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Vaccine Hesitancy: Socio-Demographic and Perceptual Differences between Urban and Rural Individuals in Bangladesh

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Abstract Understanding the determinants of COVID-19 vaccine hesitancy is critical for public health strategy. This study aimed to compare the socio-demographic and perceptual factors influencing vaccine hesitancy between urban and rural populations in Bangladesh. **Methods:** A comparative study was conducted at Ashiyan Medical College, Dhaka, Bangladesh, from January to December 2021. A purposive sample of 58 individuals (16 urban, 42 rural) was recruited. Data on socio-demographics, vaccination status, trusted information sources, and perceptions were collected. Analysis was performed using SPSS version 23.0, employing descriptive statistics, chi-square, and t-tests. **Results:** Analysis revealed high overall vaccination uptake (Urban: 100%, Rural: 88.1%, p=0.184) but a significant rural-urban disparity in booster dose coverage (81.3% vs 33.3%, p=0.001). Rural residents had lower education and income (p<0.05). Trusted information sources differed markedly: urban respondents relied on government (81.3%), while rural respondents used community leaders (35.7%) and social media (33.3%) (p<0.001). All unvaccinated individuals (n=5) were rural, citing fear or disbelief. **Conclusion:** Significant rural-urban disparities in booster coverage persist in Bangladesh, driven by socioeconomic factors and reliance on informal information sources. Targeted, community-led interventions are essential to build vaccine confidence and improve uptake in rural populations.

Keywords: *Booster dose, COVID-19, Health communication, Vaccine hesitancy, Urban-rural differences*

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1. Introduction

The COVID-19 pandemic, caused by the novel coronavirus SARS-CoV-2, represents one of the most profound global public health crises in modern history [1]. With millions of deaths worldwide and severe disruptions to health systems and economies, the rapid development and deployment of effective vaccines offered a pivotal pathway out of the pandemic [2]. Vaccines have proven to be the most critical tool in reducing severe disease, hospitalization, and mortality, thereby alleviating the burden on healthcare infrastructure [3,4]. However, the success of vaccination programs is contingent not only on the availability and efficacy of the vaccines but also on their widespread public acceptance. Vaccine hesitancy, defined by the World Health Organization (WHO) as a "delay in acceptance or refusal of vaccines despite availability of vaccination services," has emerged as a significant threat to global health security [5]. This complex issue is influenced by a confluence of factors, including complacency, convenience, and confidence, and varies considerably across different geographic, cultural, and socio-demographic contexts [6,7]. In low- and middle-income countries (LMICs) like Bangladesh, which launched one of the world's largest vaccination drives, addressing hesitancy is paramount to achieving herd immunity and controlling the virus's spread [8,9]. The discourse surrounding COVID-19 vaccines has been inundated with misinformation and conspiracy theories, often propagated rapidly through social media and other informal channels [10]. This infodemic has eroded public trust in health authorities and scientific institutions, fostering fear and uncertainty [11]. Studies conducted in various countries have identified key determinants of hesitancy, such as fear of side effects, concerns about the rapid development process, and low perceived risk of the disease itself [12,13]. In Bangladesh, a country with a pronounced socio-economic divide between urban and rural populations, these challenges are particularly acute. Rural communities, which constitute a significant majority of the population, often face barriers such as lower health literacy, limited access to credible information, and

stronger reliance on traditional and communal sources of advice compared to their urban counterparts [14,15]. Understanding the nuanced differences in attitudes and perceptions between these two populations is therefore essential. While previous studies have examined vaccine acceptance in Bangladesh broadly, there is a scarcity of research that directly compares the socio-demographic and perceptual drivers of hesitancy between urban and rural dwellers within the same methodological framework. This gap limits the ability to design precisely targeted and effective intervention strategies. This study aims to fill this gap by conducting a comparative analysis of vaccine hesitancy in urban and rural settings in Bangladesh. Specifically, it seeks to profile and compare the socio-demographic characteristics, trusted sources of information, exposure to misinformation, and key motivators for vaccination between these two groups. The findings are intended to inform policymakers and health communicators in developing localized, context-specific strategies to enhance vaccine confidence and uptake across the entire nation.

2. Methodology

Study population: This comparative study was conducted at the outpatient department of Ashiyan Medical College, Dhaka, Bangladesh. The study population consisted of adult individuals attending the facility during the data collection period from January to December 2021.

Inclusion criteria: Participants were eligible for inclusion if they were aged 18 years or older and were able to provide verbal consent to participate in the study. There were no restrictions based on gender, vaccination status, or medical history.

Exclusion criteria: Individuals who were critically ill, had significant cognitive impairments that prevented them from understanding the study questions, or who declined to participate were excluded from the study.

Study procedure: A purposive sampling technique was employed to recruit participants. A structured questionnaire was administered through face-to-face interviews by trained research assistants. The questionnaire collected data on socio-demographics, vaccination status, sources of health information, and perceptions related to COVID-19 vaccines.

Data analysis: Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 23. 0. Descriptive statistics were presented as frequencies, percentages, means, and standard deviations. Chi-square and Fisher's exact tests were used for categorical variables, while an independent samples t-test was used for continuous variables. A p-value of <0. 05 was considered statistically significant.

3. Result

A total of 58 individuals participated in this study, comprising 16 (27.6%) urban and 42 (72. 4%) rural residents. The socio-demographic analysis revealed significant disparities between the groups. The urban cohort was significantly more educated, with 87.5% having an HSC or higher level of education, compared to 52. 4% of the rural cohort (p = 0.016). Income distribution also differed markedly; all urban respondents (100%) reported an income greater than 10,000 BDT, whereas only 59. 5% of rural respondents fell into this category, with 23. 8% earning 5,000-10,000 BDT and 16. 7% earning less than 5,000 BDT (p = 0.001). Occupational profiles were distinct, with urban areas dominated by service holders (56.3%) and rural areas by housewives (35.7%) and businessmen (23.8%) (p<0.001). No significant differences were found in mean age, gender distribution, or average household size. Vaccination uptake was high overall, with no significant difference in the proportion vaccinated between urban (100%) and rural (88.1%) areas (p=0.184). However, a significant gap existed in the completion of the full vaccination regimen. A markedly higher proportion of urban respondents (81.3%) had received a booster dose compared to just 33. 3% of rural respondents (p=0.001). Critical perceptual differences were observed. Trusted sources of vaccine information varied dramatically. Urban respondents placed paramount trust in government sources (81.3%), while rural respondents relied more on community leaders (35.7%) and social media (33.3%) (p<0.001). The primary motivator for vaccination also differed; a workplace requirement was the key factor for 50.0% of urban respondents, whereas rural respondents were primarily motivated by community examples (31.0%) and family encouragement (26.2%). All unvaccinated individuals (n=5) were from rural areas, citing "fear of side effects" or "don't believe in vaccine" as their reason.

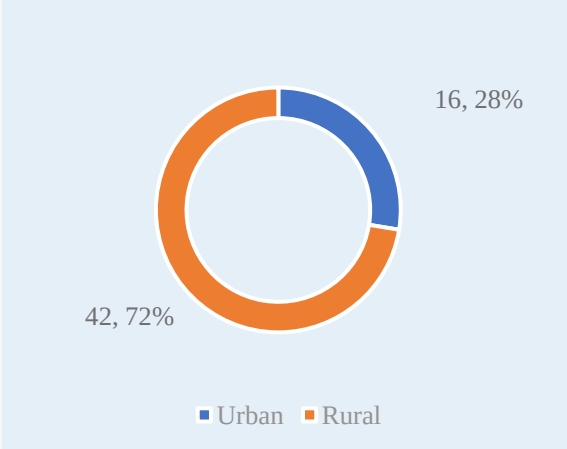

Figure 1. Distribution of participants by location

Table 1. Socio-demographic profile of participants by location

Variable	Category	Urban (n=16)	Rural (n=42)	p-value
Age, Mean (SD)	Years	36. 38 (13. 84)	34. 36 (12. 32)	0. 584
Gender, n (%)	Male	7 (43. 8)	21 (50. 0)	0. 673
	Female	9 (56. 3)	21 (50. 0)	
Education, n (%)	HSC &above	14 (87. 5)	22 (52. 4)	0. 016

	Secondary or less	2 (12. 5)	20 (47. 6)	
Income, n (%)	>10,000 BDT	16 (100. 0)	25 (59. 5)	0. 001
	5,000–10,000 BDT	0 (0. 0)	10 (23. 8)	
	<5,000 BDT	0 (0. 0)	7 (16. 7)	
Household size, Mean (SD)	Number of people	4. 75 (1. 34)	8. 17 (4. 23)	0. 102

Data analysis: Independent samples T-test for continuous variables; Chi-square test for categorical variables

Table 2. Occupation profile by location

Occupation	Urban (n=16) n (%)	Rural (n=42) n (%)	p-value
Healthcare/Service sector	9 (56. 3)	5 (11. 9)	<0. 001
Businessman	1 (6. 3)	10 (23. 8)	
Housewife	2 (12. 5)	15 (35. 7)	
Farmer/Fisherman	0 (0. 0)	6 (14. 3)	
Student/Others	4 (25. 0)	6 (14. 3)	

Data analysis: Chi-square test

Table 3. Vaccination status and dose completion by location

Vaccination Status	Urban (n=16) n (%)	Rural (n=42) n (%)	p-value
Vaccinated	16 (100. 0)	37 (88. 1)	0. 184
Doses received (Among vaccinated)			
1 Dose	0 (0. 0)	11 (29. 7)	0. 001
2 Doses	3 (18. 8)	8 (21. 6)	
Booster dose	13 (81. 3)	18 (48. 6)	

Data analysis: Fisher's Exact Test for 'Vaccinated' (due to a cell count <5); Chi-square test for 'Doses Received'

Table 4. Trusted sources of vaccine information by location

Most Trusted Source	Urban (n=16) n (%)	Rural (n=42) n (%)	p-value
Government	13 (81. 3)	7 (16. 7)	<0. 001
Social media	0 (0. 0)	14 (33. 3)	
Community leaders	1 (6. 3)	15 (35. 7)	
Health workers	2 (12. 5)	3 (7. 1)	
None	0 (0. 0)	3 (7. 1)	

Data analysis: Chi-square test

Table 5. Key perceptual factors by location

Factor	Category	Urban	Rural	p-value
		n (%)	n (%)	
Heard Negative Info	Yes	11 (68. 8)	31 (73. 8)	0. 704
	No	5 (31. 3)	11 (26. 2)	
Primary motivator	Workplace requirement	8 (50. 0)	6 (14. 3)	0. 062
	Government endorsement	3 (18. 8)	3 (7. 1)	
	Family encouragement	2 (12. 5)	11 (26. 2)	
	Community example	1 (6. 3)	13 (31. 0)	
	Doctor's advice	2 (12. 5)	2 (4. 8)	
Reasons for not vaccinating	Fear / Disbelief	0 (0. 0)	5 (11. 9)	

Data analysis: Chi-square test

Table 6. Source of negative information (Among those who heard any, n=42)

Source	Urban (n=11) n (%)	Rural (n=31) n (%)	p-value
Friends/Family	7 (63. 6)	22 (71. 0)	0. 679
News media	3 (27. 3)	5 (16. 1)	
Religious sermons/Other	1 (9. 1)	4 (12. 9)	

Data analysis: Chi-square test. Percentages are calculated per location group

4. Discussion

This study provides a comparative analysis of the socio-demographic and perceptual factors driving COVID-19 vaccine hesitancy between urban and rural populations in Bangladesh. The findings reveal a critical divergence: while overall vaccination uptake was high and comparable, a significant rural-urban disparity existed in booster dose coverage and the underlying drivers of acceptance and hesitancy. The high overall vaccination rate (88. 1% rural, 100% urban) is encouraging and aligns with the successful initial rollout of Bangladesh's national vaccination campaign, which achieved high coverage targets [16].

However, the stark contrast in booster dose administration (33. 3% in rural vs. 81. 3% in urban areas) unveils a more nuanced picture of hesitancy. This suggests that while initial barriers may have been overcome, a "compliance gap" emerges for subsequent doses, a phenomenon observed in other LMICs where follow-up vaccination rates lag behind initial uptake [17]. This finding is alarming, as booster doses are crucial for maintaining immunity against emerging variants and preventing severe disease [18]. The socio-demographic profile of our sample underscores deep-seated structural inequities. The rural population had significantly lower educational attainment and income levels, factors consistently identified as key social determinants of health and predictors of lower health literacy and vaccine uptake [19,20]. This economic and educational disadvantage creates a fertile ground for hesitancy, as individuals with lower health literacy may find it more challenging to navigate complex and evolving scientific information [21]. Perhaps the most salient finding of this study is the dramatic difference in trusted information sources. The urban cohort's strong reliance on government sources (81. 3%) indicates a higher level of institutional trust, which is a well-established facilitator of vaccine acceptance [22]. In contrast, the rural population's primary reliance on community leaders and social media (35. 7% and 33. 3%, respectively) highlights a trust deficit in official channels and a heightened vulnerability to misinformation. This aligns with global studies showing that misinformation spread through social media and close social networks is a primary driver of vaccine hesitancy [23]. The fact that all unvaccinated individuals were from rural areas and cited fear or disbelief reinforces that misinformation, often propagated through these trusted informal channels, has tangible, negative consequences on health behavior [24]. Consequently, the motivators for vaccination also differed. The urban population was primarily driven by workplace requirements, an external mandate. The rural population was more influenced by internal social factors: community examples and family encouragement. This indicates that strategies effective in urban settings, like mandates, may be less impactful in rural communities. Instead, interventions leveraging community leaders and existing social networks for peer-to-peer advocacy could be far more effective [25].

Limitations

The study findings are limited by the purposive sampling method and small sample size from a single center, which affects generalizability. The cross-sectional design also prevents the establishment of causal relationships between the examined variables.

Conclusion

This study confirms a significant rural-urban disparity in COVID-19 booster dose coverage in Bangladesh, despite high initial uptake. Vaccine confidence in rural areas is hindered by lower socio-economic status and greater reliance on informal information sources compared to official channels. Public health strategies must move beyond one-size-fits-all campaigns and instead implement targeted interventions that leverage trusted community leaders to effectively combat misinformation and improve vaccine acceptance in underserved rural populations.

Recommendation

Future vaccination campaigns should prioritize decentralized, community-led strategies in rural Bangladesh. These initiatives must actively engage local leaders and healthcare workers to disseminate trustworthy information and directly address misinformation, thereby bridging the confidence gap and improving booster dose uptake.

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