Descriptive analysis of determinants leading to COVID-19 vaccine hesitancy of healthcare workers in Sri Lanka

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ABSTRACT

INTRODUCTION Healthcare workers (HCWs) globally were prioritized for COVID-19 vaccination to safeguard against the strain on health systems. However, many HCWs had expressed concerns about getting vaccinated. In Sri Lanka, vaccines were being administered to HCWs with little examination of vaccine hesitancy in this context. To address this gap, the aim of this research was to identify the determinants related to knowledge, attitude, and perceptions of HCWs leading to COVID-19 vaccine hesitancy in a district hospital in Sri Lanka.

METHODS This descriptive cross-sectional study was conducted within the context of the second wave of the pandemic in February 2021 at DGH Awissawella, Sri Lanka. We used a self-administered questionnaire that covered aspects outlined in the determinants of vaccine hesitancy matrix for adult vaccines and the five psychological antecedents of vaccination (5C) model.

RESULTS Within our sample, the majority of the vaccine-eligible HCWs (93.5%) volunteered for vaccination. Among healthcare workers who refused the COVID-19 vaccine (6.5%), 72% were middle-aged and 70% were females. Among the group that declined the vaccine, primary level education was the single sociodemographic barrier associated with not receiving the COVID-19 vaccine and most of this group were health assistants.

CONCLUSIONS Concerns about the COVID-19 vaccine's origin may impact vaccination decisions. Despite high acceptance, targeted interventions for hesitant healthcare workers are vital, particularly with booster doses approaching. These insights will guide future strategies to address vaccine hesitancy among HCWs, enhancing vaccination uptake during similar epidemics and improving public health outcomes.

INTRODUCTION

The presence of HCWs significantly influenced patient throughput in healthcare pathways, with the COVID-19 pandemic exacerbating staff absenteeism at service delivery points[1-3]. Prioritizing COVID-19 vaccination for healthcare workers globally aimed to safeguard their well-being[4-6] and ensure the continuity of healthcare services, despite widespread apprehension among them regarding the vaccine[7]. Vaccine hesitancy is a form of negative behavior of an individual as a result of the decision-making process. The concept of vaccine hesitancy in an individual is not directly complying with the accepted theoretical constructs of classic social cognitive models, such as the Health Belief Model or Theory of Planned Behaviour[8]. Following the rapid development of various COVID-19 vaccines globally, concerns about the safety, efficacy and potency of the vaccines were debated. This is important because the knowledge, beliefs and attitudes of a person may determine their intention to get vaccinated[9]. The willingness of HCWs for vaccination has been investigated in many settings, since these professionals are key players in recommending vaccination and encouraging vaccine uptake among the general public[10]. Lower attendance for COVID-19 vaccination has been reported in some countries among the general population[11] and even among the HCWs[12]. Most published studies in the earlier stages of the COVID-19 pandemic were conducted in high-income countries, with few studies available from low- and middle-income countries (LMICs). The focus on protection of its healthcare workforce from COVID-19 as part of health service provision has been a prime concern

of all countries from the beginning of the pandemic. Against this background, the Ministry of Health Sri Lanka introduced COVID-19 vaccines at the earliest possible instance and, considering the high priority of the requirement to safeguard essential healthcare facilities, HCWs were offered the initial stocks of vaccine, which were received in January 2021[13]. In Sri Lanka, understanding the motivating factors and hesitancy surrounding COVID-19 vaccination across different settings is crucial for informing future adult vaccine initiatives, especially for addressing similar respiratory epidemics. Our study aimed to assess HCW knowledge, attitudes, and COVID-19 vaccine acceptance or hesitancy at the onset of the vaccination program in Sri Lanka.

METHODS

Study design and setting

This was a cross-sectional institution-based study that was carried out in DGH Avissawella Sri Lanka. This is a 600-bed general hospital located in Colombo district. The DGH was one of the COVID-19 vaccine centers established as instructed by the Ministry of Health Sri Lanka, under guidance and supervision by the immunization supervisory health teams from the Epidemiology Unit. The population of interest was all HCWs (clinical and non-clinical) attached to DGH Avissawella and the whole population was included in the study. At the time of the study, 912 HCWs were linked to DGH Avissawella. They were grouped into five HCW categories according to their designations: 'Medical officers', 'Nursing staff', 'Paramedical/professionals supplementary to medicine (PSM)', 'Health assistants' and 'other'. A total of 100 HCWs were not eligible for the vaccine, as assessed by the medical team in accordance with the vaccine guidelines issued by Ministry of Health Sri Lanka on 28 January 2021[13]. Of all vaccine eligible HCWs (n=812), 96% (n=779) participated in the self-administered questionnaire (SAQ).

Ethical considerations

This study, classified as minimal risk research, received ethical approval from the Ethics Review Committee (ERC) of the Postgraduate Institute of Medicine, University of Colombo. After obtaining written informed consent, research participants independently completed the questionnaire in hard copy format under the supervision of data collectors.

Data collection

This study was conducted as a rapid survey in February 2021 and the study instrument was a self-administered questionnaire. Vaccine hesitancy was defined as delay or refusal of vaccination even though vaccination services are available[14]. The main outcome variable of this study was as vaccine refusal. As justified in the psychological-behavioral research literature, the questionnaire was adopted from five psychological antecedents (5C model)[15]. Within this questionnaire, questions that assessed the knowledge of HCWs were assessed with responses noted as 'correct' or 'incorrect', while the attitudes were assessed on a four-point Likert scale with results dichotomized into 'agreed' and 'disagreed' categories for analysis.

Additional information included was the participants age group (21–35, 26–55, 56–70 years), sex (male, female), marital status (married, single), hospital position (health assistant, paramedical, nursing staff, medical officers, other), and education level (primary, secondary, tertiary, graduate/postgraduate), which were used as covariates.

Statistical analysis

Descriptive statistics were employed to assess the distribution of key parameters, while logistic regression analyses were applied to examine associations between vaccine hesitancy and knowledge and attitudes. Adjusted odds ratios (AORs) and their corresponding 95% confidence intervals (CIs), were calculated. The multivariate model was adjusted for sociodemographic variables including age, sex, marital status, and education level. Quantitative data analysis utilized SPSS (IBM SPSS Statistics Version 27).

RESULTS

Supplementary file Table 1 depicts the distribution of sociodemographic characteristics of the HCWs included in the survey (n=779). Of the HCWs who declined the COVID-19 vaccine, 72% were middle-aged, 70% were females, nearly 50% were nurses, and 64% had tertiary as their highest level of education. The HCWs who declined the vaccine (n=53) volunteered to respond to the SAQ (Supplementary file). Table 1 shows the sociodemographic variables that were associated with the HCWs' decision to decline the vaccine. In the univariate analysis, both education level and designation were significantly associated ($p<0.05$) with vaccination refusal. In the adjusted multivariable analysis, only education level was associated with vaccination refusal; those with primary education were more likely to decline the COVID-19 vaccine (AOR=11.7; 95% CI: 2.6–52.3). The association of knowledge items with vaccination refusal is shown in the Supplementary file. Knowledge of 'Vaccine inventor' (OR=0.3; 95% CI: 0.1–0.5) and 'Duration between vaccine doses' (OR=0.4; 95% CI: 0.2–0.7) was negatively associated ($p<0.05$) with vaccination refusal. Perception of HCWs towards the quality-related attributes were assessed only for vaccinated participants (n=726) and a very high proportion (>99%) either strongly agreed or agreed towards the services provided at the vaccine center in the DGH (Supplementary file). A sensitivity analysis was performed to compare the sociodemographic characteristics of the non-respondents to the statement 'Opening times of the vaccination center' with the respondents and results revealing that both 'Secondary' education level (OR=2.7; 95% CI: 1.7–4.2) and 'Graduate/postgraduate' education level (OR=0.1; 95% CI: 0.04–0.2) were significantly different among HCWs who responded and did not respond to the relevant question. The distribution of survey participants

Table 1. Comparison of sociodemographic characteristics between the HCWs who declined or who were vaccinated for COVID-19 in DGH Avissawella, Sri Lanka 2021 (N=779)

Variables	Vaccine preference of HCWs (observed)		Univariate analysis		Multivariate analysis[e]	
	Vaccine declined % (n)	Vaccine accepted % (n)	OR (95% CI)	p	AOR (95% CI)	p
Total	6.8 (53)	93.2 (726)				
Age (years), mean ± SD	44.0 ± 8.9	43.0 ± 9.2	1.0 (0.9–1.0)	0.432	1.0 (0.9–1.0)	0.474
Sex						
Female	7 (37)	93 (489)	1.0 (0.6–2.0)	0.713	1.0 (0.5–2.1)	0.958
Male ®	6.3 (16)	93.7 (237)	1		1	
Marital status						
Married	7.3 (50)	92.7 (633)	2.4 (0.7–8.0)	0.139	1.6 (0.4–5.6)	0.504
Single[a] ®	3.1 (3)	96.9 (93)	1		1	
Designation						
Other[b]	3.4 (4)	96.6 (112)	0.3 (0.1–0.9)	<0.046	0.2 (0.05–1.1)	0.070
Health assistants	14.1 (20)	85.9 (122)	1.5 (0.8–2.9)	0.179	1.7 (0.6–4.5)	0.316
Paramedical/PSM[c]	3.4 (2)	96.6 (56)	0.3 (0.07–1.4)	0.143	0.4 (0.09–1.8)	0.245
Nursing officers ®	9.7 (26)	90.3 (243)	1		1	
Medical officers	0.5 (1)	99.5 (193)	0.05 (0.01–0.4)	<0.003	0.2 (0.004–7.9)	0.378
Education level[d]						
Primary	36.8 (7)	63.2 (12)	5.8 (2.1–15.8)	<0.001	11.7 (2.6–52.3)	<0.001
Secondary	6.3 (11)	93.7 (163)	0.6 (0.3–1.3)	0.274	0.6 (0.2–1.8)	0.401
Tertiary ®	9.1 (34)	90.9 (340)	1		1	
Graduate/Postgraduate	0.5 (1)	99.5 (211)	0.05 (0.01–0.3)	<0.003	0.2 (0.01–8.5)	0.415

a Single represents all unmarried (90), widowed (4), and divorced (1) staff members. **b** Staff working in administration, security services, cleaning, laundry and canteen. **c** Professions Supplementary to Medicine. **d** Primary–Up to GCSE/Qualified, Secondary–A/L /Qualified, Tertiary–Diploma or any NVQ (GCSE General Certificate of Secondary Education, A/L-Advanced Level, NVQ-National Vocational Qualification). **e** Multivariate model was adjusted for all the independent variables in the table, i.e. age, sex, marital status and education level. AOR: adjusted odds ratio. ® Reference categories.

to the SAQ by designation category and the perception of COVID-19-vaccinated HCWs towards service-related attributes is shown in the Supplementary file.

DISCUSSION

The monitoring and evaluation of COVID-19 vaccine acceptance, among communities and countries, were crucial to containing the pandemic. To place this study in context, Sri Lanka has never conducted or experienced any regular adult vaccine program, and the AstraZeneca (ChAdOx1nCoV-19 Corona Virus Vaccine-Recombinant) COVID-19 vaccine program was initiated rapidly by the government of Sri Lanka as an emergency measure for the purpose of containing the rapid spread of the disease. When considering the situational factors in this study, vaccine hesitancy was measured in the form of a decision of outright vaccination refusal according to the vaccine hesitancy continuum[14]. In contrast, most published studies were conducted mostly as online surveys reliant on social media before the relevant COVID-19 vaccines were available and accessible to their respective geographical localities[11,16-18].

Compared to the reported rates of vaccine hesitancy among the general population of other countries, this study revealed a very low rate of COVID-19 vaccine hesitancy within our group of HCWs (6.5%). In the US, it was 33%[16] and a study that covered population samples in Ireland and the UK estimated vaccine hesitancy as 35% and 31%, respectively[17]. The reported vaccine acceptance rates in China (91.3%), Indonesia (93.3%), Malaysia (94.3%) and Ecuador (97%) were closer to the findings for Sri Lanka in this study. In contrast, France (58.9%), the US (56.9%), Poland (56.3%), Russia (54.9%), Italy (53.7%), Jordan (28.4%) and Kuwait (23.6%) have reported lower acceptance rates of COVID-19 vaccines among the general population[11]. The average prevalence of COVID-19 vaccination hesitancy among HCWs worldwide was estimated as 22.51%[10]. A

recent survey reported average vaccine hesitancy among HCWs as 37% in a survey of 91 countries[19]. Intention to get vaccination against COVID-19 in HCWs was reported as 76.9% in France[18], 68.6% in Pakistan[20] and 63% in China[21]. Vaccine acceptance among key workers and non-key workers in the UK were found to be 76.2% and 73.1%, respectively[22]. Our study population covered both key workers and non-key workers as a mixed population, and it was not possible to separate groups since some HCWs work in both positions (front-line care and back-room staff) according to their work shifts. Two systematic reviews of COVID-19 vaccine acceptance rates among HCWs found results that ranged from 27.7% to 77.3%[12] and 27.7% to 78.1%[11]. While a more recent study of vaccine booster hesitancy among HCWs in Singapore found this to be 24%[23]. It is worth noting that many of the above countries have an annual influenza vaccine program, which was conducted in parallel to the administration of the COVID-19 vaccine, and some reported that vaccine hesitancy among HCWs were similar for COVID-19 and influenza vaccines[24]. In Sri Lanka, there is no regular program for influenza vaccination or any other adult vaccination. This lower exposure to earlier vaccination programs might have an influence on the acceptance of the COVID-19 vaccine among HCWs in Sri Lanka.

This study demonstrated that the only sociodemographic variable that was positively associated with the decision to decline the vaccine was primary education level (schooling up to GCSE level). Similarly, vaccine acceptance was found to be higher with increasing education level in HCWs in seven European countries[25-27]. Considering the sociodemographic profile of the HCWs in this study, 97% had completed at least up to secondary level of education [Advanced level (A/L) qualified]. Education level is a major attribute to knowledge level and has been associated both positively and negatively with vaccine hesitancy[28]. There was a significant difference between the vaccinated and vaccine refusal group for the two knowledge areas of the 'vaccine inventor' and the 'duration between vaccines doses' in this study, which suggests that having sufficient knowledge about the vaccine manufacturer was more likely to provide confidence to receive the vaccination regardless of the manufacturer or manufacturing country of the vaccine. A similar perception towards the COVID-19 vaccine brand was reported among the general public in Sri Lanka[29].

Moreover, the concerns for self and family protection and the confidence towards the vaccines' ability to reduce complications of the disease have been strongly associated with acceptance of the vaccine and was similar in HCW groups in the USA and Bangladesh[25,30]. The higher perceived risk of COVID-19 infection was a significant factor for COVID-19 vaccine acceptance in general public in Sri Lanka[29]. In a recent study of the general population in Sri Lanka, over 20% of the respondents expressed hesitancy towards vaccination[31].

A multi-country survey revealed that personal protection is the priority interest for accepting the vaccine[28] and similar attitudes were found among the vaccinated HCWs in this study. Among the vaccine attributable factors related to safety, people were more concerned about adverse effects, immunogenicity and duration of immunity of different COVID-19 vaccine brands and it is critical to raise knowledge of such details to build public confidence[32-34]. The negative relationship of lower levels of education (primary education) towards vaccine acceptance in HCWs may also have an influence on the use of information and shaping of this attitude. Institutional trust is considered as a foundation to build confidence in combatting vaccine hesitancy in HCWs.

Limitations

The current study was conducted as a rapid assessment, serving as an observational study to offer real-time evidence for monitoring the initiation of the COVID-19 vaccination program in Sri Lanka. There is an inherent limitation of evidence generated using observational study methods for proving the causal relationship between the factors in relation to knowledge, attitudes and sociodemographic factors and the behavioral outcomes related to vaccine hesitancy in HCWs in this study. Moreover, vaccine hesitancy for COVID-19 may fluctuate over time, with rapid changes in the context, and hence this study cannot assess any changes in vaccine hesitancy of the selected population over the period. Selection bias may have been introduced to the study due to the single setting used for the study. A form of performance bias might have been introduced to the study, because the extent of exposure to localized environmental factors that modify knowledge and attitudes of sub-groups was not considered in the study.

CONCLUSIONS

The results revealed that there was a sufficient coverage of the COVID-19 vaccine, because nearly all of the vaccine-eligible HCWs were vaccinated. Among the vaccine refusal group, primary level education was the only sociodemographic barrier identified as being associated with not receiving the COVID-19 vaccine and most of this group were health assistants. In-depth psychological investigations are needed to explore the exact intent of the population. High agreement with the statement about the services provided in the COVID-19 vaccine program, confirmed that well-organized services at the COVID-19 vaccine centers are likely to encourage participation of HCWs for vaccinations.

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CONFLICTS OF INTEREST
The authors have completed and submitted the ICMJE Form for Disclosure of Potential Conflicts of Interest and none was reported.

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DATA AVAILABILITY
The data supporting this research are available from the authors on reasonable request.

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