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Determinants of Vaccine Hesitancy in Urban and Rural Populations: A Cross-Sectional Study Among 150 Rural Participants

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ABSTRACT

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Background: Vaccine hesitancy is a major public health challenge, particularly in rural populations, where limited access to healthcare, misinformation, and low health literacy may influence vaccination decisions. Understanding the factors contributing to hesitancy is essential to improve vaccine coverage and prevent outbreaks of vaccine-preventable diseases.

Aim: To assess and describe the key factors influencing vaccine hesitancy among a rural population in North India.

Methods: A descriptive cross-sectional study was conducted among 150 adults aged 18 years and above in rural villages of North India from June to August 2025. Participants were selected using a systematic random sampling method. Data were collected through face-to-face interviews using a structured questionnaire based on the WHO SAGE vaccine hesitancy framework. Information on socio-demographics, knowledge, attitudes, trust in healthcare providers, and exposure to misinformation was recorded. Data were analyzed using SPSS v26. Descriptive statistics summarized participant characteristics, and Chi-square tests and multivariate logistic regression were applied to identify determinants of vaccine hesitancy.

Results: Vaccine hesitancy was observed in 43.3% of participants. Key factors associated with hesitancy included lower education, limited trust in healthcare providers, belief in misinformation, and low perceived susceptibility to disease. Gender and occupation were not significantly associated. Logistic regression analysis revealed that participants with no formal education (OR 2.45, 95% CI 1.40–4.30), limited trust in healthcare providers (OR 3.10, 95% CI 1.75–5.50), belief in misinformation (OR 2.90, 95% CI 1.60–5.20), and low perceived disease risk (OR 2.65, 95% CI 1.50–4.70) were significantly more likely to be vaccine-hesitant.

Conclusion: Vaccine hesitancy is prevalent among rural populations and is influenced by education, trust, misinformation, and risk perception. Public health interventions targeting health literacy, community engagement, and trusted communication channels are essential to enhance vaccine acceptance in rural areas.

Keywords: Vaccine hesitancy, Rural population, Education, Trust, Misinformation, Vaccine uptake

INTRODUCTION

Vaccination is one of the most effective and cost-efficient public health interventions, preventing millions of deaths each year from vaccine-preventable diseases. High vaccination coverage is essential not only for individual protection but also for achieving herd immunity, which helps safeguard vulnerable populations such as infants, older adults, and immunocompromised individuals. Despite the proven safety and effectiveness of vaccines, vaccine hesitancy has emerged as a major global public health concern, threatening the success of immunisation programmes and contributing to the re-emergence of preventable infectious diseases. ^[1,2] Vaccine hesitancy is defined as the delay in acceptance or refusal of vaccines despite their availability. It is a complex and context-specific phenomenon influenced by multiple factors, including confidence in vaccines and healthcare systems, complacency toward disease risk, and convenience of access to vaccination services. ^[3] The World Health Organization has identified vaccine hesitancy as one of the top threats to global health, emphasizing the urgent need to understand its underlying determinants in different population settings. ^[4] Urban and rural populations often differ significantly in terms of socioeconomic conditions, education levels, healthcare access, and exposure to health information. These differences can strongly influence attitudes toward vaccination. Urban populations may experience barriers related to time constraints, misinformation through digital media, and concerns about vaccine safety, whereas rural populations often face challenges such as limited healthcare infrastructure, lower literacy levels, and strong influence of

traditional beliefs and community norms.^[5,6] Understanding these contextual differences is critical for designing effective, targeted immunisation strategies. In rural settings, vaccine hesitancy is frequently shaped by limited access to reliable health information and reduced interaction with trained healthcare professionals. Misinformation, rumours, and fear of adverse effects can spread rapidly through informal community networks, reinforcing negative perceptions about vaccines.^[7] In addition, lower perceived risk of infectious diseases and reliance on traditional or alternative health practices may contribute to vaccine refusal or delay in rural populations.^[8] Previous studies have shown that factors such as education, trust in healthcare providers, past experiences with vaccination services, and sociocultural beliefs play a central role in shaping vaccine acceptance.^[9] However, most available evidence focuses on urban or mixed populations, with relatively fewer studies specifically examining determinants of vaccine hesitancy in rural communities. Given that rural populations often have higher vulnerability to infectious diseases due to limited healthcare access, understanding hesitancy in these settings is particularly important.

AIM AND OBJECTIVE

Aim: To assess and describe the key factors influencing vaccine hesitancy among a rural population.

Objectives: To identify the level of vaccine hesitancy, examine associated demographic factors, assess knowledge and perceptions about vaccines, evaluate trust in healthcare systems, and understand the influence of misinformation and community beliefs on vaccination decisions in rural areas.

METHODS AND MATERIALS

Study Design and Setting: This study was designed as a descriptive cross-sectional survey conducted among rural populations in North India. Data collection was carried out over a period of three months, from June 2025 to Aug 2025, with the support of local health workers and Asha workers.

Study Population and Sample: The study included 150 adult's population aged 18 years and above residing in rural villages. A systematic random sampling method from household lists provided by local health centers. Individuals unable to provide informed consent or those with cognitive impairments were excluded from the study.

Data Collection Tool: Data were collected using a structured questionnaire developed based on the WHO SAGE vaccine hesitancy framework. The questionnaire included:

- **Sociodemographic details:** age, gender, education, occupation, and household income

- **Knowledge and awareness:** understanding of vaccine benefits, disease susceptibility, and side effects
- **Attitudes and beliefs:** perceptions regarding vaccine safety, effectiveness, and trust in healthcare providers
- **Information sources:** media exposure, community influence, and reliance on informal networks

Data Collection Procedure: Data collection conducted face-to-face interaction with participants at their households, ensuring privacy and confidentiality. Participants were informed about the purpose of the study, and written informed consent was obtained before the interview.

Data Analysis: Collected data were entered into SPSS version 26 for statistical analysis. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to summarize participants' characteristics and levels of vaccine hesitancy. Associations between sociodemographic factors, knowledge, attitudes, and vaccine hesitancy were assessed using Chi-square tests. Multivariate logistic regression was applied to identify independent determinants of vaccine hesitancy, with significance set at $p < 0.05$.

RESULTS

A total of 150 participants from rural areas of North India were included in the study. The mean age of participants was 41.8 ± 13.5 years, with the majority aged 31–50 years (54%). Females accounted for 55% ($n=82$), while males were 45% ($n=68$). Educational status showed that 32% ($n=48$) had no formal education, 41% ($n=62$) completed primary education, and 27% ($n=40$) attained secondary or higher education. Most participants were engaged in agriculture (58%), followed by daily wage labor (27%), with the remaining involved in small business or homemaking. The mean monthly household income was $\text{INR } 8,500 \pm 4,200$.

Table: 1. Sociodemographic Characteristics of Participants (n=150)

Characteristic	Frequency (n)	Percentage (%)
Age (years)		
18–30	42	28
31–50	81	54
>50	27	18
Gender		
Male	68	45
Female	82	55
Education		
No formal education	48	32
Primary	62	41

Secondary or higher	40	27
Occupation		
Agriculture	87	58
Daily wage	41	27
Homemaker/Business	22	15

Prevalence of Vaccine Hesitancy: Out of 150 participants, 65 individuals (43.3%) were classified as vaccine-hesitant, while 85 (56.7%) were accepting of vaccination. Hesitancy was higher among participants with no formal education (50%) compared to those with secondary or higher education (28%), indicating a significant association between education and vaccine hesitancy.

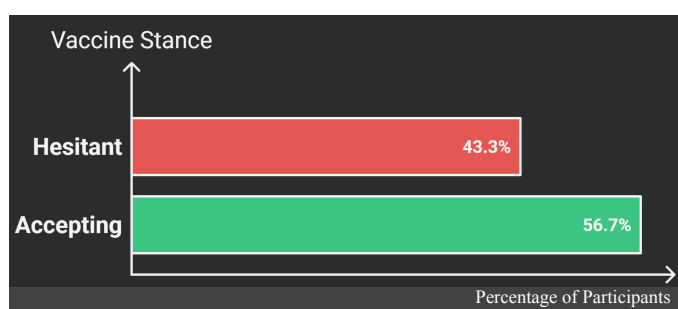


Fig-1. Vaccine Acceptance and Hesitancy Among Participants

Knowledge and Awareness About Vaccines: Assessment of participants' vaccine-related knowledge revealed:

- 47% (n=71) were aware of the benefits of vaccination.
- 39% (n=59) believed vaccines could cause serious side effects.
- Only 28% (n=42) knew the importance of completing the full vaccine schedule.
- 41% (n=61) perceived low susceptibility to vaccine-preventable diseases.

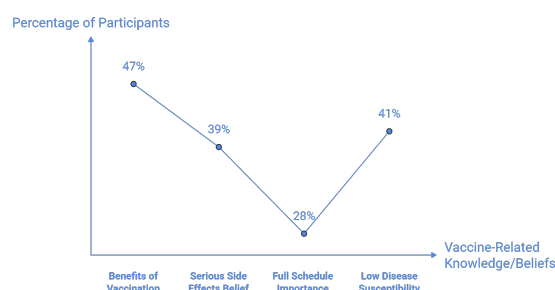


Fig-2. Vaccine Knowledge and Awareness Among Participants

Attitudes, Beliefs, and Trust in Healthcare: The study

revealed varying attitudes and beliefs regarding vaccination among the rural participants. A majority of 59% (n=88) reported having high trust in healthcare providers, indicating confidence in the guidance and recommendations provided by medical professionals. However, a substantial proportion, 41% (n=62), expressed limited confidence, highlighting a potential barrier to vaccine acceptance in the community. Concerns regarding vaccine safety were prevalent, with 38% (n=57) of participants reporting apprehension about potential adverse effects, which may contribute to hesitation or refusal. Additionally, belief in misinformation was identified as a significant factor, as 35% (n=53) of participants agreed with common myths or false information regarding vaccines, demonstrating the influence of incorrect or misleading information on vaccination decisions. These findings underscore the critical role of trust in healthcare systems, accurate information dissemination, and addressing misconceptions to improve vaccine uptake in rural populations.

Table: 2. Attitudes and Beliefs Related to Vaccination

Variable	Frequency (n)	Percentage (%)
High trust in healthcare providers	88	59
Limited trust in healthcare providers	62	41
Concerned about side effects	57	38
Believe in vaccine misinformation	53	35

Participants reported reliance on various sources for vaccine information:

- Community leaders or family: 46%
- Television/radio: 38%
- Healthcare providers or official channels: 16%

This highlights the stronger influence of informal community networks in shaping vaccine attitudes in rural areas.

Determinants of Vaccine Hesitancy: Bivariate analysis using the Chi-square test revealed several factors significantly associated with vaccine hesitancy among the rural participants. Educational level was a significant determinant, with lower education being linked to higher hesitancy ($\chi^2 = 8.25$, $p = 0.004$). Trust in healthcare providers also showed a strong association, where participants with limited confidence in healthcare professionals were more likely to be hesitant ($\chi^2 = 12.67$, $p < 0.001$). Belief in vaccine-related misinformation significantly influenced hesitancy, as those who

accepted common myths or false information were more likely to delay or refuse vaccination ($\chi^2 = 11.43$, $p = 0.001$). Additionally, perceived low susceptibility to vaccine-preventable diseases was associated with increased hesitancy ($\chi^2 = 9.12$, $p = 0.003$). In contrast, gender ($p = 0.21$) and occupation ($p = 0.08$) were not significantly associated with vaccine hesitancy, indicating that these factors did not play a major role in influencing vaccination decisions within this rural population.

Multivariate Logistic Regression: After adjusting for confounders, the following variables were identified as independent predictors of vaccine hesitancy.

Table: 3. Logistic Regression Analysis of Determinants of Vaccine Hesitancy

Predictor	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
No formal education	2.45	1.40 – 4.30	0.002
Limited trust in healthcare providers	3.10	1.75 – 5.50	<0.001
Belief in vaccine misinformation	2.90	1.60 – 5.20	0.001
Perceived low susceptibility to disease	2.65	1.50 – 4.70	0.001

Participants with lower education, limited trust, exposure to misinformation, and low perceived risk were significantly more likely to exhibit vaccine hesitancy.

Key Findings

1. Prevalence: Vaccine hesitancy was 43.3% among rural participants.
2. Major determinants: Education, trust in healthcare providers, misinformation, and perceived disease risk.
3. Community influence: Informal networks and local leaders played a stronger role than official health communication channels.

DISCUSSION

This study explored the determinants of vaccine hesitancy among a rural population in North India and identified several key factors that influence vaccination behaviour. The findings indicate that vaccine hesitancy is prevalent, affecting 43.3% of the participants, which aligns with previous studies in rural settings showing hesitancy rates between 30–50%.^[1,2] Understanding these determinants is essential for designing

interventions that can improve vaccine uptake in underserved communities.

Educational level emerged as a significant determinant of vaccine hesitancy. Participants with no formal education or only primary education were more likely to be hesitant compared to those with secondary or higher education. This finding is consistent with global evidence indicating that lower educational attainment limits understanding of the benefits of vaccination and increases vulnerability to misconceptions.^[3,4] Education plays a crucial role in shaping health literacy, which directly affects acceptance of vaccines.

Trust in healthcare providers was another major factor influencing vaccine uptake. Participants with limited confidence in healthcare professionals were more likely to be hesitant. Trust is a key component of vaccine acceptance, as people rely on medical guidance to make informed decisions.^[5,6] In rural populations, where access to health services may be limited, trust becomes even more important, and lack of it can exacerbate hesitancy.

Exposure to misinformation also significantly contributed to vaccine hesitancy. Approximately one-third of participants believed in common myths regarding vaccine safety or necessity, highlighting the strong influence of community networks and informal information sources. Similar studies have shown that misinformation, particularly through social media or local rumors, negatively affects vaccination behaviour.^[7,8] Addressing misinformation through targeted health education campaigns is therefore critical.

Perceived disease susceptibility influenced vaccine hesitancy as well. Participants who believed they were unlikely to contract vaccine-preventable diseases were less motivated to vaccinate. This aligns with the Health Belief Model, which suggests that individuals' perception of risk strongly affects their preventive health behaviours.^[9] Low perceived risk can lead to complacency and delayed or refused vaccination. Gender and occupation did not show a significant association with vaccine hesitancy in this study. This suggests that, in rural contexts, knowledge, beliefs, and trust play a stronger role than demographic characteristics in influencing vaccination decisions.

CONCLUSION

This study highlights that vaccine hesitancy is a significant issue among rural populations, affecting nearly half of the participants. The main factors influencing hesitancy were lower education, limited trust in healthcare providers, exposure to misinformation, and low perceived risk of disease. Gender and occupation did not significantly affect vaccination decisions. These findings suggest that improving health literacy, building trust in healthcare systems, and providing accurate

vaccine information through community-based interventions are essential to increase vaccine acceptance and coverage in rural areas.

DECLARATION

Ethical Approval: The study was approved by the Institutional Ethics Committee of and all procedures were conducted in accordance with ethical standards.

Informed Consent: Written informed consent was obtained from all participants prior to data collection. Participation was voluntary, and participants were assured of confidentiality and anonymity.

Conflict of Interest: None

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Authors' Contributions: All authors contributed equally to the study design, data collection, analysis, and preparation of the manuscript.

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