENCE	-.068	.080	.730	1	.393	.934
	MOTHER_AGE	-.065	.073	.787	1	.375	.937
	Constant	2.995	.317	89.104	1	.000	19.983

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Table 04: Results of the Omnibus Test

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	371.190	6	.000
	Block	371.190	6	.000
	Model	371.190	6	.000

4.0 DISCUSSION

This study examined the maternal, socioeconomic, healthcare, and environmental determinants associated with low birth weight in Sri Lanka using nationally representative data from the 2016 Sri Lanka Demographic and Health Survey. The findings indicate that maternal education and antenatal care utilization are the most significant predictors of low birth weight among the variables included in the analysis. These results emphasize the importance of social and healthcare-related factors in shaping birth outcomes and provide important evidence for maternal and child health policy development in Sri Lanka.

The logistic regression model was statistically significant, indicating that the selected explanatory variables collectively contributed to predicting low birth weight outcomes. Although the model explained a moderate proportion of variation in birth weight, this finding is consistent with many public health and epidemiological studies where birth outcomes are influenced by multiple biological, behavioral, environmental, and genetic factors that may not be fully captured in large-scale survey datasets.

Maternal education emerged as one of the strongest protective factors against low birth weight. Mothers with higher educational attainment were significantly less likely to deliver low birth weight infants compared to mothers with lower education levels. This finding is consistent with previous studies conducted in Sri Lanka and other low- and middle-income countries, which have repeatedly identified maternal education as an important determinant of neonatal health outcomes (Herath & Chandrasiri, 2020; Silva et al., 2021). Educated mothers are more likely to possess greater health literacy, improved awareness of maternal nutrition, and better understanding of pregnancy-related risks. In addition, higher educational attainment may improve women's decision-making capacity, healthcare-seeking behavior, and ability to utilize available maternal healthcare services effectively.

The findings also support the Social Determinants of Health framework, which emphasizes that health outcomes are shaped not only by biological conditions but also by broader social and economic circumstances (Marmot & Wilkinson, 2019). Maternal education may therefore influence birth outcomes indirectly through improved living conditions, nutritional practices, and utilization of healthcare services during pregnancy.

Antenatal care utilization was another highly significant predictor of low birth weight. Mothers who attended a greater number of antenatal care visits were significantly less likely to deliver low birth weight infants. The negative correlation observed between antenatal care attendance and low birth weight further reinforces the protective role of regular prenatal care. This finding

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is consistent with previous research demonstrating that adequate antenatal care contributes to early identification and management of pregnancy complications, nutritional counselling, fetal growth monitoring, and maternal health education (Perera et al., 2017; Ranathunga et al., 2024).

Although Sri Lanka has achieved high national coverage of maternal healthcare services, the present findings suggest that disparities may still exist in the utilization or quality of antenatal care. Mothers who fail to complete the recommended number of antenatal visits may miss important opportunities for health monitoring and preventive interventions. Therefore, improving both access to and continuity of antenatal care services remains essential for reducing adverse birth outcomes.

Interestingly, maternal body mass index did not demonstrate a statistically significant association with low birth weight in the adjusted model. This finding differs from several previous studies that identified maternal undernutrition and low pre-pregnancy BMI as important predictors of fetal growth restriction and low birth weight (Gunawardane et al., 2021; Ranathunga et al., 2024). One possible explanation is that the influence of BMI may be mediated through other variables such as antenatal care utilization, maternal nutrition during pregnancy, or socioeconomic conditions. In addition, the use of broad BMI categories may not fully capture variations in maternal nutritional status relevant to pregnancy outcomes.

Similarly, household wealth index did not show a statistically significant relationship with low birth weight. This finding may reflect the relatively equitable access to public maternal healthcare services available in Sri Lanka. Unlike many developing countries where financial barriers strongly limit healthcare access, Sri Lanka's free maternal healthcare system may reduce the direct influence of household income on pregnancy outcomes. However, wealth-related disparities may still operate indirectly through nutrition, living conditions, and environmental exposures.

The non-significant association between place of residence and low birth weight also warrants consideration. Although regional and sectoral disparities in healthcare access have been documented in previous studies, the present findings suggest that differences between urban and rural populations may be less pronounced after adjusting for maternal education and healthcare utilization. This may indicate the effectiveness of Sri Lanka's widespread maternal and child healthcare infrastructure in reducing geographic inequalities in maternal health outcomes.

The study further highlights the multidimensional nature of low birth weight. Birth outcomes are not determined by a single factor but rather by the interaction of maternal health conditions, healthcare utilization, social circumstances, and environmental exposures throughout pregnancy. This observation is consistent with the Life Course Approach, which suggests that maternal and child health outcomes are shaped by cumulative social and biological experiences over time (Kuh et al., 2018).

Despite the important findings, several limitations should be acknowledged. First, the cross-sectional design limits the ability to establish causal relationships between explanatory variables and low birth weight. The observed associations indicate relationships rather than direct causation. Second, the study relied on secondary survey data, restricting the analysis to

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variables available within the DHS dataset. Important determinants such as dietary intake, gestational weight gain, maternal stress, paternal characteristics, and detailed environmental exposures were not available for inclusion in the analysis.

In addition, some variables may have been subject to reporting or recall bias, particularly those related to antenatal care utilization and household conditions. The relatively modest pseudo R-squared values also suggest that additional biological and contextual factors not captured in the dataset may contribute to low-birth-weight outcomes.

Nevertheless, the study provides valuable nationally representative evidence on the determinants of low birth weight in Sri Lanka. The findings emphasize that improving maternal education and strengthening antenatal healthcare utilization are critical strategies for reducing low birth weight and improving neonatal health outcomes.

5.0 CONCLUSION

This study examined the determinants associated with low birth weight in Sri Lanka using nationally representative data from the 2016 Sri Lanka Demographic and Health Survey. The findings demonstrate that maternal education and antenatal care utilization are the most important predictors of low birth weight among the variables included in the analysis.

Mothers with higher educational attainment were significantly less likely to deliver low birth weight infants, highlighting the importance of maternal education in improving health awareness, healthcare utilization, and pregnancy-related decision-making. Similarly, mothers who attended an adequate number of antenatal care visits had substantially lower odds of delivering low birth weight infants, emphasizing the critical role of prenatal healthcare services in promoting healthy birth outcomes.

In contrast, variables such as maternal body mass index, household wealth index, maternal age, and place of residence did not show statistically significant independent associations with low birth weight after adjusting for other factors in the regression model. These findings suggest that healthcare utilization and maternal education may have a stronger direct influence on birth outcomes within the Sri Lankan context.

Overall, the study highlights that low birth weight remains a multifactorial public health issue influenced by both healthcare-related and broader social determinants. Strengthening maternal education and improving access to quality antenatal care services are therefore essential strategies for reducing low birth weight and improving neonatal health outcomes in Sri Lanka.

The findings contribute valuable evidence for policymakers, healthcare professionals, and public health planners seeking to develop targeted interventions aimed at improving maternal and child health. Continued investment in maternal healthcare services and women's education is likely to produce long-term benefits for population health and child development.

Based on the findings of this study, several recommendations can be proposed to support the reduction of low birth weight and improve maternal and neonatal health outcomes in Sri Lanka.

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Maternal education was identified as a significant protective factor against low birth weight. Therefore, policies and programs aimed at improving female education should be strengthened. Public health education initiatives should focus on maternal nutrition, pregnancy care, reproductive health, and healthy lifestyle practices. Community-based awareness programs targeting adolescent girls and women of reproductive age may further improve maternal health knowledge and pregnancy outcomes.

Given the strong protective effect of antenatal care attendance, efforts should be made to ensure that all pregnant women complete the recommended number of antenatal visits. Healthcare authorities should strengthen maternal outreach services, particularly in underserved and geographically isolated communities. Increasing awareness regarding the importance of regular prenatal care may also encourage early registration and consistent attendance at maternal health clinics.

Although antenatal care coverage is relatively high in Sri Lanka, attention should also be given to improving the quality of services provided during pregnancy. Maternal healthcare programs should emphasize comprehensive nutritional counselling, early identification of high-risk pregnancies, and continuous monitoring of maternal and fetal health conditions. Expanding training opportunities for maternal healthcare providers may further improve service quality and effectiveness.

Special attention should be directed toward women from socially and economically disadvantaged backgrounds who may experience barriers to healthcare access and maternal nutrition. Mobile health clinics, community outreach programs, and targeted nutritional support initiatives may help reduce inequalities in maternal and neonatal health outcomes.

Reducing low birth weight requires coordinated action beyond the healthcare sector alone. Collaboration between the health, education, nutrition, and social welfare sectors is necessary to address the broader social determinants of maternal and child health. Integrated public health strategies that combine healthcare services with social and educational support may produce more sustainable improvements in birth outcomes.

Future studies should incorporate longitudinal designs and include additional biological, behavioral, and environmental variables that were not available in the present dataset. Research examining maternal dietary intake, gestational weight gain, psychological stress, paternal characteristics, and environmental pollution would provide a more comprehensive understanding of the determinants of low birth weight in Sri Lanka. Further regional analyses may also help identify population groups at greater risk and support more targeted policy interventions.

5.1 Declarations

• Ethics approval and consent to participate

This study is based on secondary data obtained from the Sri Lanka Demographic and Health Survey (DHS) 2016 conducted by the Department of Census and Statistics, Sri Lanka. Ethical approval for the original survey was obtained by the relevant national ethics review authority and institutional review boards involved in the DHS implementation. The present study used

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anonymized, publicly available secondary data; therefore, no additional ethical approval or informed consent was required.

• Availability of data and materials

The datasets used and/or analyzed during the current study are not publicly available due to data usage restrictions imposed by the Department of Census and Statistics, Sri Lanka. However, the data are available from the corresponding author on reasonable request and with permission from the Department of Census and Statistics.

• Competing interests

The authors declare that they have no competing interests.

• Funding

No external funding was received for this study.

• Authors' contributions

The study was conceptualized by the primary researcher. Data analysis and interpretation were carried out by the authors. The manuscript was drafted by the authors, and all sections were critically reviewed and approved for submission. All authors read and approved the final manuscript.

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