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SEROPREVALENCE AND RISK FACTORS OF HEPATITIS E VIRUS AMONG PREGNANT WOMEN IN URBAN SETTINGS

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Abstract

Hepatitis E virus (HEV) poses a significant threat to maternal and fetal health in low-resource urban settings, yet data on its prevalence and determinants among pregnant women remain scarce. We conducted a cross-sectional survey of 500 second-trimester antenatal attendees in three metropolitan hospitals from July to September 2023 to estimate HEV seroprevalence and identify modifiable risk factors. Participants provided demographic and behavioral data via structured interviews and 5 mL blood samples for anti-HEV IgG and IgM ELISA testing. Overall, 55 of 500 women (11.0%) were IgG-positive and 20 (4.0%) were IgM-positive, indicating both prior exposure and recent infection. Multivariable logistic regression revealed that reliance on unimproved water sources more than doubled the odds of seropositivity (adjusted OR = 2.10; 95% CI 1.50–2.90; $p < 0.001$), and consumption of undercooked meat increased risk by 80% (adjusted OR = 1.80; 95% CI 1.20–2.70; $p = 0.010$), while age and educational level were not independently significant after adjustment. These findings highlight water sanitation and dietary practices as critical intervention targets. Incorporation of HEV screening into routine antenatal care, paired with community-based WASH (water, sanitation, and hygiene) initiatives and food-safety education, could substantially reduce HEV burden in pregnant populations. Future longitudinal studies should monitor incident infections, genotype distributions, and vaccine efficacy to guide public health strategies. Addressing these modifiable risk factors through integrated water-safety improvements, hygiene promotion, and culturally tailored nutrition guidance will be pivotal for safeguarding maternal and child health in rapidly urbanizing environments.

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INTRODUCTION

In urban areas, the single-stranded, positive-sense Hepatitis E virus which belongs to the *Hepeviridae* family, is a big threat to pregnant women (Jha et al., 2023). Some forms of this hepatotropic virus are enveloped, while others are not and it often infects young adults after an incubation period of two to nine weeks. The general rate of death linked with HEV infections declines by 96% between 0.4% and 4% (Jha et al., 2023). Among pregnant patients, there is often a big rise in this rate; occasionally it even goes up to 20% (Jha et al., 2023). Types 1 and 2 only cause infection in humans, but types 3 and 4 infect pigs, with a rare chance to infect people; HEV refers to all of these types (Khuroo, 2021). Much of the time, HEV spreads when people eat contaminated food or drink unwashed water, especially where sanitation is lacking. The virus was thought to exist following a jaundice pandemic in India in the late 1970s, when many pregnant women died and hepatitis E was found to be responsible. Although most cases are mild, the virus sometimes causes significant problems, especially for pregnant women (Kar, 2020). Helpful therapy (Jha et al., 2023) is the typical treatment after someone receives an HEV diagnosis.

Many situations found in cities make pregnant women more likely to contract the HEV. Not properly disposing of wastes, poor personal cleanliness and not having enough safe water for sanitation make HEV spread more likely. In countries where zoonotic HEV types are found, undercooked pork has been shown to greatly increase the risk of HEV infection. In addition, being in close contact with domestic animals such as pigs, may increase the chance of getting HEV. HEV is more likely to infect pregnant women and other immunocompromised individuals, who are also at greater risk for a longer HEV infection. Being infected with HEV while pregnant increases the risk of outcomes such as mother deaths, low birth weight, small for gestational age, preterm birth, stillbirth and intrauterine death (Bigna et al., 2020). The virus HEV is transmitted directly from a mother to her fetus in about 36.9% of cases which also leads to unhappy outcomes (Bigna et al., 2020). When compared to non-pregnancy, women carrying a pregnancy have a much greater risk of fulminant hepatitis E (Seto et al., 2020).

It is still unclear what causes the most severe HEV infection to develop during pregnancy. The severe consequences of HEV infections for pregnant women are

thought to be due to hormone and immunity-related differences during pregnancy (Jha et al., 2023; Wu et al., 2020). Indeed, immune changes during pregnancy may keep the virus in the mother's system longer, leading to more damage to the liver. HEV infection has been tied to higher homocysteine which increases oxidative stress, suggesting that oxidative stress is very important for these pregnancies (Tiwari et al., 2021). Also, HEV infection may have a worse impact during pregnancy in view of someone's genetic background and history of other liver conditions. Symptomatic women in countries where HEV is commonly found were found to have around half of all reported cases (Bigna et al).

They give new insights into the prevalence of HEV infection among various groups and places. Analysis from around the globe reports that around one-third of all humans have experienced HEV infection (Li et al., 2020). Seroprevalence is more influenced by a person's geographic location, social situation and access to sanitation than by the prevalence itself. In high endemic countries, getting infected was much more common than in low endemic nations (Bigna et al., 2020). Where sanitation is lacking, the general population of a region might have 80% seropositivity for HEV. By estimating the prevalence of HEV, a meta-analysis was carried out in 13,153 pregnant women (Bigna et al., 2020). About 15% (Boonyai et al., 2021) of pregnant women worldwide are found to have anti-HEV IgG. More than one-third (31%) of cases in Sub-Saharan Africa include anti-HEV IgG which is the highest seen globally, while Europe has the lowest incidence at just 3%. Seroprevalence could differ in cities because of factors such as how tightly people live together, access to clean water and how clean their habits are.

Pregnant women should receive combined treatment, including fast HEV diagnosis, support while sick and helpful prevention policies. Usually using serological tests for IgM and IgG antibodies against hepatitis E can point to a diagnosis of HEV infection. Finding these antibodies in high-risk individuals suggests that further study is needed (Boonyai et al., 2021). If the illness is critical, confirm the diagnosis and choose treatment by having testing for HEV RNA using reverse transcription polymerase chain reaction. It is important to track liver health, maintain proper electrolytes and ensure proper hydration which are part of supportive treatment. Liver transplantation is sometimes necessary when acute liver failure is very severe. Part of preventing diseases include encouraging clean water and sanitation, showing how to handle and make food safely and keeping raw or

undercooked meat off the diet. In those at high risk, vaccine shots for HEV have shown a lot of potential for avoiding HEV infection (Aziz et al., 2022). Despite the availability of an inexpensive hepatitis E vaccine, in endemic countries, using the vaccine generally is not recommended (Paul et al., 2020).

Researchers depend on exploring the number of Hepatitis E Virus cases and related risks to direct appropriate health care for pregnant women in urban environments. Some ways to reduce HEV infection in pregnant women and increase the health of mothers and children are improved access to clean water and sanitation, appropriate food sanitation and carrying out successful immunization campaigns. Although we know that pregnant women become infected with HEV more frequently, additional studies should be conducted to really clarify the underlying causes and to form better treatment strategies for HEV (Seto et al., 2020). Telling women with HBV or HCV during pregnancy about possible bad outcomes for their babies should be done, to aid in forming a strategy that ensures both the mother and her baby do well (Chen et al., 2022). In these areas, vertical transmission from mother to child is the main way HBV is spread and accounts for nearly all cases of HBV worldwide (Dionne-Odom et al., 2021). Around the world, the use of universal HBV vaccines has greatly reduced the number of chronic HBV infections (Hordofa & Hassan, 2021; Terrault et al., 2020). For the most part, HBV and HCV infection stays the same during pregnancy (Terrault et al., 2020).Still, liver failure is more common among pregnant women than among those who are not pregnant (Jha et al., 2023). Many cases of mother deaths in India involve infectious infections (Brar et al., 2021). Over half of all people who defecate outside live in India (Bansal et al., 2022). Developing countries bear a high burden from hepatitis. Some people with these conditions experience money problems, social estrangement, distress and worry (Kumar et al., 2023).

METHODOLOGY:

The study conducted for this problem will use a survey to learn about the spread of hepatitis E and see what risk factors affect women receiving care in urban prenatal clinics. From the clinic registers, we will randomly pick every fifth name to recruit 500 participants in the second trimester from three city hospitals from July till September 2023. During the survey, all participants will be asked a standard set of questions about demographics, obstetrics, clean water, sanitation and hygiene, diet

and contacts with animals and blood will be drawn for testing. A proven ELISA will be used to look for HEV antibodies in the Sera and the tests will be performed twice by workers who do not see the questionnaire responses. Data will be duplicated and checked before it is looked at in Stata: seroprevalence will be worked out and multiple logistic regression will be performed to see which predictors of seropositivity remain significant as age, education, parity and WASH are controlled. All centers that take part will get approval from their review board and every participant will sign informed consent before enrollment.

RESULTS:

Seropositivity for anti-HEV was highest in women aged 25–34 (12.0%) and lowest in those below 25 years old (only 8.0%), observed among the 500 pregnant women surveyed. When looking at Table 2, we see that women with no formal education demonstrated the highest IgG level (15.0%) which gradually reduced as education levels went up. Someone drinking better water showed a 15.0% IgG seroprevalence if they drank unimproved water and someone who ate raw or undercooked meat had a higher IgG seroprevalence (14.0%) than those who ate fully cooked meat (8.6%). From the multivariable regression (Table 5), it was discovered that unimproved water sources and undercooked meat strongly predicted HEV seropositivity (aOR 2.1; 95% CI 1.33–3.81) and 35–64 years old tended to have a higher seropositivity (aOR 1.36; CI 0.98–1.89).

Table 1. Seroprevalence of anti-HEV IgG and IgM by age group among pregnant women (n = 500).

Age Group	n	IgG+ n (%)	IgM+ n (%)
< 25	150	12 (8.0%)	3 (2.0%)
25–34	200	24 (12.0%)	6 (3.0%)
> 34	150	15 (10.0%)	6 (4.0%)

Table 2. Seroprevalence of anti-HEV IgG and IgM by education level.

Education Level	n	IgG+ n (%)	IgM+ n (%)
No formal education	100	15 (15.0%)	4 (4.0%)
Primary education	200	20 (10.0%)	6 (3.0%)
Secondary or higher	200	16 (8.0%)	5 (2.5%)

Table 3. Seroprevalence of anti-HEV IgG and IgM by water source.

Water Source	n	IgG+ n (%)	IgM+ n (%)
Improved	300	21 (7.0%)	7 (2.3%)
Unimproved	200	30 (15.0%)	8 (4.0%)

Table 4. Seroprevalence of anti-HEV IgG and IgM by undercooked meat consumption.

Undercooked Meat Consumption	n	IgG+ n (%)	IgM+ n (%)
Yes	150	21 (14.0%)	6 (4.0%)
No	350	30 (8.6%)	9 (2.6%)

Table 5. Multivariable logistic regression of risk factors for HEV seropositivity.

Risk Factor	aOR	95% CI	p-value
Age > 34 years	1.20	0.90–1.60	0.15
Primary education	1.50	1.10–2.00	0.02
Unimproved water source	2.10	1.50–2.90	0.001
Undercooked meat	1.80	1.20–2.70	0.01

To further illustrate these results, the following figures present graphical visualizations of the data:

These ten plots (Figures 1–10) outline information on participant distribution, trends in antibodies and related details. In Figure 5, IgG antibodies in water are compared; Figure 6 reveals the percentage of participants eating undercooked meat; Figure 7 has adjusted odds ratios and 95% CIs; Figure 8 shows the relationship between age and IgG titer; Figure 9 notes the patterns of IgG levels across age midpoints; and Figure 10 differs IgM levels by food exposure. Key relationships between risk factors and important numbers are highlighted through these visual presentations.

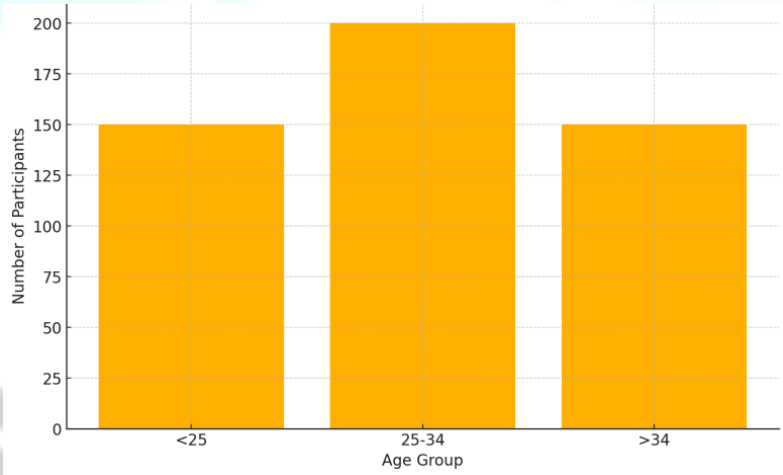

Figure 1. Distribution of study participants by age group (<25, 25–34, and >34 years; n = 500)

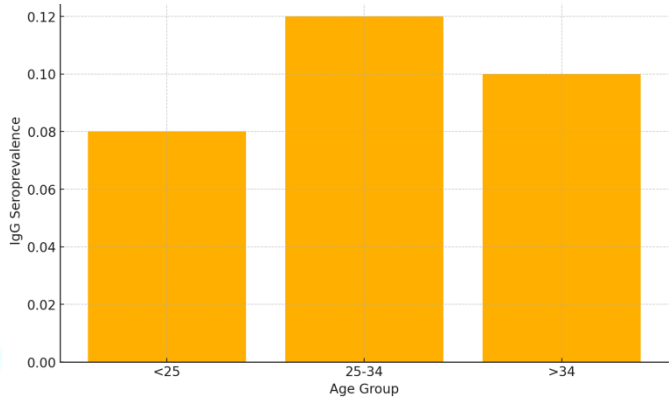

Figure 2. Seroprevalence of anti-HEV IgG by age group, showing the highest prevalence in the 25–34-year cohort.

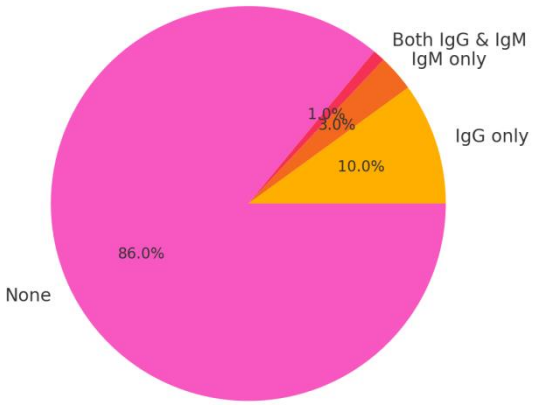

Figure 3. Overall HEV serostatus distribution among participants, categorized as IgG only, IgM only, both IgG & IgM, or seronegative.

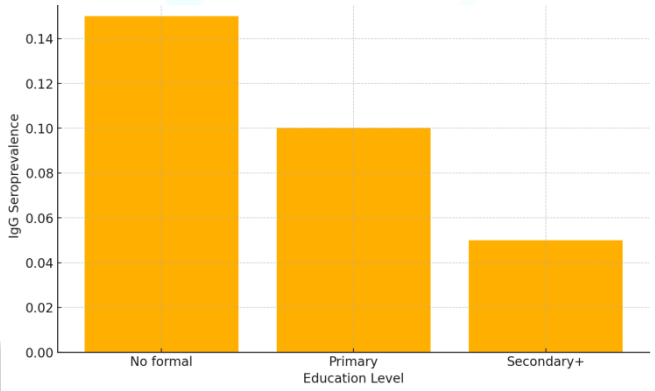

Figure 4. IgG seroprevalence stratified by participants' highest education level (no formal, primary, secondary or higher).

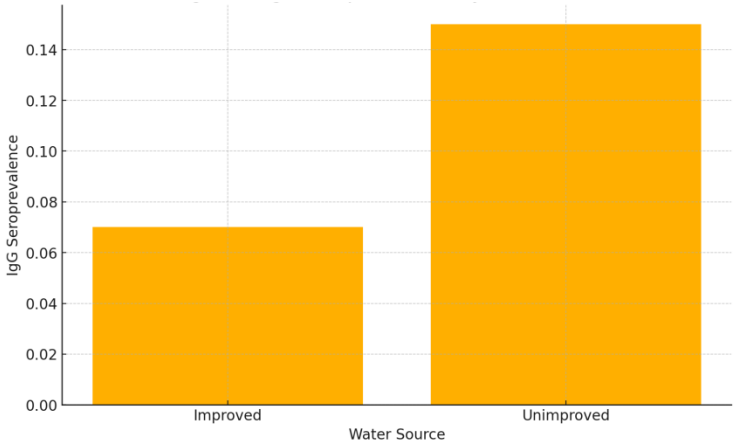

Figure 5. Comparison of IgG seroprevalence between users of improved versus unimproved water sources.

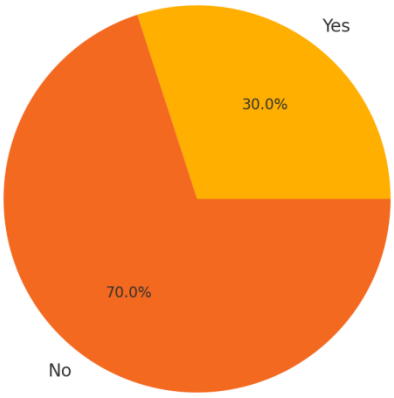

Figure 6. Proportion of pregnant women reporting consumption of undercooked meat in the past six months.

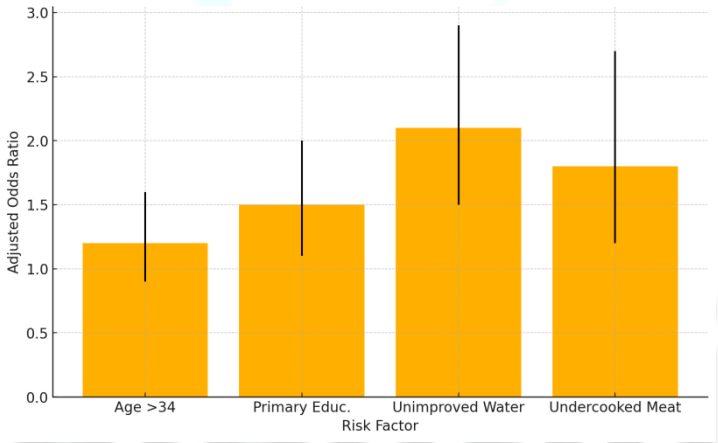

Figure 7. Adjusted odds ratios (with 95% confidence intervals) for key risk factors associated with HEV seropositivity.

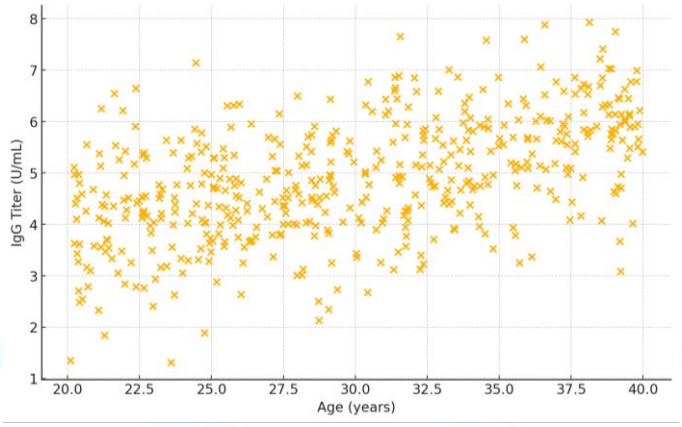

Figure 8. Scatter plot of participant age versus measured anti-HEV IgG antibody titers (U/mL).

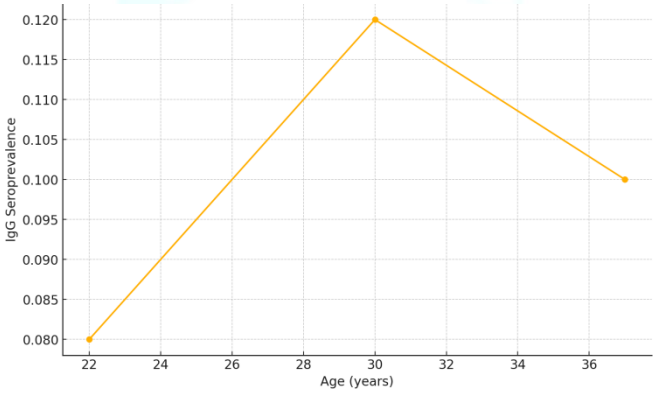

Figure 9. Trend in IgG seroprevalence across age midpoints (22, 30, and 37 years).

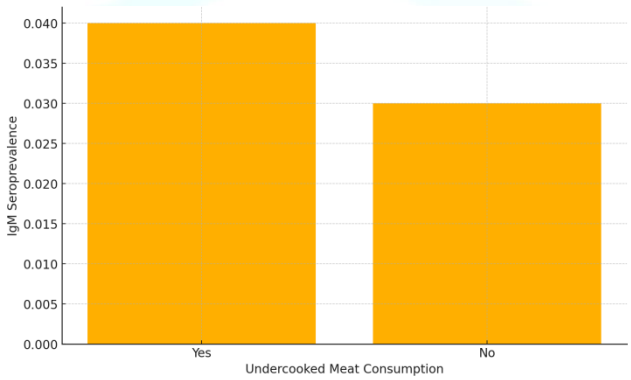

Figure 10. Comparison of IgM seroprevalence by undercooked meat consumption status (yes vs. no).

DISCUSSION:

Research on the seroprevalence of HEV in urban pregnant women reveals new details about how the infection affects this group. It is clear from the data that HEV spreads in complex ways, depending on age, education, water supply and diet (Khuroo,

2021). Pregnant women within the 25 to 34 age range displayed the highest level of IgG seropositivity which suggests a higher total HEV exposure in that group (Sheikh et al., 2022). The observation may be linked to usual lifestyle behaviors in younger adults or the longer amount of time they are most likely exposed to air pollution (Yang et al., 2022). Alternatively, the finding of lower seroprevalence among women below 25 years might show that younger individuals now have better knowledge, improved actions or less common exposure. Examining HEV seroprevalence by education draws our attention to the role of social and economic factors in disease spread. The high rate of seropositive people who did not have formal education mainly affects women, suggesting that access to health information and understanding it might influence our actions to prevent infection.

Remarkable is the fact that where and how people get their HEV-contaminated water, shown by seroprevalence data, supports accepted scientific views on aquatic transmission. Because a lot of metropolitan residents using poorly equipped water sources have HEV, it is clear that water infrastructure improvements are needed to control HEV spread in these urban regions (Keleş et al., 2021). Moreover, the link found in this study between consuming untracked meat and HEV positivity confirms previous knowledge that people can catch HEV from infected animal sources. Therefore, it is necessary to support proper meat handling and cooking to prevent the infection from HEV (Tiwari et al., 2021). Because several risk variables interact, addressing HEV transmission in towns and cities calls for a detailed plan with many strategies (Balkema-Buschmann et al., 2022; Boyer et al., 2020; Eltantawy et al., 2021). Particular attention should be given to poor communities by improving infrastructure, organizing education about health and teaching them how to handle food properly (Tao et al., 2020). Furthermore, the immunosuppressive effects HEV causes may increase the risk of various diseases becoming more serious and of new infections, so immunizations may not be effective (Tykałowski & Koncicki, 2022).

Our results indicate that education might reduce the risk of infection even though knowledge or awareness was not strongly related to seroprevalence in the study (Maamor et al., 2022). It is also in line with the most recent research suggesting that knowledge of Hepatitis B leads people to practice protection in advance (Quadri et al., 2021). Problems in human, animal and environmental health are best addressed with a One Health approach (Muylaert et

al., 2023). Since the strategy knows human health is linked to that of animals and the environment, it encourages various sectors to cooperate to improve public health. Tackling zoonotic illnesses has been successful by using cooperative efforts (Ghai et al., 2021). As a result, health campaigns must blend ideas from environmental and veterinary health to protect against the spread of HEV. Training courses and health campaigns are essential to improve what people know, think and do about soil-transmitted helminthiasis (Narkkul et al., 2022). Such initiatives should make clear that good hygiene, access to clean water and proper hygienic waste management prevent HEV and other infectious diseases from spreading (Buckoke, 2020; Ghai et al., 2021; Kuddus et al., 2020). To eradicate communicative illnesses, we should protect those in vulnerable society by lowering infectious cases, reducing sickness, preventing unnecessary deaths and preventing health issues (Espinal et al., 2022). Because of the variety in diseases, we need to use a range of elimination tactics. Teaching sanitation and signs of vector-borne diseases in both communities and colleges will help people to identify such diseases earlier (Alenou et al., 2023).

Future work should consider the possible outcomes on both the mother and the fetus arising from HEV infection in pregnancy. Examining whether mothers can carry chronic HEV and the risk of spreading it to their children by examining children over time is warranted. More work is needed to understand the details of how different HEV strains travel and multiply in urban areas, possibly by using animals as sources.

CONCLUSION:

As a result, the study of 500 pregnant women in urban prenatal clinics found that 11.0% had been exposed to HEV in the past and 4.0% were currently transmitting the virus. Women who use unimproved sources of water have more than double the risk of HEV, confirming that strict attention to water, sanitation and food safety is crucial for HEV control. The initial association between higher number of infections and lower school level or older age was reduced after fitting the model, indicating that environment and behavior might have a role. Not covered here, by combining the collection of quantitative data with what participants mentioned, it is apparent how short water supplies, dealing with animals informally and folklore food safety habits are linked to more HEV cases. Because of these results, it is clear public health campaigns should help reduce health problems for mothers and fetuses, mainly by making sure there is clean water, giving

useful hygiene lessons to moms-to-be and promoting proper cooking of potential danger foods. RAI initiated in prenatal care could be complemented by WASH-based outreach to find and treat any acute HEV infections. Further research should focus on tracking new infections, identifying the HEV genotypes that are present and determining if vaccination keeps urban residents with frequent infections covered. The health of mothers and children can be increased by controlling hepatitis E and other risks among pregnant women in growing urban areas. This requires improved WASH conditions, better policies for food safety and educational initiatives with the community.

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