| RESEARCH PAPER |

Willingness to Vaccinate against COVID-19 among Bangladeshi Sanitation and Waste Workers: Workplace Setting Approach to Maximize Vaccination Coverage

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Abstract

Background: Vaccination against COVID-19 is paramount to protect the sanitation and waste workers of Bangladesh during this pandemic as they work in a variety of hazardous conditions. To avail the successful coverage it is also essential to identify the factors regarding facilitating the process including their willingness for COVID-19 vaccination.

Objective: This study was aimed to explore the factors related to willingness for COVID-19 vaccination among this worker group.

Methods: A cross-sectional study with a mixed-method approach was conducted among 800 sanitation and waste workers and 20 administrative authorities from the sanitation and waste management department of Dhaka city. Quantitative data was collected from the sanitation and waste workers of both North and South City Corporations of Dhaka and qualitative information was gathered from the respective administrative authorities. Logistic regression analysis and Chi-square test were used for the quantitative analysis, while the thematic analysis was used to extract results from qualitative data.

Results: Although, most authorities were found to be knowledgeable, while workers had poor knowledge and misconceptions about COVID-19 vaccination. Majority workers (94.6%) had willingness to be vaccinated, owing to the effective implementation of the COVID-19 vaccine policy of Bangladesh government such as various motivational programs, assistance in vaccine registration process, establishment of special vaccine administration etc. Willingness towards vaccination found significant among the workers who were married (AOR=2.93), had more than two children (AOR=2.97), had monthly family income more than 30,000/- BDT (AOR=4.94), consumed smokeless tobacco (AOR=2.77) and who got all the necessary personal protective equipment available in their job (AOR=2.60).

Conclusion: This study reflected the incredible success in willingness to vaccinate against COVID-19 among sanitation workers of Bangladesh. It is important to develop and implement action plan at policy level to protect the vulnerable groups through various relevant programs that would ensure the full coverage of vaccination across the country.

Keywords: Willingness to vaccinate, COVID-19, vaccination, Bangladeshi sanitation and waste workers, workplace setting, vaccination coverage.

Introduction

COVID-19 was stated as a public health emergency of international concern by WHO in 2020.[1] After that there was created an urgent necessity to produce effective vaccines as the COVID-19 pandemic has increased worldwide and the most competent way to halt the spread is vaccination.[2] Still one of the major challenges to manage the COVID-19 pandemic is the uncertainty of willingness to accept vaccinations.[3]

Worldwide, 17 vaccines against COVID-19 are in use now, with 3.8 billion doses given on or after 26 June 2021. Some 75% of these have been administered by only 10 countries and less than 1% in low-income countries (LICs) as a whole. But the world was not on track to meet that ambition. Whereas most of the high-income countries (HICs) have exceeded the 20% target, as of early September, only 12 low- and middle-

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income countries (LMICs – out of 47) and no LICs have reached it.[1]

In the United States, reported that there was a social movement to reject covid-19 vaccine, which contributed to an increase in the proportion of people who refuse vaccination efforts in the US and Europe in recent years.[4] Another study in Congo found that only about half (56%) of the respondents were willing to receive a COVID-19 vaccine, which is far below what is required to stop the ongoing COVID-19 pandemic.[2]

For increasing COVID-19 vaccination status, to save lives, socioeconomic safety, and as a part of the pandemic control tactic, WHO sets vaccination coverage targets for each country.[1] Afterward the overall willingness among the general global population to get a COVID-19 vaccine was increased to moderately high (60.1%); however, the existence of hesitancy might be a major obstacle to the global efforts to control the current pandemic.[5] Bangladesh started COVID-19 vaccinations in February 2021 and achieved the global target of 70 percent fully vaccinated population including the front liners by June 2022 targeted by WHO.[6] Although a study conducted among Bangladeshi general population reflected that 32.5% of the respondents had hesitancy towards COVID-19 vaccination and hesitancy was high among the population from central Bangladesh, including Dhaka. [17]

Sanitation workers played silently a front-line role in the pandemic by keeping cities as clean and healthy as the underrepresented soldiers.[7] Throughout the pandemic, sanitation and waste workers deprived of leave although they tried hard to ensure a clean city for its inhabitants. Because of the nature of their job, sanitation and waste workers were at high risk of COVID-19 infection as they came into direct contact with potential prevailing of the virus with working in COVID-19 hospitals, cleaning drainage, and manual scavengers.[8]

To reduce the spread progression of the pandemic situation, the sufferings of sanitation and waste workers, and to protect them, their vaccination was needed to carry out on a priority basis. The willingness to receive vaccines by sanitation and waste workers was most important to fulfill the vaccination target. For these grounds, it is essential to assess the willingness of taking the COVID-19 vaccine and its related factors among sanitation and waste workers

as well as the role of policymakers to increase their willingness.

To accomplish any achievement or goal, it is very crucial to apply a strategy and willingness to do it. But there very few studies were identified regarding this issue. Therefore, the study aimed to assess the willingness to vaccinate against COVID-19 among Bangladeshi sanitation and waste workers in workplace setting approach to maximize vaccination coverage.

The findings of this study might encourage other researchers to carry out further large-scale studies on the effects and roles of policy-makers on increasing willingness for achieving the target and possibly will execute the approach of a well-built strategy on willingness in other sectors as well.

Materials and Method

This was a descriptive type of cross-sectional study followed by mix-method i.e. quantitative and qualitative approach. Data were collected in this study during April to May 2022. This study included a total of 800 sanitation and waste workers and 20 administrative authorities of sanitation and waste management department of Dhaka city of Bangladesh. Initially it was assumed that a potential standard sample size 384 would be taken by using the formula "$n = Z^2pq/d^2$" where Z (standard normal deviate) considered as 1.96; p (the proportion was assumed as 50% considering the explorative study) was considered as 0.50 and margin of error was considered as 0.05. However, final sample size was directed to 403 by added 5% as cushion to take into account non-response. After data cleaning and initial management final samples were fixed at 400. Considering the multidimensional workers of Dhaka city, 50% (400 workers: 40 from 10 zones; and 10 authorities) of the study subjects were recruited in the study followed systematic random sampling from the Dhaka North City Corporation (DNCC) and remaining 50% (400 workers: 40 from 10 zones; and 10 authorities) were enrolled from the Dhaka South City Corporation (DSCC). Sanitation and waste workers were recruited in this study randomly from the list provided by DNCC and DSCC.

A pre-tested and semi-structured questionnaire was used to gather quantitative data from the sanitation and waste workers using interviewer-administered method. In addition, a topic guide was used to collect

qualitative data from the authorities of both DNCC and DSCC using Key Informant Interview (KII). Verbal informed consent was taken to obtain data from both the workers and their authorities. The quantitative questionnaire comprised of several segments: (i) Willingness to be vaccinated (ii) Knowledge on infection of COVID-19; (iii) Demography, organizational and health related information: age, gender, habitat, marital status, number of children, religion, ethnicity, family type, education, tobacco using status, mode and types of service, availability of protective equipment, job satisfaction and co morbidities. The qualitative questionnaire comprised of several segments: (i) Identification of availability of support services for COVID-19 vaccination for the workers and counseling services to make willingness for the vaccination; (ii) Knowledge on infection and vaccination of COVID-19; (iv) Demography and organizational information of the authority: age, gender, education, availability of protective equipment.

Collected data was analyzed employing the Statistical Package for the Social Sciences (SPSS) software. Study characteristics were subjected to descriptive statistics for summarizing the obtained data. To categorize the data of age, the cut off value was decided according to previous relevant published articles.[9] Job satisfaction was measured through three-point (3-point) Likert scale.[10] Knowledge on COVID-19 infection was categorized by a scoring system. Poor knowledge corresponded to a score of (<50%) and good knowledge was >50%.[11] A multinomial logistic regression analysis was performed followed by modeling procedure considering backward elimination process, including pre-specified confounders. Odds Ratios with 95% confidence intervals with respect to willingness towards vaccination status was calculated for the specified exposures. Qualitative data was analyzed using matrix sheet according to specific objectives and variables.

This study was approved by the Ethical Review Committee of the Department of Public Health of Northern University Bangladesh (NUB/DPH/EC/2022/ 13-b) and conformed to the Declaration of Helsinki.

Results

Authorities had good knowledge regarding COVID-19 infection and vaccination. They stated that they had strict vaccination support policies for the sanitation and waste workers. They implemented the policies

efficiently to achieve the 100% vaccine coverage although majority of sanitation workers had unwillingness towards vaccination. Deputy Chief Waste Management Officer quoted that their workers thought as '*Why we will take injection, we will survive as long as our God wills*'.

The authorities of the sanitation and waste workers executed some way outs during implementation of COVID-19 vaccination policies among the workers. They initiated different types of motivational programs for creating their willingness during their morning attendance meeting, made convenient vaccine registration system, specified vaccine administration center and also took support from different non-government organizations. Almost all authorities quoted that

'*The workers didn't have willingness for taking vaccine in the initial stage, but they took vaccines later when they found that their authorities took vaccine and had good health*'.

Among 800 sanitation workers about 94.60% (n= 757/ 800) revealed spontaneous willingness towards COVID-19 vaccine where 5.40% (n= 43/800) workers showed unwillingness to take vaccine against COVID-19. (Figure 1)
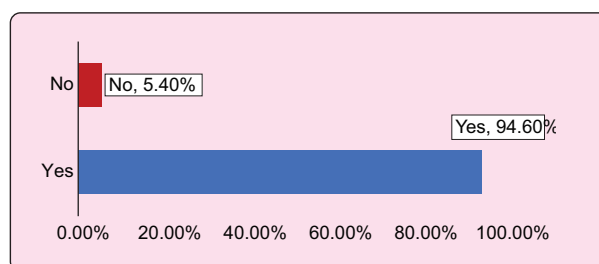

Figure 1: Proportion of willingness towards COVID-19 vaccination among the respondents (n= 800)

Results of multivariate (cross table) analysis revealed the characteristics determining the status of willingness to be vaccinated against COVID-19. It was found that age group, gender, religion, ethnicity, marital status, number of children and their habitation played a significant (p<0.01) role on positive willingness to receive COVID-19 vaccine. Moving toward job profile, government waste management workers, who were involved with hospital waste and sewerage disposal, got available protective equipment at their work place and having "fair" job satisfaction witnessed for positive

significant (p<0.01) willingness towards COVID-19 vaccine. This study also showed that non-smoker sanitation workers who consume smokeless tobacco found to have significantly (p=0.05 and p=0.02) association with positive willingness towards COVID-19 vaccination. Finally, good knowledge on COVID-19 of sanitation workers were identified as a significant (p<0.01) factors for spontaneous willingness towards vaccination. (Table I and II)

In Table III, regression analysis discovered several vital predictors which influenced the respondents' willingness. Middle aged (30-39 years) (COR/p= 4.03/0.01; 95% CI: 1.52- 10.71), female (COR/p= 3.79/0.01; 95% CI: 1.67-8.63), married workers (COR/p= 2.62/0.01; 95% CI: 1.41–4.87), who had more than 2 children's (COR/p= 2.17/0.06; 95% CI: 0.95–4.94) residing in urban setting (COR/p= 15.02/0.01; 95% CI: 3.89 - 58.09) and had good knowledge about COVID-19 (COR/p= 5.16/0.03; 95% CI: 1.23-21.54) showed more higher odds for willingness compared to others. In addition, ethnic minor sanitation workers (COR/p= 10.93/0.01; 95% CI: 3.36–35.62) who were

Table I: Socio-demographic characteristics and knowledge associated with the willingness towards COVID-19 vaccination (n=800)

Characteristics	Willingness Status Towards Vaccination			
	Number of participants, n (%)	Willingness Yes, n (%)	Willingness No, n (%)	p-value (≤0.05)
Age Group (In Years)				
≤29	253 (31.6)	227 (28.4)	26 (3.3)	<.01*
30-39	181 (22.6)	176 (22.0)	5 (0.6)	
40-49	161 (20.1)	156 (19.5)	5 (0.6)	
>50	205 (25.6)	197 (24.6)	8 (1.0)	
Gender				
Male	477 (59.6)	440 (55.0)	37 (4.6)	<.01*
Female	323 (40.4)	316 (39.5)	7 (0.9)	
Habitat				
Urban	791 (98.9)	751 (93.9)	40 (5.0)	<.01*
Semi-urban	9 (1.1)	5 (0.6)	4 (0.5)	
Marital Status				
Married	611 (76.4)	586 (73.3)	25 (3.1)	<.01*
Single	189 (23.6)	170 (21.3)	19 (2.4)	
Family Type				
Nuclear	624 (76.4)	580 (72.5)	44 (5.5)	<.01*
Extended	176 (22.0)	176 (22.0)	0 (0)	
Number of Children				
<2	573 (71.6)	536 (67.0)	37 (4.6)	.05*
>2	227 (28.4)	220 (27.5)	7 (0.9)	
Religion				
Muslim	433 (54.1)	393 (49.1)	40 (5.0)	<.01*
Non-Muslim	367 (45.9)	363 (45.4)	4 (0.5)	
Ethnicity				
Bengali	461 (57.6)	420 (52.5)	41 (5.1)	<.01*
Ethnic Minorities	339 (42.4)	336 (42.0)	3 (0.4)	
Knowledge on COVID-19 Infection				
Poor	649 (81.1)	607 (75.9)	42 (5.3)	<.01*
Good	151 (18.9)	149 (18.6)	2 (0.3)	

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

Table II: Occupation, lifestyle and clinical characteristics associated with the willingness towards COVID-19 vaccination (n=800)

Characteristics	Willingness Status Towards Vaccination			
	Number of participants, n (%)	Willingness Yes, n (%)	Willingness No, n (%)	p-value (≤0.05)
Mode of Service				
Government	337 (42.1)	326 (40.8)	11 (1.4)	<.01*
Private	394 (49.3)	361 (45.1)	33 (4.1)	
Contractual	65 (8.1)	65 (8.1)	0 (0)	
Master role	4 (0.5)	4 (0.5)	0 (0)	
Types of Work				
General waste management	616 (77.0)	573 (71.6)	43 (5.4)	<.01*
Other waste management (hospital/ sewerage)	184 (23)	183 (22.9)	1 (0.1)	
Availability of Protective Equipment				
Yes	409 (51.1)	400 (50.0)	9 (1.1)	<.01*
No	391 (48.9)	356 (44.5)	35 (4.4)	
Job Satisfaction				
Good	450 (56.3)	416 (52.0)	34 (4.3)	<.01*
Fair	334 (41.8)	325 (40.6)	9 (1.1)	
Poor	16 (2.0)	15 (1.9)	1 (0.1)	
Tobacco Smoking Status				
Yes	396 (49.5)	368 (46.0)	28 (3.5)	.05*
No	404 (50.5)	388 (48.5)	16 (2.0)	
Smokeless Tobacco Consumption Status				
Yes	207 (25.9)	189 (23.6)	18 (2.3)	<.02*
No	593 (74.1)	567 (70.9)	26 (3.3)	
Co morbidities				
Yes	96 (12)	96 (12.0)	0 (0)	<.01*
No	704 (88)	660 (82.5)	44 (5.5)	
Adverse Health Effect				
Yes	646 (80.8)	634 (79.3)	12 (1.5)	<.01*
No	154 (19.3)	122 (15.3)	32 (4.0)	

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

non-Muslim (COR/p= 9.24/0.01; 95% CI: 3.27–26.07) got higher odds for willingness. Moreover, study subjects with higher (314.70 USD) monthly income (COR/p= 4.44/0.05; 95% CI: 1.04–19.00) who got available protective equipment (COR/p= 4.37/0.01; 95% CI: 2.07–9.22) and had job satisfaction as "fair" (COR/p= 2.95/0.01; 95% CI: 1.39–6.24) revealed positive willingness. Study also revealed that nonsmoker (COR/p= 1.85/0.06; 95% CI: 0.98–3.47) sanitation worker who consumed smokeless tobacco (COR/p= 2.08/0.02; 95% CI: 1.11 –3.87) had significantly higher odds for willingness to receive vaccine against COVID-19.

Once modeling was done along with backward elimination process study revealed that married workers (AOR=2.93; 95% CI: 8.05-42.08) who had more than 2 children (AOR=2.97; 95% CI: 1.09-6.15) and had monthly family income more than 30,000/- BDT (AOR=4.94; 95% CI: 1.19-6.44) were identified as final predictors for willingness towards vaccination. In addition, study also found that, sanitation workers who consume smokeless tobacco (gul, jarda, shada pata, etc.) (AOR=2.77; 95% CI: 1.03-23.69) and those who got all the necessary protective equipment available (AOR=2.60; 95% CI: 1.01-7.76) in their job identified as significant predictors for willingness to be vaccinated. (Figure 2)

Table III: Predictors associated with the willingness to vaccinate against COVID-19among the respondents (n=800)

Variables	Willingness vs. unwillingness to vaccinate			
	Sig. (p-value)	Willingness COR	95% Confidence Interval	
			Lower Bound	Upper Bound
Age group (In Years)				
≤29		Reference		
30-39	0.01	4.03	1.52	10.71
40-49	0.01	3.57	1.34	9.51
>50	0.01	2.82	1.25	6.37
Gender				
Female	0.01	3.79	1.67	8.63
Male		Reference		
Habitat				
Urban	0.01	15.02	3.89	58.09
Semi-urban		Reference		
Marital Status				
Married	0.01	2.62	1.41	4.87
Single		Reference		
Number of children				
>2	0.06	2.17	0.95	4.94
<2	Reference			
Religion				
Non-Muslim	0.01	9.24	3.27	26.07
Muslim		Reference		
Ethnicity				
Ethnic Minorities	0.01	10.93	3.36	35.62
Bengali		Reference		
Monthly income				
<20000		Reference		
20000-30000	0.69	1.14	0.6	2.15
>30000	0.05	4.44	1.04	19
Smoking habit				
Yes		Reference		
No	0.06	1.85	0.98	3.47
Smokeless Tobacco Consumption Status				
Yes	0.02	2.08	1.11	3.87
No		Reference		
Availability of protective equipment				
Yes	0.01	4.37	2.07	9.22
No		Reference		
Job satisfaction				
Fair	0.01	2.95		6.24
Poor	0.85	1.23		9.56
Good		Reference		
Total knowledge				
Good	0.03	5.16		21.54
Poor		Reference		

Binary Logistic Regression Analysis was used to identify the predictors.
Statistical significance at p value d"0.05; reference category was considered for willingness to receive COVID-19 vaccination

Footnote: Statistically significant predictors identified from the adjusted regression model at p d"0.05. Reference category for adverse health effect is no adverse health effect, for available protective equipment is no available protective equipment, for smoking habit is no smoking habit, for monthly income is less than 20,000 BDT, for number of children is less the two number of children and finally for marital status is unmarried.
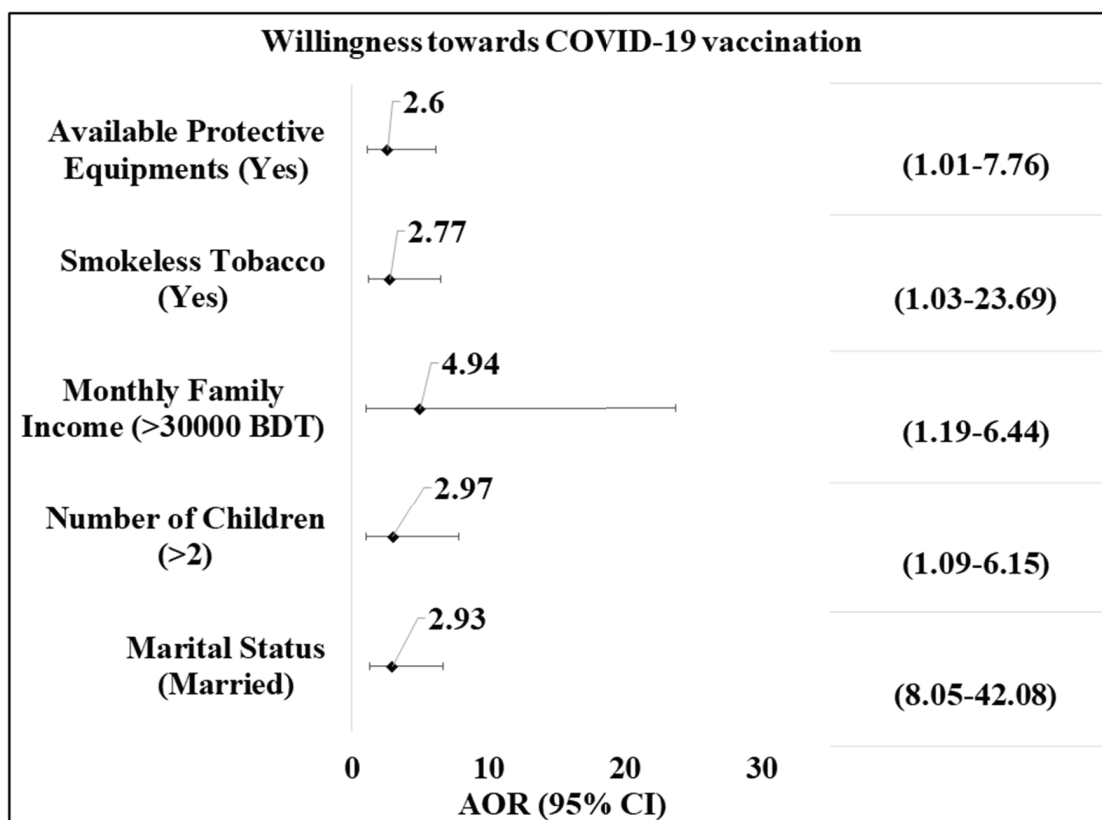
Figure 2: Predictors influencing the willingness to be vaccinated against COVID-19 of the respondents (n=800)

Discussion

Sanitation workers work straightly with human waste, which exposes them to pathogens nonetheless to toxic gases that contributes to the several types of chronic diseases and make them vulnerable to be infected with corona virus.[12] Therefore, our study focused on willingness towards COVID-19 vaccination and its associated predictors with their knowledge and vaccination status too which is one of the most pressing public health issues.

A great number of sanitation worker (94.60%, n=757/800) were found to have willingness to be vaccinated while a few number (5.40%, n=43/800) did not. A contrast finding was found from a study of USA where a less number (49%, n=495/1005) had willingness to be vaccinated among the essential workers.[13] This outcome might be due to professional variances, educational background and cultural divergence.

This study showed that non-smokers and the respondents who consumed smokeless tobacco found to have significant association (p=0.05 and p=0.02) with positive willingness towards vaccination. Good

knowledge on COVID-19 of sanitation workers were identified as a significant (p<0.01) factor for spontaneous willingness towards vaccination. This positive scenario represented successful outcome of the effective vaccination policy which also supported by our qualitative approach such as authorities had good knowledge on COVID-19. A study of Congo showed that knowledge toward COVID-19 is not associated (p=0.39) with acceptance and intention to receive vaccine. [14] This contrast may be due to geographical location and study participants with lack of motivation from the respective authorities.

Moving upon predictors, it was observed that middle aged, female, married workers, who had more than 2 children, residing in urban setting and had good knowledge about COVID-19 showed higher odds for willingness compared to others. A Bangladeshi study showed no significant evidence on association between definite SARS-CoV-2 vaccination intent and socio-demographic variables. However, a significant association was observed between definite vaccination intent among the individuals with previous COVID-19 infection status. The odds of definitive vaccination

intent among the individuals with previous COVID-19 infection found higher than among those of no previous infection.[15] It was suggested that equitable vaccination coverage for population possible if addressing the technological issues properly which support our qualitative part strongly.

Our study with logistic regression analysis revealed that married workers (AOR=2.93; 95% CI: 8.05-42.08) who had more than 2 children (AOR=2.97; 95% CI: 1.09-6.15) and had monthly family income more than 30,000/- BDT (AOR=4.94; 95% CI: 1.19-6.44) were identified as final predictors for willingness. Southern Ethiopian study among the most risky group of exposure found that, willingness to take COVID-19 vaccine was significantly associated with attitude towards the vaccine (OR = 2.830; 95% CI = 1.834–4.368), perception that prevalence and death rate reports of the government are real (OR = 0.365; 95% CI = 0.197–0.676), and having a close relative ever infected by COVID-19 (OR = 2.602; 95% CI = 1.117–6.063). [16] The findings of our research were consistent with the findings of different studies conducted in other parts of the world. However, final predictors of different components vary due to group of people, socio-economic variances and priority of variables according to the study objects for analysis.

Responses were received from the capital city only which limits the generalization of the whole country's population-based outcome. It was not possible due to lack of resources, funding and time constraints. Despite limitations, our data were from densely populated capital city, which provides a close enough image with a realistic idea. As strength, study provides a better apprehension into the willingness of COVID-19 vaccine and related predictors. The unique findings may guide the future researchers for further large-scale studies among this neglected vital group of population.

Conclusions

Remarkably it was discovered in this study that the majority of workers were initially unwilling to be vaccinated against COVID-19. Despite these knowledge and belief barriers, the most of these workers were motivated to be vaccinated later with attributable and uninterrupted authority support under organizational vaccination support policies. The study provided empirical evidence on willingness to vaccinate as a part of vaccination effort among the Bangladeshi sanitation and waste workers influenced by socio-demographic characteristics, organizational and health

related information, knowledge on COVID-19 infection and prevention, respective support and counseling services. The main finding of the study will help our government plan and amend national level policies as well as guidelines on occupational health and safety in an emergency for other minority groups of workers, which would create a positive perception of immunization among them. As frontline responders to such health-related emergencies, sanitation and waste workers along with all other vulnerable labor groups will benefit from various health-safety opportunities in order to work sustainably for our society.

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