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INFECTIOUS DISEASE SCREENING IN PREGNANCY: ASSESSING SEROPREVALENCE OF HCV, HBV, HIV, SYPHILIS, AND RUBELLA IN KARACHI, PAKISTAN

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ABSTRACT

Background: The vertical transmission of hepatitis B virus (HBV), hepatitis C virus (HCV), human immunodeficiency virus (HIV), rubella, and syphilis poses significant public health concerns. This study aimed to investigate the seroprevalence of these infections among pregnant women.

Methodology: This cross-sectional study was conducted on pregnant women who visited the Clinical Pathology Laboratory at Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan, between January and April 2021. Data were collected through a questionnaire assessing demographics and related risk factors. Blood samples were tested for HBsAg, anti-HCV, anti-HIV, rubella, and syphilis using the chemiluminescence enzyme immunoassay method. Data analysis was performed using SPSS version 20.

Results: Out of 560 pregnant women screened, 0.7% tested positive for hepatitis B, 1.6% for HCV, and 100% were negative for HIV and syphilis. Rubella IgG positivity was 85%, with 99% negative for rubella IgM. Ethnic distribution showed 58% Urdu speakers, followed by Pashto (10%) and Sindhi (7.5%). Previous birth history revealed 69% had more than one birth, and 16% reported blood transfusions, with older women having a higher prevalence ($p = 0.005$). Significant variation in gestational age distribution was observed ($p < 0.001$).

Conclusion: In conclusion, the seroprevalence of rubella IgG was high, while infections such as HCV, HBV, and rubella IgM were less prevalent among pregnant women, with no cases of HIV or syphilis detected. This highlights the importance of routine prenatal screening for vertical transmission prevention. Effective immunization and treatment strategies are essential to minimize these infections' impact on maternal and neonatal health.

Keywords: Hepatitis B, Hepatitis C, HIV, Rubella, Syphilis, Pregnancy, Seroprevalence

INTRODUCTION

Hepatitis B virus (HBV) and hepatitis C virus (HCV) are significant causes of chronic viral hepatitis, cirrhosis, and hepatocellular carcinoma (HCC)[1], contributing to a substantial global health burden. Additionally, infections such as human immunodeficiency virus (HIV), syphilis, and rubella pose risks during pregnancy and can result in severe complications for both mothers and their newborns [2].

HBV identified as the second most significant carcinogen after tobacco and recommends routine vaccination for newborns to prevent vertical transmission [3]. HBV transmission can occur through various routes: parenteral (contact with infected blood or fluids), horizontal (close contact without sexual intercourse), sexual, and perinatal (mother-to-child). In highly endemic regions, perinatal transmission is particularly significant, often occurring during labor due to exposure to infected maternal fluids or via a damaged placenta. The risk of transmission increases in cases of maternal HBeAg positivity and elevated HBV DNA levels [4]. Perinatal transmission of HBV is especially concerning because newborns face a greater risk of chronic infection (over 90%) compared to adults [5].

Hepatitis C virus (HCV) is another critical cause of chronic viral hepatitis, cirrhosis, and HCC. An estimated 170 million individuals worldwide are infected with HCV, with prevalence rates among pregnant women up to 8%. The risk of HCV transmission is primarily linked to maternal viral load, with higher levels correlating with increased risk [6].

Human immunodeficiency virus (HIV) can be transmitted vertically, perinatally, or postnatally, with an overall transmission rate of 15-30%. Preventing mother-to-child transmission is critical and can be achieved through early diagnosis and effective interventions such as antiretroviral therapy, significantly reducing the incidence of pediatric HIV cases [7].

Globally, syphilis remains a significant public health issue, with approximately 12 million new cases reported each year, primarily in underdeveloped countries. Mother-to-child transmission (MTCT) of syphilis is linked to inadequate antenatal care; however, WHO data indicates that most adverse pregnancy outcomes associated with maternal syphilis occur in women who did receive antenatal care but were not properly screened or treated [8].

Rubella, caused by the rubella virus, is a contagious disease often referred to as "German measles" or "three-day measles". Transmission occurs via respiratory droplets, with rubella typically presenting mild, self-limiting symptoms such as low-grade fever, malaise, arthralgia, lymphadenopathy, upper respiratory symptoms, sore throat, and a maculopapular rash. The virus initially replicates in the nasopharynx, spreads to the cervical lymph nodes, and subsequently enters the bloodstream. The incubation period for rubella is approximately 2 to 3 weeks, with humans being the only known hosts [9].

Infection with the rubella virus during early pregnancy poses significant risks, including fetal demise or congenital rubella syndrome (CRS) in newborns. CRS is most likely to occur when a mother contracts the virus during the first trimester or just before conception. Rubella is a leading cause of vaccine-preventable birth defects, particularly in developing countries, and has also been linked to autism [10].

In countries with limited healthcare resources, such as Pakistan, the burden of infectious diseases in pregnant women is exacerbated by gaps in access to antenatal care, low vaccination coverage, and limited awareness of preventive health measures. Studies have shown that the prevalence of HBV and HCV infections is particularly high in regions with inadequate blood screening, unsafe medical practices, and low awareness of viral transmission risks. Chronic hepatitis B and C are major causes of liver disease and hepatocellular carcinoma, with vertical transmission contributing significantly to the ongoing prevalence of these viruses in the population [11].

This study aims to provide an in-depth analysis of the seroprevalence of HBV, HCV, HIV, rubella, and syphilis among pregnant women attending a clinical pathology laboratory JPMC Karachi. Additionally, the study seeks to explore the relationship between socio-demographic factors, such as age, ethnicity, education and other risk factors, with infection prevalence.

METHODOLOGY

Study Participants

This cross-sectional study included pregnant women who visited the Clinical Pathology Laboratory at Jinnah Postgraduate Medical Centre (JPMC) in Karachi, Pakistan, from January to April 2021. Participants were enrolled after providing informed consent and completing a structured questionnaire. Individuals with incomplete data were excluded from the analysis.

Data Collection

Data were collected using a structured questionnaire designed to gather demographic information and assess related risk factors. The questionnaire included sections on age, ethnicity, obstetric history, previous blood transfusions, and other potential risk factors associated with infectious diseases. Trained healthcare professionals administered the questionnaire to ensure consistency and accuracy. Informed consent was acquired from all participants prior to enrollment in the study. Participant confidentiality was maintained throughout the research process.

Sample Collection and Laboratory Testing

Blood samples collected from pregnant women were subjected to various laboratory tests to screen for infectious diseases using the chemiluminescence enzyme immunoassay (CLIA) method. The presence of Hepatitis B Virus (HBV) was assessed by detecting HBsAg, while anti-HCV antibodies were identified for Hepatitis C Virus (HCV). Human Immunodeficiency Virus (HIV) screening involved testing for anti-HIV antibodies. For rubella, both rubella IgG and IgM antibodies were analyzed to determine susceptibility and active infection status. Additionally, syphilis screening was performed using appropriate serological tests. All laboratory procedures adhered to manufacturer instructions and standard operating protocols to ensure the accuracy and reliability of the results.

Data Analysis

Data were entered into a secure database and analyzed using SPSS version 20. Descriptive statistics summarized demographic characteristics and seroprevalence rates. Confidence intervals (CIs) were calculated for proportions, and p-values were computed using appropriate statistical tests (e.g., Chi-square tests for categorical variables) to determine the significance of differences among age groups and other demographic factors. A p-value of <0.05 was considered statistically significant.

RESULT

A total of 560 pregnant women were screened for infectious diseases. The screening results for hepatitis B (HBV) showed that 556 participants (99%) tested negative for HBsAg (CI: 98% to 100%), while 4 participants (0.7%) tested positive (CI: 0.23% to 1.9%), indicating a negligible prevalence of hepatitis B (p-value = 0.15).

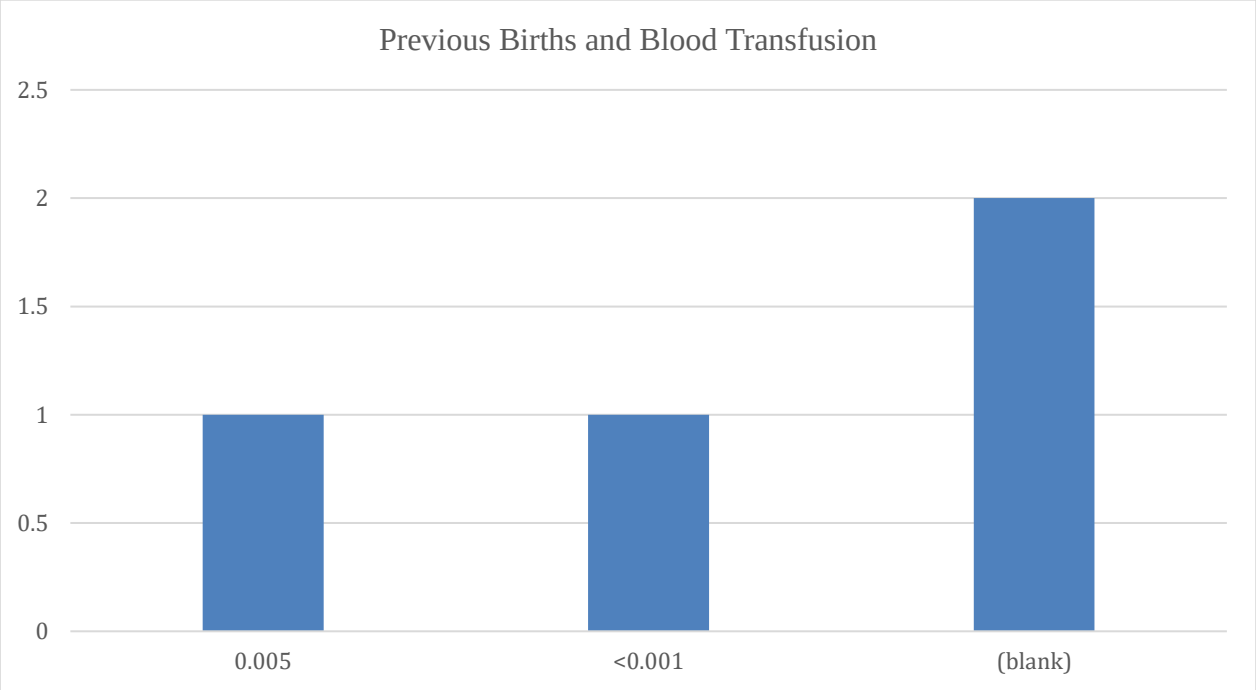
In the Anti-HCV screening, 551 participants (98%) were negative (CI: 97% to 99%), and 9 participants (1.6%) tested positive (CI: 0.79% to 3.1%), with no significant differences across age groups (p-value = 0.8).

All 560 participants (100%) tested negative for HIV, demonstrating successful screening efforts, with a 95% confidence interval ranging from 99% to 100% across all age groups. For rubella, IgG screening results indicated that 10 participants (1.8%) had equivocal results (CI: 11% to 17%), 75 (13%) were negative (CI: 0.91% to 3.4%), and 475 (85%) tested positive (CI: 82% to 88%), with a p-value of 0.8, indicating no significant differences among age groups. In the case of rubella IgM, 553 participants (99%) tested negative (CI: 97% to 99%), while 7 participants (1.3%) tested positive (CI: 0.55% to 2.7%), with a p-value of 0.4. While syphilis screening revealed that all participants tested negative (560, 100%, CI: 99% to 100%)(Table.1).

Table:1 Demographic and Clinical Characteristics of Pregnant Women Categorized by Age Groups

Part 1: Previous Births and Blood Transfusion

Characteristic	Overall	95% CI	16-25	95% CI	26-35	95% CI	36-46	95% CI	p-value
PREVIOUS BIRTH									<0.001
>1	388 (69%)	65%, 73%	164 (56%)	50%, 62%	201 (84%)	78%, 88%	23 (82%)	62%, 93%	
0	172 (31%)	27%, 35%	128 (44%)	38%, 50%	39 (16%)	12%, 22%	5 (18%)	6.8%, 38%	
BLOOD TRANSFUSION	92 (16%)	14%, 20%	34 (12%)	8.3%, 16%	52 (22%)	17%, 28%	6 (21%)	9.0%, 41%	0.005

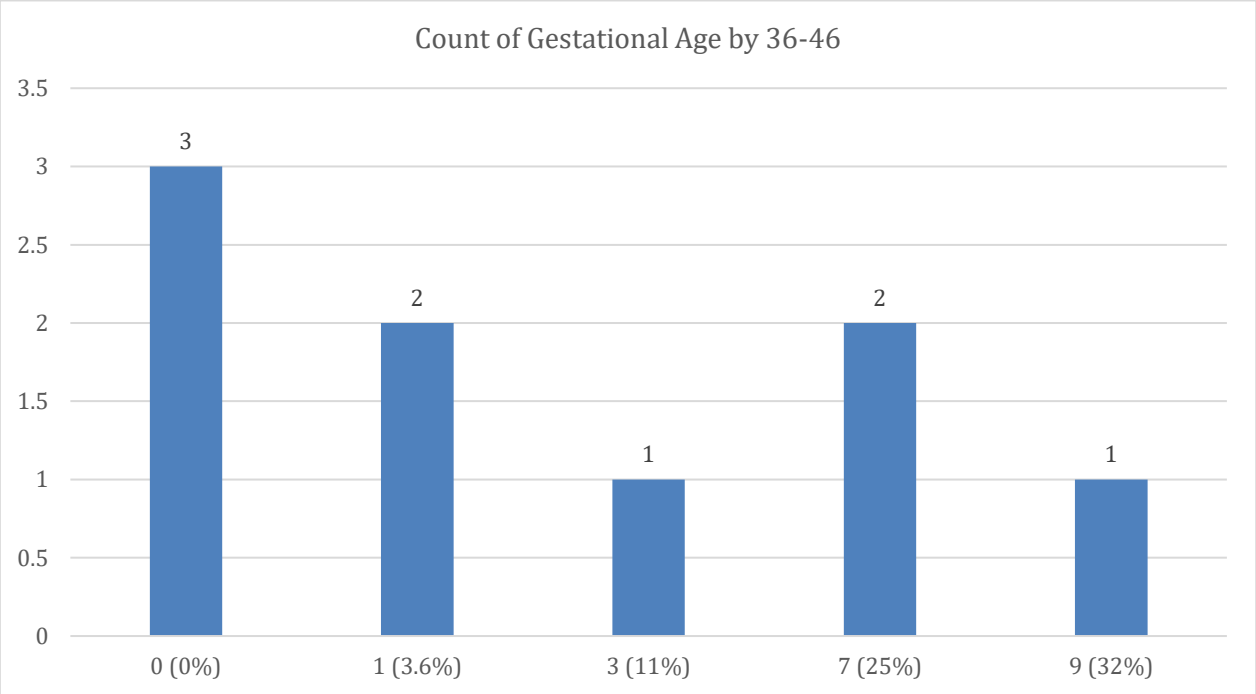


Regarding previous birth history, 388 participants (69%) reported having more than one birth, with a CI of 65% to 73%. In contrast, 172 participants (31%) indicated they had no previous births, with a CI of 27% to 35%. This distribution exhibited a significant variation by age group (p-value < 0.001) (Table.1).

Part 2: Gestational Age

Gestational Age	Overall	95% CI	16-25	95% CI	26-35	95% CI	36-46	95% CI
1st	1 (0.2%)	0.01%, 1.2%	0 (0%)	0.00%, 1.6%	1 (0.4%)	0.02%, 2.7%	0 (0%)	0.00%, 15%
2nd	10 (1.8%)	0.91%, 3.4%	5 (1.7%)	0.63%, 4.2%	5 (2.1%)	0.77%, 5.1%	0 (0%)	0.00%, 15%
3rd	27 (4.8%)	3.3%, 7.0%	17 (5.8%)	3.5%, 9.3%	10 (4.2%)	2.1%, 7.8%	0 (0%)	0.00%, 15%
4th	44 (7.9%)	5.8%, 10%	25 (8.6%)	5.7%, 13%	18 (7.5%)	4.6%, 12%	1 (3.6%)	0.19%, 20%

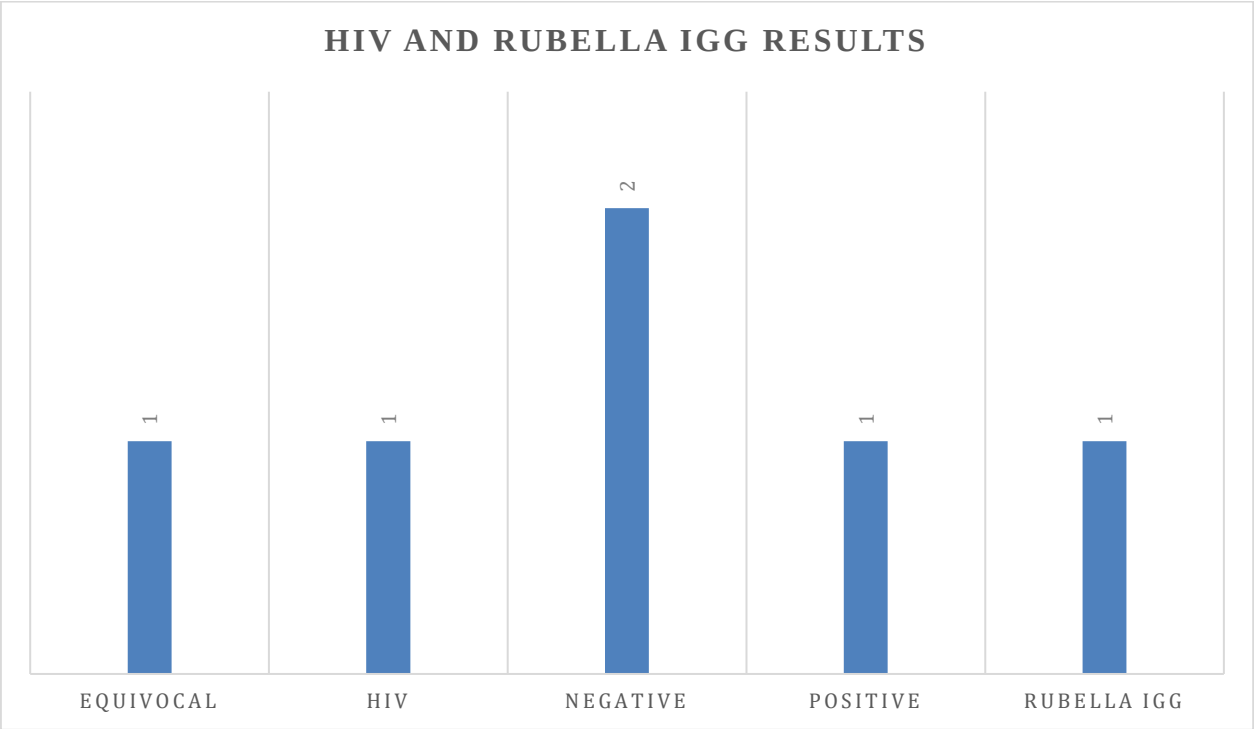
5th	95 (17%)	14%, 20%	42 (14%)	11%, 19%	46 (19%)	15%, 25%	7 (25%)	11%, 45%
6th	132 (24%)	20%, 27%	65 (22%)	18%, 28%	58 (24%)	19%, 30%	9 (32%)	17%, 52%
7th	154 (28%)	24%, 31%	80 (27%)	22%, 33%	67 (28%)	22%, 34%	7 (25%)	11%, 45%
8th	81 (14%)	12%, 18%	48 (16%)	12%, 21%	30 (13%)	8.7%, 18%	3 (11%)	2.8%, 29%
9th	16 (2.9%)	1.7%, 4.7%	10 (3.4%)	1.7%, 6.4%	5 (2.1%)	0.77%, 5.1%	1 (3.6%)	0.19%, 20%



Concerning blood transfusion history, 92 women (16%) reported receiving a transfusion, with a CI of 14% to 20%. Notably, the prevalence was higher among women aged 36 to 46 years, with 6 participants (21%, CI: 9.0% to 41%), compared to younger age groups (p-value = 0.005) (Table.1).

Part 3: HIV and Rubella IgG Results

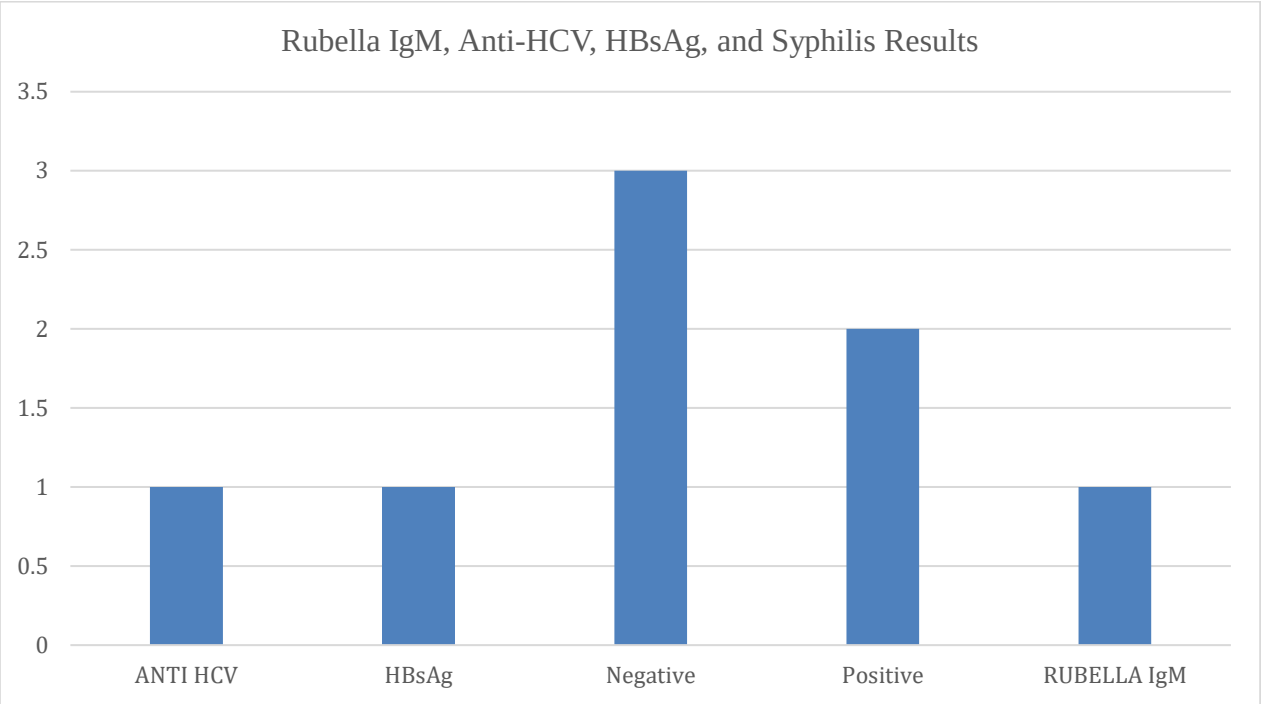
Characteristic	**Overall**	**95% CI**	**16-25**	**95% CI**	**26-35**	**95% CI**	**36-46**	**95% CI**
HIV								
Negative	560 (100%)	99%, 100%	292 (100%)	98%, 100%	240 (100%)	98%, 100%	28 (100%)	85%, 100%
RUBELLA IgG								
Equivocal	10 (1.8%)	11%, 17%	4 (1.4%)	10%, 19%	5 (2.1%)	9.1%, 18%	1 (3.6%)	2.8%, 29%
Negative	75 (13%)	0.91%, 3.4%	41 (14%)	0.44%, 3.7%	31 (13%)	0.77%, 5.1%	3 (11%)	0.19%, 20%
Positive	475 (85%)	82%, 88%	247 (85%)	80%, 88%	204 (85%)	80%, 89%	24 (86%)	66%, 95%



The distribution of gestational age showed that 154 women (28%) were in their 7th month of pregnancy, with a CI of 24% to 31%. The first month had the lowest representation, with only 1 participant (0.2%, CI: 0.01% to 1.2%), indicating a significant difference (p-value < 0.001) (Table.1).

Part 4: Rubella IgM, Anti-HCV, HBsAg, and Syphilis Results

Characteristic	Overall	95% CI	16-25	95% CI	26-35	95% CI	36-46	95% CI
RUBELLA IgM								
Negative	553 (99%)	97%, 99%	289 (99%)	97%, 100%	237 (99%)	96%, 100%	27 (96%)	80%, 100%
Positive	7 (1.3%)	0.55%, 2.7%	3 (1.0%)	0.27%, 3.2%	3 (1.3%)	0.32%, 3.9%	1 (3.6%)	0.19%, 20%
ANTI HCV								
Negative	551 (98%)	97%, 99%	288 (99%)	96%, 100%	235 (98%)	95%, 99%	28 (100%)	85%, 100%
Positive	9 (1.6%)	0.79%, 3.1%	4 (1.4%)	0.44%, 3.7%	5 (2.1%)	0.77%, 5.1%	0 (0%)	0.00%, 15%
HBsAg								
Negative	556 (99%)	98%, 100%	291 (100%)	98%, 100%				

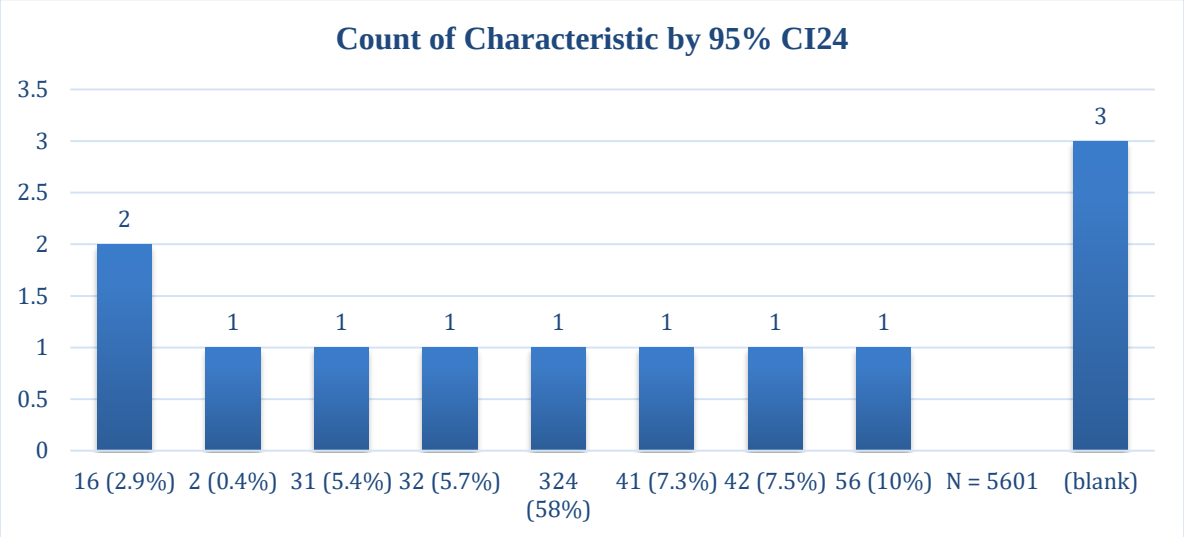


The ethnic composition of the pregnant women in the study revealed that the majority were Urdu speakers, accounting for 324 participants (58%) with a 95% confidence interval (CI) of 54% to 62%. Among other ethnic groups, Baloch individuals represented a prevalence of 2 (0.4%, CI: 0.06% to 1.4%), while Bengalis comprised 16 participants (2.9%, CI: 1.7% to 4.7%). Hindko speakers made up 32 participants (5.7%, CI: 4.0% to 8.1%). Additional ethnicities included Pashto (56, 10%, CI: 7.7% to 13%), Punjabi (41, 7.3%, CI: 5.4% to 9.9%), Sindhi (42, 7.5%, CI: 5.5% to 10%), and Siraiki (16, 2.9%, CI: 1.7% to 4.7%)(Table.2).

Table: 2 Distribution of Ethnicity Among Pregnant Women by Age Groups

Characteristic	**Overall** N = 5601	**95% CI**2	**16-25** N = 2921	**95% CI**2	**26-35** N = 2401	**95% CI**2	**36-46** N = 281	**95% CI**2
ETHNICITY								
Baloch	2 (0.4%)	0.06%, 1.4%	2 (0.7%)	0.12%, 2.7%	0 (0%)	0.00%, 2.0%	0 (0%)	0.00%, 15%
Bengali	16 (2.9%)	1.7%, 4.7%	9 (3.1%)	1.5%, 6.0%	7 (2.9%)	1.3%, 6.2%	0 (0%)	0.00%, 15%
Hindko	32 (5.7%)	4.0%, 8.1%	15 (5.1%)	3.0%, 8.5%	15 (6.3%)	3.7%, 10%	2 (7.1%)	1.2%, 25%
OTHERS	31 (5.4%)	3.7%, 7.6%	20 (6.8%)	4.3%, 11%	7 (2.9%)	1.3%, 6.2%	3 (11%)	2.8%, 29%
Pashto	56 (10%)	7.7%, 13%	31 (11%)	7.4%, 15%	25 (10%)	7.0%, 15%	0 (0%)	0.00%, 15%
Punjabi	41 (7.3%)	5.4%, 9.9%	19 (6.5%)	4.1%, 10%	18 (7.5%)	4.6%, 12%	4 (14%)	4.7%, 34%
Sindhi	42 (7.5%)	5.5%, 10%	23 (7.9%)	5.2%, 12%	17 (7.1%)	4.3%, 11%	2 (7.1%)	1.2%, 25%
Siraiki	16 (2.9%)	1.7%, 4.7%	10 (3.4%)	1.7%, 6.4%	6 (2.5%)	1.0%, 5.6%	0 (0%)	0.00%, 15%

Urdu	324 (58%)	54%, 62%	162 (55%)	50%, 61%	145 (60%)	54%, 67%	17 (61%)	41%, 78%
1 n (%)								
2 CI = Confidence Interval								



DISCUSSION

This study aimed to assess the prevalence of various infectious diseases among 560 pregnant women in Karachi, Pakistan, providing vital insights into maternal health in the region. The findings reveal a negligible prevalence of hepatitis B virus (HBV) infection, with 556 participants (99%) testing negative for HBsAg (p-value = 0.15). This low prevalence is encouraging, suggesting effective public health strategies in antenatal care, including vaccination programs and awareness initiatives that are crucial in a Pakistani context, where HBV remains a public health concern. However, the detection of 4 participants (0.7%) who tested positive (CI: 0.23% to 1.9%) highlights the need for continued vigilance and screening efforts, as these individuals may require further monitoring and treatment to prevent complications associated with HBV [12].

Similarly, the screening for hepatitis C virus (HCV) indicated a low prevalence, with 551 participants (98%) testing negative. The identification of 9 participants (1.6%) who tested positive (CI: 0.79% to 3.1%) raises awareness about the continued risk of HCV in the community. The lack of significant differences across age groups (p-value = 0.8) implies a uniform distribution of risk factors for HCV among the population studied. These results highlight the importance of continuous screening and preventive measures to maintain this low prevalence, particularly in Pakistan, where HCV prevalence rates can be higher compared to other regions [13].

The HIV screening results were particularly noteworthy, as all 560 participants tested negative. This outcome reflects successful screening efforts and underscores the importance of early detection and treatment in preventing mother-to-child transmission of HIV. The 95% confidence interval (99% to 100%) indicates a high level of confidence in these findings.

Rubella screening showed that a substantial majority (85%) tested positive for IgG, indicating immunity against rubella, which is crucial for preventing congenital rubella syndrome. However, the 13% negative rate could warrant further investigation to ensure that these women receive appropriate vaccination before or during pregnancy, especially given that rubella vaccination coverage can vary significantly across different regions of Pakistan. The presence of 10 participants (1.8%) with equivocal results and 75 (13%) testing negative underscores the need for follow-up testing and vaccination strategies [14].

The study's demographic analysis revealed that Urdu speakers comprised the majority of the sample, reflecting the linguistic composition of the local population. The low prevalence of other ethnic groups, such as Baloch and Bengali, indicates the need for targeted outreach and health education in these

communities to ensure equitable access to antenatal care and screening services, which is vital in a diverse country like Pakistan.

Regarding previous birth history, the significant finding that 388 participants (69%) had more than one birth suggests that these women may have experience navigating the healthcare system, potentially influencing their awareness of infectious diseases and prenatal care. This is particularly relevant given the significant variation in previous births across age groups (p-value < 0.001), indicating that younger women may require additional support and education.

The blood transfusion history demonstrated that 92 women (16%) reported receiving a transfusion, with a notably higher prevalence in the 36-46 age groups (21%). This finding raises concerns about the potential risks of transfusion-related infections and underscores the importance of safe blood transfusion practices in this demographic, particularly in Pakistan, where the safety of blood transfusions can vary based on available resources.

Lastly, the distribution of gestational age highlighted that most participants were in their 7th month of pregnancy, while only 0.2% were in their first month. This significant difference (p-value < 0.001) suggests a need for earlier antenatal visits to ensure timely screenings and interventions.

Overall, these results underscore the importance of continued public health efforts, targeted education, and accessible screening services to improve maternal and neonatal health outcomes in Pakistan. Addressing the identified gaps and disparities in antenatal care will be crucial in reducing the prevalence of infectious diseases among pregnant women in the region and ensuring healthier futures for mothers and their children. The positive results found in screening for infections, alongside the notable rates of immunity to rubella, suggest a cautiously optimistic outlook for maternal health in this population. However, the presence of positive cases in HBV and HCV screening indicates that ongoing vigilance and targeted interventions are essential to maintain these positive health outcomes [15].

CONCLUSION

In conclusion, this cross-sectional study provides valuable insights into the seroprevalence of hepatitis B, hepatitis C, HIV, rubella, and syphilis among pregnant women at JPMC, Karachi. The findings indicate a low prevalence of hepatitis B and C, with no cases of HIV or syphilis detected, underscoring the effectiveness of screening efforts. The high seropositivity for rubella IgG highlights prior exposure or vaccination, though a small percentage of participants tested equivocal or negative. Significant differences in previous birth history and blood transfusion rates were observed across age groups, emphasizing the importance of tailored antenatal care and monitoring in this population.

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