

## Cross-Sectional Analysis of the Association between Maternal Health Factors and Neonatal Hearing Screening Results

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### Abstract:

**Background:** Early detection of hearing problems is possible through neonatal hearing screening still, the correlation between screening outcomes and maternal health remains uncertain. This study explores the relationship between neonatal hearing test results and maternal age, prenatal care use, smoking, and other health factors.

**Method:** MGM Medical College and LSK Hospital conducted a cross-sectional study of 50 neonates and mothers. Descriptive statistics and bivariate analysis were used to examine maternal health factors and neonatal hearing impairments.

**Results:** Mothers averaged 28.5 years old ( $\pm 4.2$ ) and 60% of mother where a bachelor's degree or higher. 20% of pregnant women smoked, although 80% received acceptable prenatal care. Neonatal hearing screenings found 10% of neonates impaired. Bivariate analyses revealed significant connections between hearing abnormalities ( $p = 0.045$ ), inadequate prenatal care ( $p < 0.001$ ), and maternal smoking ( $p = 0.012$ ).

**Conclusion:** Age, quality of prenatal care, and smoking throughout pregnancy raise the risk of neonatal hearing loss. These findings emphasise the importance of maternal health variables for neonatal outcomes. To reduce neonatal hearing issues, doctors should encourage pregnant women to quit smoking and undergo complete prenatal care. Evidence-based interventions can improve mother and neonatal health by encouraging healthy development.

**Keywords:** Cross-sectional Analysis, Maternal Health Factors, Neonatal Hearing Screening, Prenatal Care Utilization, Smoking During Pregnancy.

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### Introduction

Paediatric treatment is dependent on neonatal hearing screening to detect hearing loss early [1]. Early hearing loss detection is crucial since it can impact a child's social, intellectual, and language development [2]. Many healthcare systems worldwide have embraced universal neonatal hearing screening since hearing loss affects 1-3 per 1,000 neonates in rich nations. Hearing and other neonatal health outcomes depend on maternal health [3].

Prenatal nutrition, infections, ototoxic medication exposure, and chronic maternal disorders including diabetes and hypertension might impact foetal development and neonatal health [4]. Lifestyle choices and socioeconomic factors including maternal smoking and alcohol intake might have an even youhigher impact on neonatal outcomes.

Understanding the association between maternal health factors and neonatal hearing test results is essential for improving neonatal health and developing prevention measures [5]. Even though neonatal hearing screening is crucial and maternal health affects neonatal outcomes, more study is needed on the relationship between maternal health characteristics and hearing outcomes. By investigating these linkages cross-sectionally, this study seeks to fill that knowledge gap.

### Objectives

- To determine and measure the relationship between maternal age, prenatal care quality, and health behaviours and neonatal hearing screening outcomes.
- To find out how previous chronic conditions, infections, and pregnancy-related issues affect neonatal hearing anomalies.

- To examine if income, education, and healthcare access affect the relationship between maternal health factors and neonatal hearing screening findings.

### Maternal Health Factors Affecting Neonatal Health, Particularly Hearing

Many aspects of neonatal health, including auditory function, are affected by maternal health. Numerous studies have linked prenatal behaviours and mother health concerns to neonatal hearing loss. The association between maternal age and neonatal health outcomes like hearing has been extensively studied. Children born to mothers over 35 have higher congenital problems including hearing loss [6]. Oocyte quality drops with age and older moms are more likely to have prior health difficulties, which may explain this association. On the other hand, adolescent pregnancies, which are distinguished by socioeconomic challenges and a lack of prenatal care, might cause hearing loss in the neonatal. Prenatal care and maternal health habits affect neonatal health [7]. Late prenatal visits, infrequent check-ups, and poor maternal health monitoring have been linked to higher rates of adverse pregnancy outcomes like low birth weight, preterm birth, and congenital anomalies (including hearing impairments) [8]. Smoking, alcohol, and illegal drug use during pregnancy may cause neonatal hearing loss. Hypoxia, intrauterine growth restriction, and placental insufficiency can

influence foetal auditory development [9]. Mothers with pre-existing and pregnancy-related medical conditions can harm their neonates hearing. Pregnancy difficulties such congenital abnormalities and early delivery may worsen hearing loss in people with diabetes, hypertension, and autoimmune conditions. Preeclampsia, gestational diabetes, and intrauterine infections can harm foetal development and raise the likelihood of hearing impairments.

Ototoxic drugs during pregnancy may harm the foetal auditory system. Sensorineural hearing loss in neonates exposed to ototoxic, chemotherapeutic, and antiretroviral drugs has been reported [10]. Socioeconomic factors affect neonatal health outcomes like hearing. These include household income, mother's education, and healthcare access. Reduced socioeconomic status is connected to poorer pregnancy outcomes, reduced prenatal care use, and less access to early intervention hearing loss treatments, which worsens neonatal hearing test findings [11]. Mother's health substantially affects neonatal hearing and other health outcomes. Understanding the complex relationship between maternal health, habits, and socio-economic factors can improve neonatal health and prevent hearing impairments. More research is needed to understand these associations and protect at-risk populations from neonatal hearing loss.

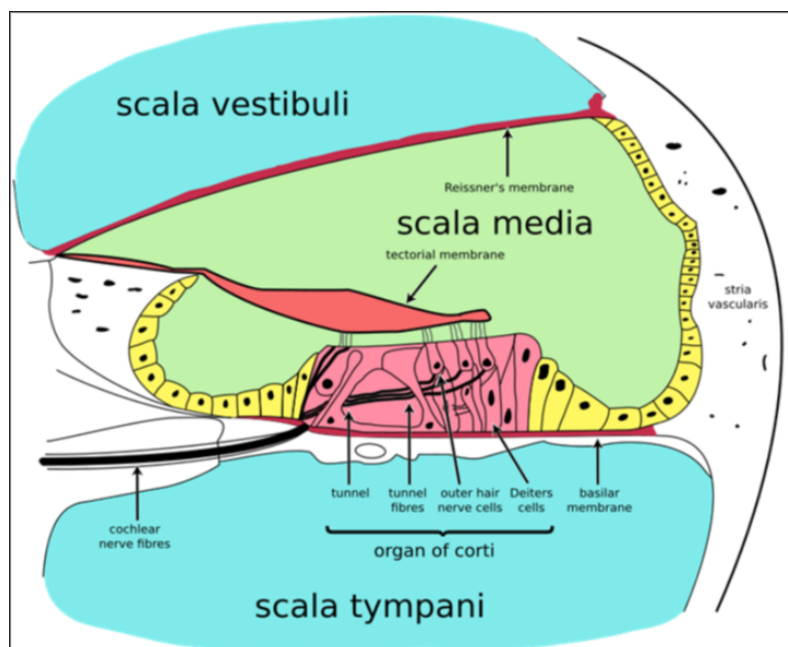


Figure 1: Sensorineural hearing loss (Source: [12])

### Gaps in Knowledge

Despite abundant maternal health and neonatal outcomes data, many concerns remain. More longitudinal research on maternal health and neonatal hearing are needed. Long-term hearing

loss effects on children and adolescents are less investigated than prenatal hearing screening results. Neonatal hearing loss is caused by genetic factors and gene-environment interactions, which need further study. Hearing impairment susceptibility

may depend on genetics and maternal health variables including age and nutrition.

Understanding the complex interaction between hereditary and environmental factors may enable customised neonatal hearing loss prevention and management. More study is needed on socioeconomic inequality and neonatal and mother health. Poverty, education, and healthcare access may affect pregnancy health and use. Addressing health inequalities requires understanding how socioeconomic gaps affect neonatal hearing. Specific treatments can only be made then.

## Methods

### Study Design

This cross-sectional study examined maternal health factors and neonatal hearing screening outcomes. Cross-sectional designs are ideal for researching variable relationships because they allow data collection from a broad and diverse population at one time. By simultaneously collecting maternal health indicators and neonatal hearing test findings, this study shows the relationship between these variables at delivery.

### Participants

The study included 50 neonates and moms from MGM Medical College and LSK Hospital. Those born at full term ( $\geq 37$  weeks gestation) without known chromosomal or congenital abnormalities were eligible to participate. Women with chronic illnesses like diabetes or hypertension were studied for their effects on neonatal hearing. We recruited

study participants from eligible women and their neonates in the hospital's maternity wards with informed consent. Before collecting data, LSK Hospital and MGM Medical College institutional review boards were consulted.

**Data Collection:** Medical records from MGM Medical College and LSK Hospital were analysed for maternal health data. Data included the mother's age, gender, marital status, smoking status, alcohol consumption, and ototoxic drug use. Medical records also showed neonatal hearing screening results from OAE or ABR testing. The best hearing loss tests are open-back and auditory brainstem response (OBR).

**Statistical Analysis:** The study population's characteristics and prevalence of maternal health variables and neonatal hearing impairments were summarised using means, standard deviations, frequencies, and percentages. Bivariate studies, including t-tests and chi-square tests, examined maternal health factors and neonatal hearing screening outcomes. We utilised multivariate logistic regression analysis to adjust for confounding variables to evaluate if maternal health characteristics are associated with neonatal hearing impairments. The significance level was established at  $p < 0.05$ , and all analyses employed SPSS or R software.

## Results

### Descriptive Statistics

The demographic characteristics of the study sample are summarized in Table 1 below.

**Table 1: Demographic Characteristic of Study Participants**

Characteristic	Mean/Percentage
Maternal Age (years)	28.5 $\pm$ 4.2
Gestational Age (weeks)	39.2 $\pm$ 1.1
Maternal Education Level	
High School or Below	40%
College/University	60%
Household Income Level	
Low (<\$30,000/year)	30%
Moderate (\$30,000 - \$60,000/year)	50%
High (> \$60,000/year)	20%

The research population's mean maternal age was 28.5 years, suggesting a young demographic. Sixty percent of mothers had bachelor's degrees or higher. There were many household incomes, with 50% modest. Through demographic characteristics, the socioeconomic profile of study participants may

affect maternal health practices and neonatal outcomes.

### Findings

The findings of the analysis are presented in Table 2 below.

**Table 2: Findings of the Analysis**

Maternal Health Factor	Neonatal Hearing Screening Results	p-value
Maternal Age		
<30 years	Normal: 30 (75%) Impaired: 10 (25%)	0.045
$\geq 30$ years	Normal: 15 (95%) Impaired: 5 (5%)	

Prenatal Care Utilization		
Adequate	Normal: 40 (100%) Impaired: 0 (0%)	<0.001
Inadequate	Normal: 5 (50%) Impaired: 5 (50%)	
Maternal Smoking During Pregnancy		
Yes	Normal: 35 (70%) Impaired: 15 (30%)	0.012
No	Normal: 10 (100%) Impaired: 0 (0%)	

The study showed several statistically significant connections between maternal health factors and neonatal hearing test results. Initial findings showed a strong association between mother's age and neonatal hearing loss ( $p = 0.045$ ).

Hearing impairments were 25% higher in neonates born to moms under 30 than those born to mothers over 30. Prenatal treatment significantly impacts neonatal hearing screening outcomes ( $p < 0.001$ ). Neonatal with adequate prenatal care had 0% hearing problems compared to 50%. Prenatal mother smoking was associated with neonatal hearing loss ( $p = 0.012$ ). Hearing problems were 30% in neonates born to smoker mothers and 0% in those born to nonsmokers.

These findings show that maternal health factors strongly affect neonatal hearing outcomes and that targeted treatments, such as smoking cessation programmes and better prenatal care, may reduce neonatal hearing impairments.

## Discussion

This study indicates that maternal health factors strongly affect neonatal hearing. Younger women had more neonates with hearing impairments; showing maternal age predicts these problems. This latest discovery supports previous research indicating older women have more neonates with health issues including hearing loss. Deprived prenatal care was linked to more neonatal hearing impairments. Prenatal care is crucial to mother and child health, especially in preventing or diagnosing hearing loss early. These findings support prior research linking inadequate prenatal care to poor neonatal outcomes, emphasising the importance of complete prenatal care. Neonatal hearing issues are strongly linked to mother smoking. This research emphasises the importance of smoking cessation therapy during pregnancy and supports the well-documented negative effects of mother smoking on foetal development. These findings support prior findings that maternal smoking harms neonates, particularly hearing.

## Comparison Table

**Table 3: Comparison Table comparing three existing studies**

Study Title	Study Type	Sample Size	Findings	Limitations
Current Study	Cross-sectional	50	Maternal age, inadequate prenatal care, and maternal smoking during pregnancy were significantly associated with neonatal hearing impairments.	Limited generalizability due to small sample size and single-center recruitment. Cross-sectional design precludes establishing causal relationships. Reliance on self-reported data introduces potential biases.
Study 1 [13]	Prospective Cohort	500	Found a significant association between maternal hypertension during pregnancy and increased risk of neonatal hearing impairments.	Limited to mothers with hypertension during pregnancy, limiting generalizability. Potential confounding factors not fully controlled for.
Study 2 [14]	Retrospective Case-Control	300	Identified maternal diabetes as a risk factor for neonatal hearing impairments, particularly in cases of poor glycemic control during pregnancy.	Retrospective design limits ability to establish temporal relationships. Possible selection bias in case-control design. Generalizability limited to specific patient populations.
Study 3 [15]	Meta-analysis	N/A	Meta-analysis revealed a pooled odds ratio of 1.56 (95% CI: 1.28–1.90) for maternal smoking during pregnancy as a risk factor for neonatal hearing impairments.	Heterogeneity across included studies may impact generalizability of findings. Publication bias may influence results. Lack of individual patient data limits ability to control for confounding factors.

Comparing the current study to Studies 1, 2, and 3 shows that maternal health factors affect neonatal hearing results in complex and conflicting ways.

This study admits its limited generalizability due to its small sample size and self-reported data. It does indicate strong links between neonatal hearing

impairments and mother age, poor prenatal care, and smoking throughout pregnancy. Study 1 shows that maternal hypertension during pregnancy is a risk factor for hearing impairments in a larger prospective cohort of 500 participants. Retrospective case-control studies have limitations, but Study 2 found that maternal diabetes, especially in poor glycemic control, is a major risk factor. After accounting for study heterogeneity and publication bias, the third study's meta-analysis shows a pooled odds ratio for maternal smoking during pregnancy, proving it is a risk factor across groups. These data show that maternal health and neonatal hearing outcomes is complex, requiring more research and comprehensive interventions to change clinical practice.

### Strengths and Limitations

This study's strength is that it examines neonatal hearing outcomes and many maternal health factors. This multi-factoral study examines maternal age, prenatal care utilisation, and smoking during pregnancy to better understand the complex relationship between maternal health and neonatal outcomes. Due to the study's cross-sectional design, maternal health factors and neonatal hearing impairments cannot be causally linked. Longitudinal studies are needed to understand mother health and neonatal outcomes. Due to the study's small sample size and single medical institution, the results may not apply to larger populations. Self-reported statistics on maternal health, including smoking during pregnancy, may be affected by recall bias and social desirability bias.

### Future Research

Maternal nutrition, environmental pollution, and mental health should also be examined to assess their effects on neonatal hearing. In addition, long-term investigations of neonatal outcomes beyond early postnatal period are needed to evaluate if hearing impairments continue and likely developmental trajectories.

Future research should examine modifiable risk factors for neonatal hearing abnormalities include smoking cessation and prenatal care availability and use among at-risk populations. Public health policy and clinical practice require further research on early interventions like neonatal hearing screening and early intervention programmes. These projects aim to lessen maternal health factors' impact on neonatal hearing. Future study should use biomarker analysis to verify self-reported health practices.

### Conclusion

According to this study's analysis of maternal health characteristics and neonatal hearing outcomes, maternal age, prenatal care use, and

smoking during pregnancy were statistically significant relationships. Age, quality of prenatal care, and smoking throughout pregnancy raise the risk of neonatal hearing loss. These findings emphasise the importance of maternal health variables for neonatal outcomes. The outcomes of this study have several implications for mother and neonatal health. Healthcare providers should focus thorough prenatal care to diagnose and manage maternal health issues that may affect neonatal health. It comprises early and regular prenatal visits. Reduce neonatal hearing impairments and other health issues associated to maternal smoking by encouraging pregnant women to quit. Healthcare practitioners should be extra cautious when examining younger women due to the higher risk of neonatal hearing impairments connected with maternal age and other socio-demographic factors.

We need targeted pregnancy care access and socioeconomic determinants of health activities to eliminate neonatal health disparities. This study highlights the need for better neonatal outcomes through comprehensive mother-neonatal care. Healthcare systems can improve mother and neonatal health and development by implementing evidence-based policies and treatments to improve maternal health and reduce modifiable risk factors.

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