Original Research

# Collective Factors for COVID-19 Vaccination Status among Bangladeshi Sanitation and Waste Workers: Mixed Method Approach Followed Workplace Setting

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**How to cite this article**: Bharat Bilkis Banu, Nasrin Akter, Sujana Haque Chowdhury et. al. Collective Factors for COVID-19 Vaccination Status among Bangladeshi Sanitation and Waste Workers: Mixed Method Approach Followed Workplace Setting. Indian Journal of Public Health Research and Development / Vol. 16 No. 3, July-September 2025.

**Abstract**

Sanitation and waste workers in Bangladesh have emerged as critical fighters against COVID-19, quietly delivering essential cleaning services despite a lack of proper recognition. This study aimed to investigate the factors influencing the COVID-19 vaccination status of these frontline workers through a cross-sectional mixed-method approach. The research included 800 sanitation workers and 20 administrative authorities from the sanitation and waste management department in Dhaka City. Quantitative data was gathered from active sanitation workers in both the North and South City Corporations, while qualitative information was obtained from administrative authorities. The findings revealed that 94.6% of sanitation workers were vaccinated, primarily due to the government's effective vaccination policy, which included motivational programs and technical support for vaccine registration. Among those vaccinated, 69% received both the first and second doses, and 21% completed the third dose. However, non-vaccination was notably higher among unmarried, younger workers with limited knowledge of COVID-19 (6.5%) and vaccination (6.6%). Significant predictors for full vaccination included older age, higher education, belonging to a nuclear family (OR: 1.75), and experiencing adverse health effects from vaccination (OR: 12.07). Misbeliefs and registration difficulties contributed to vaccine hesitancy, highlighting the need for targeted awareness programs and action plans to ensure all workers complete their vaccination.

**Keywords**: Collective factors, COVID-19, vaccination status, Bangladeshi sanitation and waste workers, workplace settings

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**Submission date:** August 31, 2024 **Revision date:** Nov 14, 2024 **Published date: June 7,2025**

## Introduction

COVID-19 was declared a pandemic and a public health emergency by WHO in January 2020. Over two years later, COVID-19's global impact has driven rapid scientific progress, leading to the development of vaccines. The WHO Global COVID-19 Vaccine Strategic Vision for 2022 promotes equitable vaccination globally as part of a broader control strategy[1]. Bangladesh began COVID-19 vaccinations in February 2021, with UNICEF delivering its first COVAX shipment on June 1, 2021. Now, approximately 69% of Bangladesh's population has received two doses, nearing the global target of 70% by mid-2022[2].

In most countries, healthcare professionals have been the visible frontline against COVID-19, often at great personal risk. Meanwhile, sanitation workers, often marginalized and with limited access to essential services, have also played a critical frontline role[3]. In Bangladesh, they face heightened exposure to COVID-19 due to close interaction with large populations and challenging living and working environments. Despite the risks, sanitation workers continued to ensure clean, safe cities, maintaining public spaces and hospitals[4].

The vulnerable position of sanitation and waste workers, who are in frequent contact with potential virus sources, underscores the need for prioritized vaccination and protection measures[5]. To protect them and as well as shrink the transmission process of the pandemic situation, sanitation, and waste worker vaccination should be carried out on a priority basis. In the overwhelming demands during the pandemic, it is also important to preserve the rights of waste workers to health, safety, and dignity. For this reason, it is crucial to know the COVID-19 vaccination status and related factors among sanitation and waste workers to safeguard them in their grueling work conditions and the role of policymakers in their vaccine status.

A strong policy and strategies are very important for achieving success in any target but there are very few studies regarding the policy of COVID-19 vaccine for the specific population group especially for the sanitation and waste workers. The study aims to assess the collective factors for COVID-19 vaccination status among Bangladeshi sanitation and waste workers in a mixed-method approach followed workplace setting. A workplace setting study assesses the condition of workers and authorities who were active in their workplaces. More specifically, this study also evaluated the knowledge of this specific group regarding COVID-19 infection and vaccination. The unique results of this current study may encourage other researchers to conduct further large-scale studies on policy-making levels, especially for such frontline workers and vulnerable groups, and may implement the approach of well-built policy in other sectors also.

## Methods

This was a descriptive type of cross-sectional study followed by a mixed-method i.e. Qualitative and Quantitative approach. Semi-structured data were collected in this study during April to May 2022. Information on knowledge and status of COVID-19 vaccination including its associated predictors related to service and demography were extracted from Bangladeshi sanitation and waste workers.

This study included a total of 800 sanitation and waste workers and 20 administrative authorities of the sanitation and waste management department of Dhaka city of Bangladesh. Quantitative information of this study was collected from the respondents' signified active sanitation and waste workers working in both North and South City Corporation of Dhaka city (DNCC & DSCC). Qualitative information was gathered from the administrative authorities responsible for the health and well-being of sanitation and waste workers of both city corporations.

A standard sample size of 384 was initially calculated using the formula "$n= Z^2pq/d^2$," with Z as 1.96, p as 0.50 (considering this an exploratory study), and a 0.05 margin of error. This was adjusted to 403 to account for a 5% non-response rate, and ultimately 400 samples were fixed after data cleaning. To ensure representation across the city, 400 respondents were selected from each corporation (50% each). Systematic random sampling was applied, dividing the study subjects across 20 zones—10 from each city corporation. From each zone, 40 sanitation workers were randomly chosen, following inclusion criteria, yielding 800 total samples. Additionally,

10 officials from each city corporation (including zone conservancy officers) were selected for qualitative interviews to provide insights into the sanitation workers' health and work conditions, ensuring comprehensive data from both worker and administrative perspectives.

Using interviewer-administered method, a pre-tested and semi-structured questionnaire was used to gather quantitative data from the sanitation and waste workers. Respondents were recruited in April 2022 in this study and accessed primarily through phone calls and later they interviewed according to their convenient schedule. In addition, a topic guide was used to collect qualitative data from the authorities of both DNCC and DSCC using Key Informant Interview. These interviews were used to explore the contributing factors in more specific detail as well as to ascertain the unknown factors for COVID-19 vaccination among the workers.

The study received ethical approval from the Northern University Bangladesh (NUB/DPH/EC/2022/13-b) and adhered to the Declaration of Helsinki. Participation was voluntary and anonymous, with informed consent obtained upfront. Data were analyzed using SPSS, employing descriptive statistics to summarize study characteristics. Age and experience were categorized based on previous studies [6], and job satisfaction was measured on a 3-point Likert scale [7]. Knowledge of COVID-19 was scored, with poor knowledge defined as <50% and good knowledge as >50% [8]. A multinomial logistic regression examined associations between vaccination status and factors like age, gender, job satisfaction, and knowledge, with Odds Ratios calculated. Qualitative data were analyzed using a matrix sheet based on study objectives.

## Results

The study found that 81% of sanitation workers (n=648/800) had very poor knowledge about vaccination, while only 19% (n=152/800) had adequate vaccine-related knowledge. Despite this lack of knowledge, 94.6% (n=757/800) of the workers were vaccinated, with 69% having received up to the second dose, 21% completing the booster dose, and only 5% vaccinated with just the first dose.(Figure1)

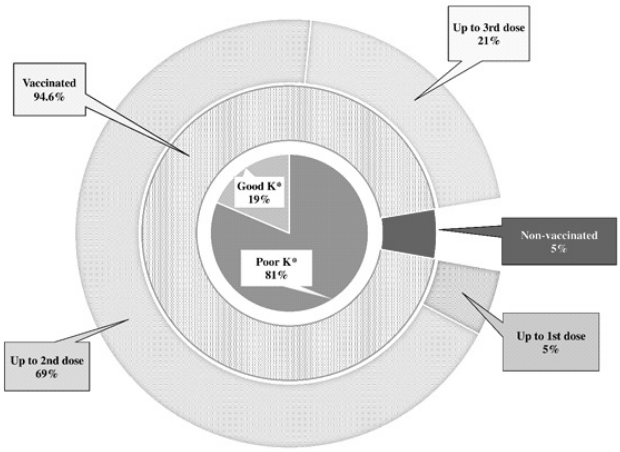


**Figure 1: Knowledge of COVID-19 vaccination and status of vaccination among sanitation workers (n=800)**

The qualitative approach of this study indicated that most authorities overseeing sanitation and waste workers had only partial knowledge regarding COVID-19 infection and vaccination components. However, they also identified significant barriers, including vaccine hesitancy driven by misinformation, lack of National ID or birth registration documents, and mistrust. About half of the authorities noted initial reluctance among workers, linked to ignorance, health concerns, and prevalent myths, such as fears that vaccines could cause health issues or death. The Deputy Chief Waste Management Officer of DNCC emphasized these widespread concerns as major factors in vaccination reluctance. Hequoted that their workers are telling.

'*Since our survival is contingent upon the will of God, we are not interested in taking an injection*.'

The authorities implemented various strategies to facilitate COVID-19 vaccination among sanitation workers. They organized motivational programs to encourage willingness, established a convenient vaccine registration system, designated specific vaccination centers, and collaborated with non-government organizations for additional support. Almost all authorities quoted that.

'Initially, the workers were unwilling to receive the vaccine, but their attitude changed when they observed that their authorities had been vaccinated and remained healthy'.

Authorities counseled sanitation workers on COVID-19 vaccination during morning meetings and individually, resulting in most receiving the first dose, many the second, and few the third. They proposed that media could encourage full vaccination. A convenient registration system was implemented, with authorities collecting National IDs. Nearly all workers received at least one dose, but some remain unvaccinated while others are completing their vaccinations.

**Table 1: Characteristics of the workers associated with their COVID-19 vaccination status (n=800)**

| Characteristics | COVID-19 Vaccination Status | | | | |
|---|---|---|---|---|---|
| | Number of participants, n (%) | Non-vaccinated, n (%) | Vaccinated (Up to 1st & 2nd dose), n (%) | Vaccinated (Up to 3rd dose), n (%) | p-value (≤0.05) |
| **Age Group (In Years)** | | | | | |
| ≤29 | 253 (31.6) | 29 (11.5) | 206 (81.4) | 18 (7.1) | <.01* |
| 30-39 | 181 (22.6) | 2 (1.1) | 151 (83.4) | 28 (15.5) | |
| 40-49 | 161 (20.1) | 6 (3.7) | 111 (68.9) | 44 (27.3) | |
| >50 | 205 (25.6) | 6 (2.9) | 123 (60) | 76 (37.1) | |
| **Gender** | | | | | |
| Male | 477 (59.6) | 34 (7.1) | 352 (73.8) | 91 (19.1) | .02* |
| Female | 323 (40.4) | 9 (2.8) | 239 (74) | 75 (23.2) | |
| **Marital Status** | | | | | |
| Married | 611 (76.4) | 20 (3.3) | 446 (76.3) | 125 (20.5) | <.01* |
| Single | 189 (23.6) | 23 (12.2) | 125 (66.1) | 41 (21.7) | |
| **Family type** | | | | | |
| Nuclear | 624 (76.4) | 41 (6.6) | 456 (73.1) | 127 (20.4) | .02* |
| Extended | 176 (22.0) | 2 (1.1) | 135 (76.7) | 39 (22.2) | |
| **Religion** | | | | | |
| Muslim | 433 (54.1) | 38 (8.8) | 343 (79.2) | 52 (12) | <.01* |
| Non-Muslim | 367 (45.9) | 5 (1.4) | 248 (67.6) | 114 (31.1) | |
| **Ethnicity** | | | | | |
| Bengali | 461 (57.6) | 38 (8.2) | 363 (78.7) | 60 (13.0) | <.01* |
| Ethnic Minorities | 339 (42.4) | 5 (1.5) | 228 (67.3) | 106 (31.3) | |
| **Education** | | | | | |
| Non-formal education | 351 (43.9) | 15 (4.3) | 247 (70.4) | 89 (25.4) | <.01* |
| Up to Primary | 388 (48.5) | 27 (7.0) | 304 (78.4) | 57 (14.7) | |
| Up to Secondary | 61 (7.6) | 1 (1.6) | 40 (65.6) | 20 (32.8) | |
| **Mode of Service** | | | | | |
| Government | 337 (42.1) | 11 (3.3) | 232 (68.8) | 94 (27.9) | <.01* |
| Private | 394 (49.3) | 30 (7.6) | 304 (77.2) | 60 (15.2) | |
| Contractual | 65 (8.1) | 2 (3.1) | 54 (83.1) | 9 (13.8) | |
| Master role | 4 (0.5) | 0 (0) | 1 (25.0) | 3 (75.0) | |
| **Position in the Organization** | | | | | |
| Cleaner | 790 (98.8) | 43 (5.4) | 587 (74.3) | 160 (20.3) | <.01* |
| Sweeper | 10 (1.2) | 0 (0) | 4 (40) | 6 (60) | |

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|---|---|---|---|---|---|
| **Working Experience (In Years)** | | | | | |
| ≤ 10 | 433 (54.1) | 31 (7.2) | 353 (81.5) | 49 (11.3) | <.01* |
| > 10 | 367 (45.9) | 12 (3.3) | 238 (64.9) | 117 (31.9) | |
| **Availability of Protective Equipment** | | | | | |
| Yes | 409 (51.1) | 10 (2.4) | 296 (72.4) | 103 (25.2) | <.01* |
| No | 391 (48.9) | 33 (8.4) | 295 (75.4) | 63 (16.1) | |
| **Job Satisfaction** | | | | | |
| Good | 450 (56.3) | 30 (6.7) | 330 (73.3) | 90 (20.0) | .02* |
| Fair | 334 (41.8) | 10 (3.0) | 252 (75.4) | 72 (21.6) | |
| Poor | 16 (2.0) | 3 (18.8) | 9 (56.3) | 4 (25) | |
| **Knowledge of COVID-19 Infection** | | | | | |
| Poor | 649 (81.1) | 42 (6.5) | 487 (75.0) | 120 (18.5) | <.01* |
| Good | 151 (18.9) | 1 (0.7) | 104 (68.9) | 46 (30.5) | |
| **Knowledge of COVID-19 Vaccination** | | | | | |
| Poor | 651 (81.4) | 43 (6.6) | 483 (74.2) | 125 (19.2) | <.01* |
| Good | 149 (18.6) | 0 (0) | 108 (72.5) | 41 (27.5) | |
| **Comorbidities** | | | | | |
| Yes | 96 (12) | 0 (0) | 45 (46.9) | 51 (53.1) | <.01* |
| No | 704 (88) | 43 (6.1) | 546 (77.6) | 115 (16.3) | |
| **Adverse Health Effect** | | | | | |
| Yes | 646 (80.8) | 1 (0.2) | 481 (74.5) | 164 (25.4) | <.01* |
| No | 154 (19.3) | 42 (27.3) | 110 (71.4) | 2 (1.3) | |

Data are presented as frequency (n), percentage (%); *Statistical significance at p-value ≤0.05. Chi-square test was used to observe the association.

Table 1 explores demographic factors affecting COVID-19 vaccination status among sanitation workers, highlighting significant trends. Younger, healthier workers, especially those aged ≤29 years (11.5%, n=29/253), single (2.2%, n=23/189), and without comorbidities (6.1%, n=42/704), were more likely to remain unvaccinated (p <.01). In terms of ethnicity, Bengali male sanitation workers showed a surprisingly lower vaccination rate (male: 7.1% & Bengali: 8.2%), though ethnic groups were expected to be more hesitant.

Education emerged as a crucial factor; workers with secondary education were more likely to be vaccinated (up to 1st and 2nd doses: 65.6%, n=40/61; 3rd dose: 32.8%, n=20/61, p<.01), reflecting basic health awareness, whereas non-formally educated workers displayed more openness to vaccination. Government-employed sanitation workers had better vaccine coverage, with fewer unvaccinated individuals (7.6%, n=30/394) compared to those in private employment, signaling effective governmental support. Interestingly, those with under 10 years of experience (7.2%, n=31/433) but high job satisfaction (6.7%, n=30/450) showed higher non-vaccination levels.

Crucially, knowledge of COVID-19 infection and vaccination influenced decisions: workers with limited knowledge (infection: 6.5%, n=42/649; vaccination: 6.6%, n=43/651) were more reluctant, even with organizational support.

**Table 2. Predictors associated with the COVID-19 vaccination status among the workers (n=800)**

| Variables | Categories | No vaccine vs. up to 1st or 2nd dose of vaccination | | | | Up to 3rd dose vs. 1st or 2nd dose of vaccination | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Sig. (p-value) | No Vaccine OR | 95% Confidence Interval | | Sig. (p-value) | 3rd dose OR | 95% Confidence Interval | |
| | | | | Lower Bound | Upper Bound | | | Lower Bound | Upper Bound |
| Age group (In Years) | ≤29 | 0.37 | 1.87 | 0.48 | 7.39 | <0.01* | 0.24 | 0.11 | 0.5 |
| | 30-39 | 0.76 | 0.76 | 0.13 | 4.57 | <0.01* | 0.37 | 0.2 | 0.68 |
| | 40-49 | 0.7 | 1.31 | 0.33 | 5.19 | 0.15 | 0.69 | 0.41 | 1.15 |
| | >50 | Reference | | | | Reference | | | |
| Marital Status | Married | <0.01* | 0.19 | 0.08 | 0.48 | 0.25 | 0.76 | 0.47 | 1.22 |
| | Single | Reference | | | | Reference | | | |
| Family type | Nuclear | 0.14 | 3.36 | 0.66 | 17.09 | 0.03* | 1.75 | 1.07 | 2.86 |
| | Extended | Reference | | | | Reference | | | |
| Ethnicity | Bengali | 0.41 | 0.57 | 0.15 | 2.17 | <0.01* | 0.34 | 0.23 | 0.52 |
| | Ethnic Minorities | Reference | | | | Reference | | | |
| Education | Non-formal education | 0.23 | 4.49 | 0.39 | 51.82 | <0.01* | 0.40 | 0.2 | 0.79 |
| | Up to Primary | 0.32 | 3.33 | 0.32 | 34.88 | <0.01* | 0.34 | 0.17 | 0.67 |
| | Up to Secondary | Reference | | | | Reference | | | |
| Working Experience (In Years) | ≤ 10 | 0.68 | 0.79 | 0.25 | 2.46 | 0.02* | 0.53 | 0.32 | 0.89 |
| | > 10 | Reference | | | | Reference | | | |
| Adverse Health Effect | Yes | <0.01* | 0.01 | 0.01 | 0.04 | <0.01* | 12.07 | 2.87 | 50.69 |
| | No | Reference | | | | Reference | | | |

Multinomial Logistic Regression Analysis was conducted to identify predictors of COVID-19 vaccination status, with *statistical significance set at $p \leq 0.05$. The reference category included individuals who received up to the 1st or 2nd dose. OR considered from the adjusted model.

The regression analysis identified key predictors for non-vaccination and completion of the third vaccine dose among sanitation workers. Married workers with adverse health effects from initial doses were more likely to be vaccinated (OR: 0.19), while single, healthier workers showed significant non-vaccination. Younger (≤29 years: OR: 0.24) and lower-educated workers were less likely to receive all doses, possibly due to knowledge gaps and myths around vaccination. Surprisingly, Bengali workers and those with less experience (OR: 0.53) had lower vaccination rates compared to ethnic minorities and longer-serving workers. Nuclear family members with adverse effects (OR: 12.07) were notably more likely to complete all doses. (Table-2)

## Discussions

Sanitation workers work directly with human waste, which leads them to chronic diseases and become infected with coronavirus[9].Since sanitation workers are on the front lines of this situation, their vaccination status is the most urgent public health concern. Regarding participants' knowledge of the COVID-19 vaccine discovered that most workers knew very little, and even fewer knew enough about it. A study from Malaysia partially supports our findings where it shows, 872 (62.0%) of the respondents had poor knowledge about the COVID-19 vaccine[10].The qualitative findings of the study support that most waste management and sanitation professionals only had a cursory awareness of it. Most workers had gotten up to the second dose, and a considerable percentage received full vaccination. It was an achievement of

the authorities' effective vaccination plan, according to the study's qualitative technique. However, it was a challenge to make sure that all sanitation personnel were vaccinated. Our qualitative section on vaccine misconceptions and misinformation is supported by a Yemeni population-based survey [11]. One finding was workers with poor knowledge on COVID-19 infection and vaccination were found less likely to have their vaccination instead of having support from the authorities. A study from Southern Ethiopia found that most respondents' hesitation to take the vaccine is due to concerns over the safety and/or side effects [12]. In contrast, research conducted in the USA revealed that a significant proportion of important workers (49%, n=495/1005) were willing to get vaccinations at the start of the global immunization campaign [13]. As a strength, our study provides a better apprehension into the full coverage of the COVID-19 vaccine package & its status among the sanitation and waste workers as well as other frontiers.

## Conclusions

This study revealed important insights into the vaccination status of Bangladeshi sanitation and waste workers. Despite knowledge barriers, the majority were vaccinated, aided by authorities, although only about one-third received booster doses. Non-vaccination was notably high among unmarried individuals lacking willingness. Complete vaccination was more common among older, educated workers from nuclear families with significant work experience and adverse effects from vaccination. Misbeliefs and registration difficulties contributed to vaccine hesitancy. The findings will guide government policies to enhance occupational health and safety for these essential workers, promoting a positive attitude toward vaccination.

**Conflict of interest:** The authors declare no conflicts of interest related to the publication of this article. Any affiliations or financial involvements have been disclosed transparently.

**Source of funding:** This research received no specific grant or funding from public, commercial, or not-for-profit organizations. The authors conducted the work independently.

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