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Maternal and Perinatal Outcomes among Women Infected with Hepatitis C

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All authors equally contributed to the study and approved the final manuscript

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ABSTRACT

Background: Hepatitis C virus (HCV) infection remains a major public health concern globally, particularly in low-resource settings. Pregnant women with HCV are at increased risk for adverse maternal and neonatal outcomes, yet research remains limited in this area, especially in regions with high prevalence like Pakistan. Socioeconomic disparity limited antenatal care access, and a lack of public awareness contributes to the continued transmission and complications of HCV during pregnancy. **Objective:** This study aimed to assess maternal and perinatal outcomes among women infected with hepatitis C, focusing on identifying sociodemographic and clinical factors contributing to disease prevalence and evaluating the impact on maternal health, fetal development, and neonatal wellbeing. **Methodology:** A descriptive cross-sectional study was conducted over six months, from May 3, 2024, to November 2, 2024, at the Department of Obstetrics and Gynecology, Peoples University of Medical and Health Sciences for Women (PUMHS), Nawabshah. A total of 124 HCV-positive pregnant women aged 15–40 years with singleton pregnancies and gestational age ≥24 weeks were enrolled. Data was collected through structured interviews and medical records, capturing sociodemographic, obstetric, and clinical variables. Outcomes included maternal complications such as preeclampsia, hemorrhage, liver dysfunction, and mode of delivery, as well as neonatal outcomes including preterm birth, low birth weight, stillbirth, early neonatal death, and NICU admission. Data were analyzed using SPSS version 20; chi-square and t-tests determined significance at $p < 0.05$. **Results:** Findings revealed that 54.84% of women were unbooked at the time of hospital presentation, and 51.61% belonged to lower socioeconomic backgrounds. Most women presented in serious (30.65%) and critical (27.42%) conditions. Maternal complications were frequent: preeclampsia (17.7%), postpartum hemorrhage (16.9%), liver dysfunction (17.2%), and preterm labor (15.7%). Cesarean and operative deliveries were performed in 63% of cases. Neonatal complications included low birth weight in over 12.4%, preterm birth (19.21%), stillbirths (15.3%), early neonatal deaths (18.6%), and NICU admissions (15.8%). Liver dysfunction and anemia were significantly associated with adverse neonatal outcomes. Critical maternal conditions and preeclampsia were linked to higher stillbirth and ENND rates. **Conclusion:** This study highlights the severe maternal and perinatal consequences of HCV in pregnancy, particularly among unbooked, low-income women. Findings stress the need for integrated antenatal screening programs, public health education, and targeted interventions to reduce HCV-related complications. Policymakers should prioritize routine HCV testing in pregnancy, improve antenatal care coverage, and invest in research exploring safe antiviral therapies during gestation. Future longitudinal studies are essential to evaluate long-term maternal and neonatal outcomes and establish effective prevention and management strategies in high-burden regions.

INTRODUCTION

Hepatitis refers to inflammation of the liver, primarily caused by infections with hepatitis viruses: A, B, C, D, and E. Among these, hepatitis C virus (HCV) is a significant global health concern due to its potential for chronic infection, leading to liver cirrhosis and hepatocellular carcinoma. HCV is a leading cause of liver-related morbidity and mortality worldwide, with an estimated 71 million people infected globally[1].

Globally, HCV affects approximately 71 million people, with the highest burden in regions such as Southern Asia[2]. In Pakistan, HCV prevalence is notably high, with studies reporting rates ranging from 0.7% to 36% among pregnant women[3]. This variability underscores the need for

comprehensive screening and preventive strategies to manage the epidemic and reduce its burden on maternal and child health[4].

HCV infection during pregnancy poses significant risks to both maternal and neonatal health. Maternal complications may include gestational diabetes, preterm birth, and hypertension. Studies have shown that hepatitis C can significantly affect pregnancy outcomes, contributing to adverse maternal conditions such as liver dysfunction[5]. Neonates born to HCV-infected mothers are at increased risk of low birth weight, intrauterine fetal death, and preterm delivery[6]. Furthermore, there is a notable association between HCV infection and increased neonatal mortality rates, emphasizing the need for targeted preventive measures[7]. Vertical transmission of HCV from mother to child occurs in approximately 1.39% of cases in Pakistan, with the highest risk associated with maternal factors such as high viral load[8].

However, the absence of definitive curative therapies during pregnancy complicates management strategies, highlighting the importance of early detection and preventive measures to reduce vertical transmission[9]. The increasing prevalence of HCV among pregnant women in Pakistan is concerning. Local research indicates that the rates of infection have been rising steadily, exacerbated by factors such as unsafe medical practices, intravenous drug use, and lack of proper screening[10]. The lack of safe and effective antiviral treatments during pregnancy further exacerbates the situation, necessitating urgent attention to preventive strategies.

Local studies have observed a rising trend in HCV prevalence among pregnant women. For instance, a study conducted at a tertiary care hospital in Pakistan reported a prevalence of 8.66% among pregnant women[11]. These findings emphasize the need for early identification and preventive approaches to mitigate adverse maternal and neonatal outcomes.

Rationale for the Study

Despite the high prevalence of HCV among pregnant women in Pakistan, there is a significant gap in research regarding its impact on maternal and perinatal outcomes. This study aims to fill this gap by investigating the effects of HCV infection during pregnancy and developing contextually relevant preventive guidelines and health interventions. By addressing these gaps, this research hopes to contribute to the improvement of maternal and neonatal health policies and strategies.

Research Question and Objectives

The primary research question guiding this study is:

- What are the maternal and perinatal outcomes among women infected with hepatitis C?

Specific objectives include:

1. Assessing the prevalence of HCV among pregnant women in women attending PUMHS tertiary care centre.
2. Investigating the impact of HCV infection on maternal health outcomes.
3. Evaluating the effects of HCV infection on neonatal health.

METHODOLOGY

Study Design

A descriptive cross-sectional study, designed to assess the maternal and perinatal outcomes among women infected with Hepatitis C Virus (HCV).

Study Setting

The study will be conducted in the Department of Obstetrics and Gynecology, Peoples University of Medical and Health Sciences for Women (PUMHS), Nawabshah, Pakistan.

Study Duration

The duration of the study is six months, from May 3, 2024, to November 2, 2024.

Sample Size and Sampling Technique

The sample size has been calculated using the WHO sample size determination software, with appropriate prevalence and confidence interval assumptions. The sampling technique employed is non-probability consecutive sampling, meaning all eligible participants during the study period who meet the inclusion criteria will be included.

Inclusion Criteria

- Women aged 15 to 40 years
- HCV-positive status confirmed via serology (anti-HCV or HCV RNA PCR)
- Singleton pregnancies
- Gestational age ≥24 weeks at the time of enrollment (OPD or admission)
- Willingness to participate and provide informed consent

Exclusion Criteria

- Multiple gestation pregnancy
- History of alcohol or substance abuse
- Active smoking
- Pre-existing chronic illnesses diagnosed before pregnancy (e.g., uncontrolled diabetes mellitus, renal or cardiac disease)
- Women with co-infections of hepatitis B, HIV, or syphilis (as these can independently affect maternal/perinatal outcomes)

Participant Characteristics and Data Collection

Data will be collected from each participant using a structured and pre-tested proforma or questionnaire through interviews and medical record review. The information recorded will include sociodemographic data such as age (15-40 years, in 5-year brackets), religion, level of education (from none to postgraduate), residency (urban vs. rural), and socioeconomic status (lower, middle, upper). Obstetric and clinical history will be noted, including parity and gravidity, previous mode of delivery (vaginal or C-section), booking status (booked/unbooked), condition at admission (stable/serious/critical), referral status (referred or not), time of presentation (antenatal, labor, postnatal), and any co-morbid conditions such as anemia, gestational diabetes, preeclampsia, liver dysfunction, renal, or cardiac disease. Maternal outcome measures will include the mode of delivery (normal vaginal, C-section, or operative), complications such as

preterm labor, antepartum hemorrhage (APH), postpartum hemorrhage (PPH), hypertension-induced pregnancy, preeclampsia, anesthesia type (general/regional), and liver dysfunction (assessed via ALT/AST/bilirubin if available). Perinatal outcome measures will include birth weight (categorized for low birth weight <2.5 kg), gestational age at birth, preterm birth (<37 weeks), stillbirth, early neonatal death (ENND), neonatal HCV infection (via HCV RNA testing if possible), and NICU admission.

Data Collection Process

Participants will be enrolled from both the outpatient department (OPD) and the inpatient wards. Data will be collected at time points including antenatal visits, during labor, and postnatally. Laboratory-confirmed HCV status will be required. Outcomes will be monitored until delivery and neonatal discharge, or death.

Ethical Considerations

Ethical approval has been obtained from the Institutional Review Board of PUMHS. Informed consent will be taken from all participants. Patient confidentiality will be maintained, and participation is voluntary.

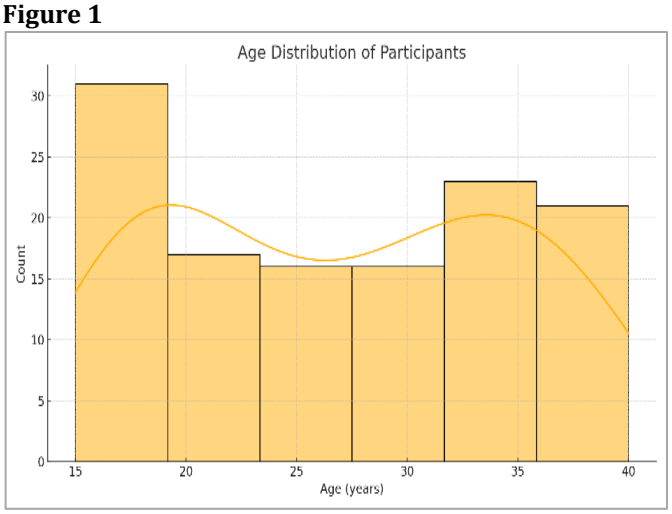
Statistical Analysis

Data will be entered and analyzed using SPSS version 20. Descriptive analysis will present categorical variables, such as booking status, parity, and HCV transmission, as frequencies and percentages. Meanwhile, continuous variables like age, gestational age, and birth weight will be reported as means ± standard deviation. Inferential statistics will include the Chi-square test to assess associations between categorical variables, such as maternal HCV status and perinatal outcomes. The Independent t-test will be used for continuous outcomes across groups, like gestational age and birth weight. A p-value of <0.05 will be considered statistically significant. Logistic regression was applied to identify independent predictors of adverse maternal or neonatal outcomes.

RESULT

The study included 124 women infected with Hepatitis C. The participants' ages ranged from 15 to 40 years, with the majority falling within the 25–35 age group, as shown in the histogram below:

Figure 1



Most participants resided in urban areas (54%), although a significant proportion came from rural (45.9%) backgrounds, highlighting the broad geographic burden of the disease.

Regarding healthcare access, a higher number of participants were un-booked, 68 (54.84%) at the time of the hospital presentation, emphasizing the gaps in antenatal care services among this population:

Most participants belonged to the lower socioeconomic group (64, 51.61%), followed by the middle class (40, 32.26%) and the upper class (20, 16.13%)

Among the participants, the highest proportion had attained higher secondary education (20.97%), followed by primary education (18.55%) and secondary education (13.71%), while a smaller percentage were graduates (12.90%) or had no formal education (12.90%), indicating a diverse range of educational backgrounds within the study population.

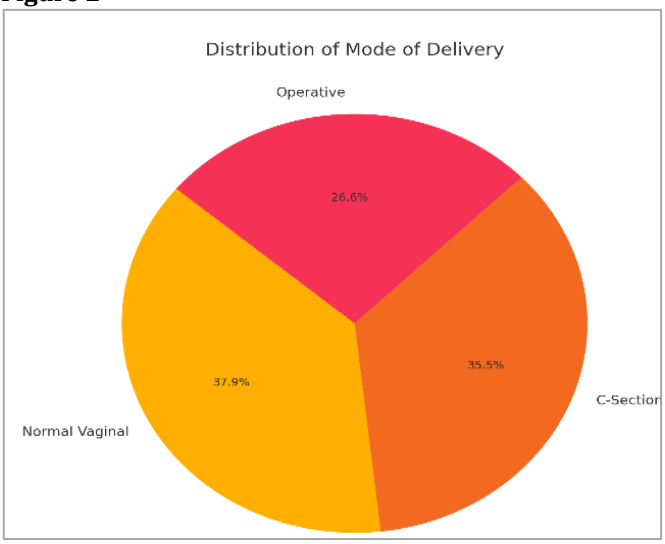
Table 1

Education Level Distribution

Education Level	Frequency	Percentage (%)
None	16.0	12.9
Primary	23.0	18.55
Secondary	17.0	13.71
Higher Secondary	26.0	20.97
Graduate	16.0	12.9
Postgraduate	26.0	20.97

Among the participants, 47 (37.90%) underwent normal vaginal delivery, 44 (35.48%) had cesarean sections, and 33 (26.61%) underwent operative deliveries, indicating a high rate of surgical intervention in the study population.

Figure 2



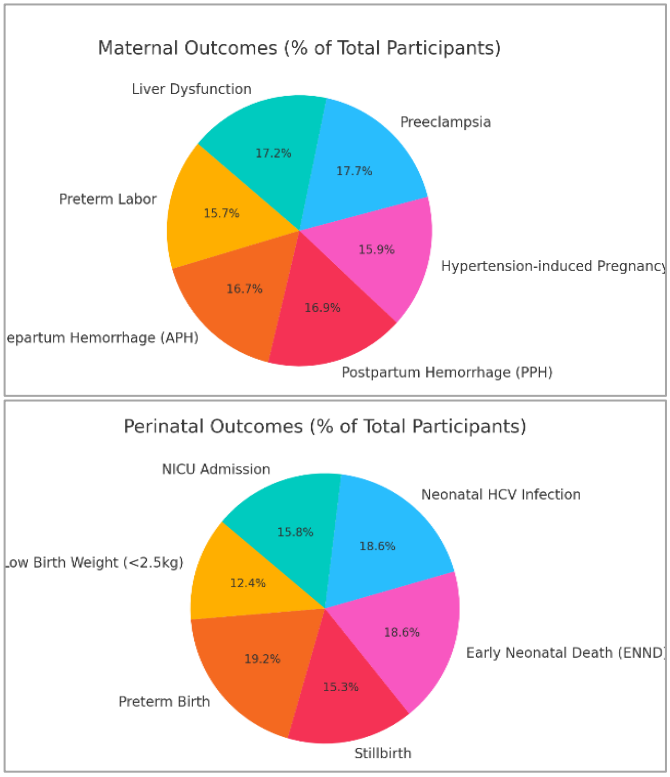
Most patients were in stable condition (52, 41.94%), followed by serious (38, 30.65%) and critical (34, 27.42%) conditions.

Analysis revealed that a considerable number of women with HCV developed liver dysfunction (17.2%). This complication was strongly associated with poor maternal outcomes such as preeclampsia and postpartum hemorrhage. Furthermore, maternal liver dysfunction showed a significant correlation with neonatal complications, including preterm birth, NICU admission, and low birth weight.

Statistically significant associations ($p < 0.05$) were identified between liver dysfunction and preeclampsia, preterm labor, and neonatal HCV infection. Notably:

- **Preterm Births** were observed in over 15.7% of cases.
- **NICU Admissions** were more common (15.8%) among neonates born to mothers with liver dysfunction or anemia.
- **Early Neonatal Deaths (ENND)** and **Stillbirths** occurred more frequently among mothers with additional comorbid conditions such as preeclampsia or critical admission status.

Figure 3 & 4



A clear trend emerged showing that unbooked patients, especially those from rural or low socioeconomic backgrounds, experienced worse outcomes. These patients were more likely to be present in a serious or critical condition and to have co-existing illnesses such as anemia or gestational hypertension, exacerbating the risks associated with HCV.

- The high rate of operative deliveries among this group (including C-sections and assisted deliveries) also reflects the complications introduced by the infection. Maternal factors such as late presentation, high gravidity, and comorbid conditions were predictive of adverse perinatal outcomes.

DISCUSSION

This study examined maternal and perinatal outcomes among 124 women infected with hepatitis C, revealing significant findings across various demographic, obstetric, maternal, and neonatal indicators.

The majority of women belonged to lower socioeconomic backgrounds and resided in urban areas (54%), although rural representation was also notable (45.9%). Nearly 55% of participants were unbooked at the time of presentation, indicating critical gaps in antenatal care. Educational levels varied widely, with a significant portion having no formal education or only primary schooling. These factors suggest socio-demographic vulnerabilities that may contribute to poorer health-seeking behavior and inadequate prenatal surveillance, which in turn exacerbate HCV-related risks.

A substantial proportion of participants developed complications such as liver dysfunction (17.2%), preeclampsia (56.45%), postpartum hemorrhage (54.03%), antepartum hemorrhage (17.7%), hypertension-related pregnancy (15.9%), and preterm labor (19.2%). These rates are noticeably higher compared to figures reported in prior studies[11]. One possible explanation is that the population served by our institution comprises high-risk and late-presenting cases, many of whom were unbooked and had co-existing morbidities such as anemia or gestational hypertension.

Regarding maternal outcomes, nearly 63% of women underwent surgical delivery (C-section or operative), which is considerably high. This is consistent with Khan et al., who noted a rising trend of operative deliveries among HCV-positive women, often due to complications like fetal distress, APH, or maternal instability[12]. This high surgical rate also reflects poor antenatal engagement and late identification of complications.

Perinatal outcomes further underscore the burden of HCV. Low birth weight was observed in over 12.4% of cases, and preterm births occurred in more than 19.2%. Stillbirths (15.3%) and early neonatal deaths (18.6%) were alarmingly frequent, particularly among mothers with preeclampsia or who presented in a critical state[13,14]. NICU admissions were also higher among neonates born to mothers with liver dysfunction or anemia (48.1%)[15]. This aligns with studies that highlighted liver dysfunction as a major determinant of neonatal morbidity in HCV-affected pregnancies[16,17].

Another important observation was the strong correlation between liver dysfunction and adverse outcomes such as preeclampsia, preterm labor, and neonatal HCV infection[18]. This supports the hypothesis that hepatic inflammation and altered liver function may influence vascular and metabolic regulation during pregnancy. While our study's rates are higher than global averages, they offer a realistic picture of the burden in resource-limited, underserved regions.

From a public health perspective, these findings underscore the urgent need for strengthening antenatal screening, especially in rural and underprivileged populations. Integrating HCV screening into routine antenatal care, improving awareness, and expanding access to diagnostic and management services are vital strategies[19]. Furthermore, health education and counseling can reduce stigmatization and improve care-seeking behavior[20].

Future research should focus on longitudinal studies assessing maternal and neonatal outcomes beyond delivery, exploring antiviral interventions safe in pregnancy, and evaluating vertical transmission risks using PCR-based neonatal diagnostics.

Limitations of this study include its single-center design and the non-probability sampling approach, which may limit generalizability. Despite this, the study provides critical insights into the maternal and perinatal impact of HCV in a high burden setting and supports calls for expanded surveillance and prevention strategies.

Limitations

- This was a **single-center** study conducted in a tertiary care hospital, which may limit the generalizability of the findings to broader populations.
- The **non-probability consecutive sampling** approach could introduce selection bias, as it may not represent the full spectrum of HCV-infected pregnant women.
- Due to **resource constraints**, confirmatory testing for neonatal HCV infection (e.g., HCV RNA PCR) was not performed universally.
- Some data, such as **co-morbid conditions**, relied on available medical records and patient self-reporting, which may be prone to underreporting or recall bias.
- The study was **cross-sectional**, so long-term maternal and neonatal outcomes beyond the immediate postnatal period were not evaluated.

Recommendations

- **Integrate routine HCV screening** into antenatal care protocols, particularly in high-burden regions.
- Enhance **public health education campaigns** to raise awareness about hepatitis C transmission, especially targeting women of reproductive age.
- Strengthen **antenatal care systems**, ensuring early booking, regular follow-up, and risk stratification for high-risk pregnancies.
- Develop **context-appropriate clinical guidelines** for monitoring and managing HCV-positive pregnancies, especially those complicated by liver dysfunction or hypertension.
- Support **future longitudinal and multicenter studies** to assess long-term outcomes of exposed neonates and the effectiveness of potential interventions, including safe antiviral therapies during pregnancy.
- Promote **training for healthcare providers** on the implications of hepatitis C in obstetric care and the importance of early intervention.

CONCLUSION

This study highlights the considerable maternal and perinatal burden associated with hepatitis C infection during pregnancy. A significant number of women presented with serious or critical conditions, often unbooked and from low socioeconomic or rural backgrounds, factors strongly linked with poor outcomes. High rates of maternal complications such as preeclampsia, liver dysfunction, and hemorrhage were observed, alongside alarming perinatal outcomes including preterm births, low birth weight, NICU admissions, stillbirths, and early neonatal deaths. These findings emphasize the urgent need for early detection, regular antenatal surveillance, and the integration of hepatitis C screening into routine obstetric care in high-prevalence regions like Pakistan.

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