



## Original Research Article

# PREVALENCE AND DETERMINANTS OF VACCINE HESITANCY AMONG ADULTS IN URBAN POPULATION

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### ABSTRACT

**Background:** Vaccine hesitancy has emerged as a major public health concern, even in urban populations with better access to healthcare services. It is influenced by multiple sociodemographic and behavioral factors, affecting vaccine uptake and the success of immunization programs. This study aimed to assess the prevalence and determinants of vaccine hesitancy among adults in an urban population.

**Materials and Methods:** A community-based cross-sectional study was conducted among 351 adults in the urban field practice area of a tertiary care center in Kalyani, West Bengal. Participants were selected using multistage sampling. Data were collected using a pretested semi-structured questionnaire. Vaccine hesitancy was assessed based on the WHO SAGE framework. Statistical analysis included descriptive statistics, Chi-square test, and logistic regression.

**Results:** The prevalence of vaccine hesitancy was 28.8%. Higher hesitancy was observed among younger adults, males, individuals with lower education, and those from lower socioeconomic status. Fear of side effects (57.4%), social media misinformation (46.5%), and doubts about vaccine efficacy (40.6%) were the most common reasons. Multivariate analysis revealed that primary education (AOR = 2.48) and lower socioeconomic status (AOR = 2.31) were significant independent predictors of vaccine hesitancy.

**Conclusion:** Vaccine hesitancy remains a significant challenge in urban populations, driven by educational, socioeconomic, and informational factors. Targeted health education, improved communication strategies, and efforts to counter misinformation are essential to enhance vaccine acceptance and strengthen immunization programs.

**Keywords:** Vaccine hesitancy; Socioeconomic factors; Health education; Immunization.

## INTRODUCTION

Vaccination is one of the most successful and cost-effective public health interventions, responsible for preventing millions of deaths annually and significantly reducing the burden of infectious diseases worldwide.<sup>[1,2]</sup> Despite these achievements, vaccine hesitancy has emerged as a major global health concern, threatening the progress made in disease control and elimination. The World Health Organization (WHO) has defined vaccine hesitancy

as the delay in acceptance or refusal of vaccines despite the availability of vaccination services and identified it as one of the top ten threats to global health.<sup>[3,4]</sup>

Vaccine hesitancy is a complex and context-specific phenomenon that varies across time, place, and population groups. It is influenced by a range of factors conceptualized under the “3Cs” model—confidence (trust in vaccines and health systems), complacency (perceived low risk of disease), and convenience (access to vaccines).<sup>[3,5]</sup> In recent years,

rapid urbanization and increased access to digital media have contributed to the spread of misinformation, further amplifying hesitancy, particularly among urban populations.<sup>[6]</sup>

Urban populations, although having better healthcare infrastructure and accessibility, demonstrate varying levels of vaccine acceptance. Studies conducted in urban settings have reported considerable prevalence of vaccine hesitancy. For instance, a cross-sectional study in an urbanized region of New Delhi reported a prevalence of 28.9%, highlighting that hesitancy persists even in areas with relatively good healthcare access.<sup>[7]</sup> Similarly, global and regional studies have shown moderate to high levels of hesitancy among adults, indicating that availability alone does not guarantee vaccine uptake.<sup>[8,9]</sup>

The COVID-19 pandemic has further highlighted the magnitude and implications of vaccine hesitancy among adults. Vaccine hesitancy has been identified as a key barrier to achieving herd immunity and controlling the spread of infection.<sup>[10]</sup> Studies have demonstrated that a substantial proportion of adults exhibit reluctance or delay in accepting COVID-19 vaccines due to concerns about safety, efficacy, and rapid vaccine development.<sup>[6,11]</sup>

Multiple determinants contribute to vaccine hesitancy in urban populations. Sociodemographic factors such as age, gender, education, and socioeconomic status play a significant role. In addition, individual perceptions—including fear of side effects, mistrust in healthcare systems, and low perceived risk of disease—have been consistently identified as major contributors.<sup>[6,12]</sup> Contextual influences such as cultural beliefs, religious affiliation, and reliance on traditional remedies also impact vaccine acceptance.<sup>[11]</sup> Furthermore, logistical barriers, including time constraints, accessibility issues, and lack of family or social support, have been reported as important predictors in urban settings.<sup>[7]</sup>

The increasing influence of social media and the “infodemic” has further complicated the issue by facilitating the rapid spread of misinformation and conspiracy theories, thereby undermining public confidence in vaccines.<sup>[9]</sup>

These factors often interact in complex ways, making vaccine hesitancy a multifactorial challenge that requires targeted and context-specific interventions. Given the growing urban population and the persistent burden of vaccine-preventable diseases, understanding the prevalence and determinants of vaccine hesitancy among adults in urban settings is crucial. Identifying these factors will aid in designing effective public health strategies, improving vaccine acceptance, and strengthening immunization programs. Therefore, this study aims to assess the prevalence and determinants of vaccine hesitancy among adults in an urban population.

## MATERIALS AND METHODS

A community-based cross-sectional study was conducted in the Department of Community Medicine at a tertiary care centre at Kalyani, West Bengal, India. The study was carried out over a period of six months, from [August 2025 to February 2026], in the urban field practice area affiliated with the Department of Community Medicine. The study population comprised adults aged 18 years and above residing in the selected urban area for at least six months prior to the study. Individuals who were seriously ill, cognitively impaired, or unwilling to participate were excluded from the study.

The sample size was calculated using the standard formula for estimation of a single population proportion, considering a prevalence of vaccine hesitancy of 28.9% based on a recent study conducted in an urban population.<sup>[11]</sup> A 95% confidence interval and 5% absolute precision were assumed for the calculation. The initial sample size was computed to be 316. After adjusting for a 10% non-response rate, the final sample size was determined to be 351 participants. A multistage sampling technique was employed to select the study participants. Initially, wards within the urban field practice area were selected using simple random sampling. Subsequently, households within each selected ward were chosen by systematic random sampling. From each household, one eligible adult respondent was selected using the lottery method.

Data were collected using a predesigned, pretested, semi-structured questionnaire administered through face-to-face interviews. The questionnaire included sections on sociodemographic characteristics (age, gender, education, occupation, and socioeconomic status), vaccination history, and factors related to vaccine hesitancy. Vaccine hesitancy was assessed using a validated scale based on the WHO SAGE Working Group framework, incorporating domains such as confidence, complacency, and convenience. Additional questions assessed sources of information, exposure to misinformation, and trust in healthcare systems.

Prior to data collection, the questionnaire was pretested in a similar urban population outside the study area, and necessary modifications were made to ensure clarity and validity. Data collectors were trained regarding the objectives of the study, ethical considerations, and interview techniques to minimize interviewer bias.

Ethical approval for the study was obtained from the Institutional Ethics Committee board. Written informed consent was obtained from all participants before enrolment in the study. Confidentiality and anonymity of the respondents were strictly maintained throughout the study.

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics such as mean, standard deviation, frequency, and percentage

were used to summarize the data. The prevalence of vaccine hesitancy was expressed as a proportion with a 95% confidence interval. Inferential statistics, including the Chi-square test, were applied to assess the association between vaccine hesitancy and categorical variables. A p-value of less than 0.05 was considered statistically significant for all analyses.

## RESULTS

In the present study, out of 351 participants, 101 (28.8%) were found to be vaccine hesitant, while 250 (71.2%) were not hesitant. This indicates that nearly one-third of the urban adult population exhibited some degree of hesitancy toward vaccination, highlighting a substantial public health concern despite the availability of vaccination services. [Figure 1]

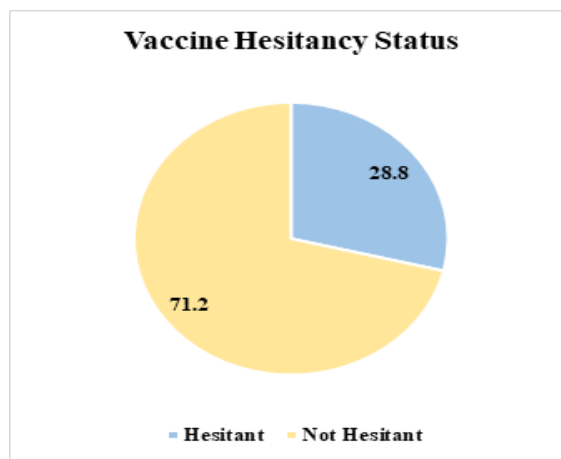


Figure 1: Prevalence of Vaccine hesitancy

The majority of participants belonged to the age group of 30–44 years (33.6%), followed by 18–29 years (29.1%). Participants aged  $\geq 60$  years constituted the smallest proportion (14.8%). Males (53.0%) slightly outnumbered females (47.0%). In terms of education, 42.5% had graduate-level education or higher, while 39.3% had secondary education. Most participants were employed (54.7%), and the majority belonged to the middle socioeconomic class (51.9%). [Table 1]

Table 1: Socio-demographic characteristics of study subjects

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	18–29	102	29.1
	30–44	118	33.6
	45–59	79	22.5
	$\geq 60$	52	14.8
Gender	Male	186	53.0
	Female	165	47.0
Education	Primary	64	18.2
	Secondary	138	39.3
	Graduate & above	149	42.5
Occupation	Employed	192	54.7
	Unemployed	78	22.2
	Homemaker	81	23.1
Socioeconomic status	Lower	89	25.4
	Middle	182	51.9
	Upper	80	22.7

Among the 101 vaccine-hesitant individuals, the most commonly reported reason was fear of side effects (57.4%), followed by influence of social media misinformation (46.5%) and doubts regarding vaccine efficacy (40.6%). Lack of trust in the

healthcare system (32.7%) and perceived low risk of disease (28.7%) were also notable contributors. Religious or cultural beliefs accounted for 17.8% of hesitancy. [Table 2]

Table 2: Distribution of Reasons for Vaccine Hesitancy (n = 101)

Reason	Frequency (n)	Percentage (%)
Fear of side effects	58	57.4
Doubts about vaccine efficacy	41	40.6
Lack of trust in healthcare system	33	32.7
Influence of social media misinformation	47	46.5
Perceived low risk of disease	29	28.7
Religious/cultural beliefs	18	17.8

A statistically significant association was observed between age and vaccine hesitancy ( $p = 0.038$ ), with higher hesitancy seen among younger age groups (18–29 years: 35.3%). Gender also showed a

significant association ( $p = 0.047$ ), with males demonstrating higher hesitancy (32.3%) compared to females (24.8%).

Education was significantly associated with hesitancy ( $p = 0.006$ ), as individuals with primary education had the highest hesitancy (43.8%), while those with graduate education showed the lowest (18.8%). Socioeconomic status also demonstrated a

strong association ( $p = 0.001$ ), with the lower class exhibiting higher hesitancy (43.8%).

However, occupation did not show a statistically significant association ( $p = 0.052$ ), although higher hesitancy was observed among unemployed individuals. [Table 3]

**Table 3: Association Between Socio-demographic Variables and Vaccine Hesitancy**

Variable	Category	Hesitant n (%)	Not Hesitant n (%)	Total	p-value
Age (years)	18–29	36 (35.3)	66 (64.7)	102	0.038*
	30–44	38 (32.2)	80 (67.8)	118	
	45–59	18 (22.8)	61 (77.2)	79	
	≥60	9 (17.3)	43 (82.7)	52	
Gender	Male	60 (32.3)	126 (67.7)	186	0.047*
	Female	41 (24.8)	124 (75.2)	165	
Education	Primary	28 (43.8)	36 (56.2)	64	0.006*
	Secondary	45 (32.6)	93 (67.4)	138	
	Graduate & above	28 (18.8)	121 (81.2)	149	
Occupation	Employed	49 (25.5)	143 (74.5)	192	0.052
	Unemployed	27 (34.6)	51 (65.4)	78	
	Homemaker	25 (30.9)	56 (69.1)	81	
Socioeconomic status	Lower	39 (43.8)	50 (56.2)	89	0.001*
	Middle	45 (24.7)	137 (75.3)	182	
	Upper	17 (21.3)	63 (78.7)	80	

In univariate analysis, younger age groups (18–29 years:  $COR = 2.61$ ; 30–44 years:  $COR = 2.26$ ) were significantly more likely to exhibit vaccine hesitancy compared to those aged  $\geq 60$  years. Males had higher odds of hesitancy compared to females ( $COR = 1.45$ ). Education showed a strong association, with individuals having primary education ( $COR = 3.36$ )

and secondary education ( $COR = 2.09$ ) being significantly more likely to be hesitant compared to graduates. Lower socioeconomic status was also a significant predictor ( $COR = 2.89$ ).

Occupation did not show a statistically significant association in univariate analysis. [Table 4]

**Table 4: Univariate (Bivariate) Logistic Regression Analysis of Factors Associated with Vaccine Hesitancy**

Variable	Category	Crude Odds Ratio (COR)	95% CI	p-value
Age (years)	18–29	2.61	1.18 – 5.75	0.018*
	30–44	2.26	1.05 – 4.85	0.035*
	45–59	1.38	0.60 – 3.16	0.442
	≥60 (Ref)	1	-	-
Gender	Male	1.45	0.92 – 2.28	0.048*
	Female (Ref)	1	-	-
Education	Primary	3.36	1.86 – 6.05	<0.001*
	Secondary	2.09	1.23 – 3.56	0.006*
	Graduate & above (Ref)	1	-	-
Occupation	Unemployed	1.55	0.88 – 2.72	0.123
	Homemaker	1.30	0.73 – 2.32	0.368
	Employed (Ref)	1	-	-
Socioeconomic status	Lower	2.89	1.63 – 5.12	<0.001*
	Middle	1.22	0.69 – 2.15	0.487
	Upper (Ref)	1	-	-

After adjusting for confounding factors, education and socioeconomic status remained significant independent determinants of vaccine hesitancy. Individuals with primary education had 2.48 times higher odds of hesitancy ( $AOR = 2.48$ ,  $p = 0.006$ ), and those belonging to the lower socioeconomic class had 2.31 times higher odds ( $AOR = 2.31$ ,  $p = 0.008$ ). Although age and gender were significant in univariate analysis, they did not retain statistical significance after adjustment, suggesting confounding effects. Similarly, occupation was not found to be an independent predictor.

Overall, the findings indicate that lower educational status and poorer socioeconomic conditions are key determinants of vaccine hesitancy in the studied urban population. [Table 5]

**Table 5: Multivariate Logistic Regression Analysis of Determinants of Vaccine Hesitancy**

Variable	Category	Adjusted Odds Ratio (AOR)	95% CI	p-value
Age (years)	18–29	2.10	0.91 – 4.85	0.081
	30–44	1.89	0.85 – 4.21	0.118
	45–59	1.21	0.52 – 2.85	0.652
	≥60 (Ref)	1	-	-
Gender	Male	1.32	0.81 – 2.14	0.262
	Female (Ref)	1	-	-
Education	Primary	2.48	1.29 – 4.76	0.006*
	Secondary	1.68	0.96 – 2.94	0.071
	Graduate & above (Ref)	1	-	-
Occupation	Unemployed	1.29	0.70 – 2.38	0.411
	Homemaker	1.18	0.63 – 2.19	0.602
	Employed (Ref)	1	-	-
Socioeconomic status	Lower	2.31	1.24 – 4.29	0.008*
	Middle	1.10	0.61 – 1.99	0.748
	Upper (Ref)	1	-	-

## DISCUSSION

The present study assessed the prevalence and determinants of vaccine hesitancy among adults in an urban population and found that 28.8% of participants were vaccine hesitant. This finding is consistent with a study conducted in an urbanized area of New Delhi by Cherian et al., which reported a similar prevalence of 28.9%.<sup>[7]</sup> This similarity suggests that vaccine hesitancy remains a persistent issue in urban Indian settings despite relatively better access to healthcare services. Comparable findings have also been reported globally, with moderate levels of hesitancy observed in various populations.<sup>[8,9]</sup>

In the present study, younger age groups exhibited higher levels of vaccine hesitancy, which was statistically significant in bivariate analysis. This aligns with findings from Gerretsen et al., who reported that younger individuals were more likely to be hesitant due to lower perceived risk and greater exposure to misinformation.<sup>[10]</sup> However, age did not remain a significant predictor in multivariate analysis, indicating the influence of confounding factors such as education and socioeconomic status. Gender differences were also observed, with males demonstrating higher hesitancy compared to females. Similar trends have been noted in some studies, although evidence remains inconsistent across settings.<sup>[9,10]</sup> The lack of significance in multivariate analysis suggests that gender may not be an independent determinant but rather interacts with other sociodemographic variables.

Education emerged as a strong and independent predictor of vaccine hesitancy in the present study. Individuals with primary education were significantly more likely to be hesitant compared to those with higher education. This finding is in agreement with previous studies, which have consistently demonstrated that lower educational status is associated with poor awareness, misconceptions, and reduced trust in vaccines.<sup>[6,12]</sup> Dubé et al. also highlighted that inadequate knowledge and misinformation contribute significantly to vaccine refusal.<sup>[12]</sup>

Socioeconomic status was another important determinant, with individuals from lower socioeconomic groups showing significantly higher hesitancy. This finding is consistent with Kalu et al., who reported that social and structural determinants, including economic disadvantage, play a critical role in vaccine acceptance.<sup>[11]</sup> Lower socioeconomic status may limit access to reliable health information and healthcare services, thereby increasing susceptibility to misinformation and hesitancy.

The most common reasons for vaccine hesitancy identified in this study were fear of side effects, influence of social media misinformation, and doubts regarding vaccine efficacy. These findings are consistent with Ouyang et al., who emphasized the role of the “infodemic” in spreading misinformation and increasing vaccine hesitancy.<sup>[9]</sup> Similarly, Hassen et al. reported that mistrust in healthcare systems and cultural beliefs significantly influence vaccine acceptance.<sup>[11]</sup>

Occupation was not found to be a significant determinant in the present study, which is in line with some previous research where employment status did not independently predict vaccine hesitancy.<sup>[6]</sup> This suggests that behavioural and perceptual factors may have a greater influence than occupational status.

Therefore, the findings of this study highlight that vaccine hesitancy in urban populations is multifactorial, influenced by educational, socioeconomic, and informational factors. The results underscore the need for targeted health education interventions, improved risk communication, and strategies to counter misinformation, particularly among lower socioeconomic and less educated groups.

The present study has certain limitations. Being a cross-sectional study, causal relationships between variables cannot be established. The findings are based on self-reported data, which may be subject to recall and social desirability bias. The study was conducted in a single urban field practice area, limiting the generalizability of results to other populations. Additionally, factors such as psychological influences and detailed behavioural

aspects of vaccine hesitancy were not explored in depth.

## CONCLUSION

The present study highlights that vaccine hesitancy remains a significant concern among adults in urban populations, with nearly one-third of participants exhibiting hesitancy. The findings indicate that vaccine hesitancy is influenced by multiple factors, with lower educational status and lower socioeconomic status emerging as significant independent determinants. Fear of side effects, misinformation through social media, and lack of trust in the healthcare system were identified as major contributing factors.

Although younger age and male gender showed higher hesitancy in initial analysis, they were not independent predictors after adjustment. The study underscores the need for targeted interventions focusing on health education, improving awareness, and addressing misconceptions regarding vaccines. Strengthening communication strategies and promoting reliable information sources are essential to enhance public confidence. Addressing these determinants is crucial for improving vaccine uptake and ensuring the success of immunization programs in urban settings.

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