



# Health Care Workers' Perceived Self-Efficacy to Manage COVID-19 Patients in Central Uganda: A Cross-Sectional Study

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**Background:** The novel coronavirus disease 2019 (COVID-19) pandemic placed health workers at the frontline of the emergency task force response; a duty that requires professional expertise and confidence to rapidly identify and treat patients with COVID-19. This study explored perceived self-efficacy (PSE) of health care workers (HCWs) in the management of patients with COVID-19 and associated factors in central Uganda.

**Methods:** We recruited 418 HCWs from four national referral hospitals in Uganda. Multivariate linear regression analysis was utilized to determine factors associated with PSE. A p-value > 0.05 was considered statistically significant.

**Results:** Majority of the participants were female, about half were nurses/midwives, and had 10 years of work experience on average. Overall, HCWs reported moderate PSE in managing COVID-19 patients which reduced with increasing severity of the COVID-19 illness. Having a PhD, being a medical doctor, agreeing or completely agreeing that one has knowledge about COVID-19 management, and having COVID-19 management training were significantly associated with increase in one's level of PSE.

**Conclusion:** This study highlights an unsatisfactory, moderate level of PSE among HCWs in the management of patients with COVID-19 in central Uganda. The health sector should focus on improving HCWs' self-efficacy through continuous training of all HCWs in the clinical management of especially the severe and critically ill cases of COVID-19. Non-doctor HCWs should be given priority as they scored lower levels of PSE; yet they are the corner stone of the primary health care system and make majority of the health human resource in low- and middle-income countries. Interventions towards creating a safe working environment for HCWs through provision of adequate infection prevention and control strategies are essential in boosting HCWs confidence to manage COVID-19 patients.

**Keywords:** perceived self-efficacy, COVID-19, Uganda, health care workers, COVID-19 knowledge, COVID-19 management, COVID-19 training

## Introduction

The Coronavirus disease 2019 (COVID-19) outbreak, declared a public health emergency of international concern and later a pandemic in March 2020,<sup>1</sup> placed health care workers (HCWs) at the frontline of the emergency response to ensure rapid identification, testing, isolation and management of suspected and confirmed cases of COVID-19.<sup>2</sup> Due to the complex nature of transmission of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)-the etiological agent for COVID-19,<sup>3</sup> over 152,000 frontline HCWs were infected with 1413 succumbing to the disease by May 2020.<sup>4</sup> Uganda registered its first COVID-19 case on March 21, 2020, and by then, many African countries had reported increasing cases of COVID-19 infection.<sup>5</sup> Based on a one month report between September and October 2020,

a cumulative total of 1,201,111 COVID-19 cases were recorded in the African region, of these, 43,868 infections were among HCWs, and Uganda registered the highest number of HCW infections in the region.<sup>6</sup> During one of Uganda's first peaks of COVID-19 (November 2020 to February 2021),<sup>7</sup> more HCWs got infected with some getting severe COVID-19 requiring hospitalization and others dying. This could have led to increased fear, anxiety, low confidence in the health system and self, leading to lower perceived self-efficacy (PSE) to manage COVID-19 patients.

Fighting the COVID-19 pandemic requires HCWs with high levels of self-efficacy to effectively work in stressful situations created by the pandemic.<sup>8</sup> Unfortunately, patients with COVID-19 symptoms tend to present in large numbers and deteriorate rapidly.<sup>9</sup> This exerts tremendous pressure on the health care system as well as the frontline HCWs including nurses, doctors, paramedics, laboratory staff, radiologists, microbiologists, physiotherapists, among others, who must be rapidly mobilized to work effectively to manage the infected patients.<sup>10</sup> However, the high transmission rate of the virus,<sup>11</sup> lack of a curative antiviral drug for COVID-19,<sup>12</sup> and emergence of new variants of SARS-Cov-2 that are likely to persist,<sup>13</sup> may affect HCWs confidence to manage patients with COVID-19.

Self-efficacy refers to an individual's belief in his or her ability to execute behaviors necessary to produce specific performance attainments, and it reflects confidence in the ability to exert control over one's own motivation, behavior, and social environment.<sup>14</sup> The self-efficacy construct founded by the psychologist, Albert Bandura, following his 20 years of research, has been widely applied to diverse behaviors such as self-management of chronic disease, smoking cessation, alcohol use, eating and exercise control among others over the years<sup>15,16</sup>. It is believed that one's expectations of self-efficacy (PSE) have influence on whether copying behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face obstacles and aversive experiences.<sup>14</sup> Differences in personality, motivation, and the task itself; determined by mastery experiences, social modeling, social persuasion, and states of physiology (emotions, mood, and physical states), significantly influence self-efficacy.<sup>17</sup> In the context of COVID-19 management, self-efficacy may depend on acquisition of skills and technical mastery within the scope of work of a particular category of HCW.

During the COVID-19 pandemic, the level of HCWs' self-efficacy to manage COVID-19 patients reported in different studies; among physicians and nurses working in the emergence, respiratory and infectious disease departments and intensive care units in Libya, those providing hospice care to dying COVID-19 patients in China, and a variety of HCWs from a district hospital in Poland ranged from low to high.<sup>18–20</sup> Training of HCWs through simulation has shown to enhance their assertiveness, mental preparedness and self-efficacy hence improving patient care outcomes.<sup>21</sup> Conversely, HCWs are experiencing significant stressors, burdens and mental health difficulties resulting from their work during the pandemic,<sup>22</sup> factors that could decrease their self-efficacy to manage COVID-19 patients. Despite the importance of HCWs' self-efficacy in managing patients with COVID-19, little is known regarding this concept in low resource settings. Nevertheless, the gravity of the pandemic is gradually shifting to African countries,<sup>23</sup> hence the need to explore this important phenomenon. We explored the HCWs' perceived self-efficacy to manage COVID-19 patients and associated factors; to provide insight for interventions aimed at reinforcing the task force response to the COVID-19 pandemic. Specifically, we explored the role of socio-demographic characteristics and COVID-19-related variables in shaping HCWs' perceived self-efficacy to manage patients with COVID-19 infection in central Uganda.

## Methods

### Study Design, Setting and Participants

We conducted a 2-months multicenter cross-sectional survey at four national referral hospitals in Kampala, the capital city of Uganda during the months of December 2020 and January 2021, at the climax of one of the first peaks of COVID-19 cases in Uganda.<sup>7</sup> These hospitals included Mulago National Referral Hospital, Mulago Specialized Women and Neonatal Hospital, Kawempe National Referral Hospital, and Kiruddu National Referral Hospital. These facilities also serve as Makerere University teaching hospitals, the leading University in the county and provide specialized and super-specialized health services to Uganda and its neighboring countries. The total bed capacities of these hospitals were approximated at 1800 as of April 2020 with about 1300 to 1500 HCWs.<sup>24</sup> The study was conducted after nine months following Uganda's first case of COVID-19 and all study sites were involved in screening and management of patients

with COVID-19 from Kampala and other regions of the country since the beginning of the pandemic, hence their selection for the study. At the time of the study, majority of Uganda's COVID-19 cases came from Kampala. This study adopts the World Health Organization definition of Health care workers (HCWs) as all people engaged in actions whose primary intent is to enhance health.<sup>25</sup> All HCWs employed in these four facilities were eligible to participate in this study, and these included: specialists, residents, general practitioners, interns, nurses, midwives among others. Of these, we recruited 418 HCWs aged 18 years and above who provided informed consent to participate in the study. We excluded HCWs with no formal registration and those who were too ill to participate in the study.

## Sample Size Estimation

We estimated sample size based on the rule of thumb of at least 10 observations per variable included in regression analysis.<sup>26</sup> Our study included 17 variables in regression analysis hence a minimum sample size of 170 participants was considered appropriate.

## Study Procedure and Data Collection

We utilized a convenient sampling strategy to recruit HCWs. Trained research assistants approached the HCWs at their working stations and requested them to participate in the study. Those who voluntarily accepted to participate and provided written informed consent were given a self-administered questionnaire that took a maximum of 10 minutes to be completed. Eligible HCWs were recruited from all departments in the four facilities for a period two weeks per facility.

The data collection tool obtained information on: (i) socio-demographic characteristics including age, sex, marital status, level of education, occupation, type of employment, and duration of work-experience among others; (ii) COVID-19 related knowledge and experiences, such as ever working in a COVID-19 treatment unit, ever been involved in management of suspected and confirmed cases of COVID-19, attending a formal training about COVID-19 management, having knowledge about COVID-19 management and COVID-19 test status; (iii) level of satisfaction with available supplies for prevention of COVID-19 from the workplace; (iv) Likelihood of getting infected with SARS-CoV-2 from the workplace; and (v) perceived self-efficacy to manage patients with COVID-19.

## Study Measure

### Perceived Self-Efficacy to Manage COVID-19 Patients

In this study, we define perceived self-efficacy as HCWs' confidence in his/her ability to manage patients with COVID-19. HCWs were asked to rate their level of perceived self-efficacy with respect to their scope of work in the management of COVID-19 patients for the different categories of HCWs as per Uganda health service commission guidelines.<sup>27</sup> This was described to study participants in the context of COVID-19 by research assistants prior to filling the questionnaire. Perceived self-efficacy was assessed using an adapted practice rating scale from Bandura's guide for constructing self-efficacy scales.<sup>28</sup> The scale is based on a standard methodology where individuals are presented with items portraying different levels of task demands, as they rate the strength of their belief in the ability to execute the requisite activities on a scale, ranging from 0 ("Cannot do at all") through intermediate levels of assurance, 5 ("Moderately certain can do") to complete assurance, 10 ("Highly certain can do"). We used a 5-item scale ([Supplementary Table S1](#)) consisting of questions about the management of COVID-19 cases in order of increasing severity according to national guidelines for management of COVID-19.<sup>29</sup> These included: (i) suspected case, (ii) mild case, (iii) moderate case, (iv) severe case, and (v) critically ill case; each requiring specific management ranging from simple home-based remedies to advanced intensive care depending on severity.<sup>29</sup> Descriptions of case definitions from suspected to critically ill COVID-19 were provided to HCWs by research assistants before they answered the questionnaire. A sample question was, "If you were asked to manage a patient with mild COVID-19 right now, how confident are you that you can manage him/her appropriately?" HCWs rated the strength of their ability to manage each case as described above. An overall mean score for participants on all items was computed, with a higher score indicating higher levels of perceived self-efficacy to manage patients with COVID-19. The reliability (Cronbach's alpha) of the scale was 0.88 in a pilot study among 24 medical students in clinical years and 0.94 in this study. Various researchers have used a similar method to formulate

scales for assessing self-efficacy for different health behaviors such as regulation of exercise,<sup>30</sup> and adherence to medication among HIV-infected adults.<sup>31</sup>

## Data Analysis

Data was entered in to Microsoft excel 2010, cleaned and exported to STATA version 16.0 for final analysis. Descriptive characteristics such as frequencies, means, and standard deviations were used to describe the distribution of the different variables. Student's *t*-test and One-way Analysis of Variances (ANOVAs) were used to determine significant difference between perceived self-efficacy mean score of categorical variables. For continuous variables, Pearson correlations were computed to determine their relationship with the outcome variable. Association between independent variables (age, gender, marital status, level of education, occupation, employment status, duration of work experience in the health sector, duration of work experience at current facility, knowledge about COVID-19, training about COVID-19, ever working in COVID-19 treatment unit, ever managing a suspected or confirmed case of COVID-19, ever testing for COVID-19, level of satisfaction with availability of supplies for prevention of COVID-19 at the workplace, and likelihood of getting infected with COVID-19 from the workplace) and the dependent variable (perceived self-efficacy to manage COVID-19 patients) were assessed by conducting bivariate and multivariate linear regression analyses. Three separate sensitivity regression analyses were conducted for subgroups of HCWs; nurses/midwives, doctors, and HCWs who had ever managed suspected or confirmed cases of COVID-19. A *p*-value <0.05 was considered statistically significant.

## Ethical Consideration

This study complies with the declaration of Helsinki. The study was reviewed and approved by the Mulago Hospital Research and Ethics Committee (MHREC) under reference number (MHREC 1908), administrative clearance was also provided by all the four hospitals involved in the research. All study participants provided written informed consent prior to participation in the study.

## Results

### Participant Characteristics

Details of the participant characteristics are presented in [Table 1](#). A total of 418 health care workers (HCWs) with mean age of 36.3 years (*SD*=10) participated in the study. The majority were female (61.7%, *n* = 258), married 52.6% (*n* = 220), and had a Bachelor's level of education 47.13% (*n* = 197). About half of the participants (50.96%, *n* = 213) were nurses/midwives and 10 years of work experience on average (*SD*= 9.3). Almost 90% of the participants agreed or completely that they had knowledge on COVID-19 management, and half (50.7%, *n* = 212) had received a formal training about COVID-19 management. Only 28 (6.7%) of the ever worked in a COVID-19 treatment unit, 51.9% (*n* = 217) ever been involved in management of a suspected case of COVID-19, and only 23.4% (*n* = 98) had ever been involved in management of a confirmed case of COVID-19. The vast majority (78.46%, *n* = 328) of the participants were either somewhat, mostly or completely dissatisfied with availability of supplies for prevention of COVID-19 at their facility, and 43.5% (*n* = 182) reported that they were extremely likely to get infected with SARS-CoV-2 from the work place ([Table 1](#))

### Perceived Self-Efficacy to Manage COVID-19 Patients

HCWs reported overall moderate perceived self-efficacy (PSE) in managing COVID-19 patients (mean score 5.4 [*SD* = 2.3]). The level of PSE gradually decreased with increase in disease severity. [Figure 1](#). There was no significant age difference in the level of PSE for participants (*p* = 0.181). Males reported a significantly higher level of PSE compared to females (6.2, [*SD* = 2.4] vs 4.9 [*SD* = 0.1]; *p*<0.001). Similarly, doctors reported a significantly higher levels of PSE compared to nurses and other HCWs (6.7 [*SD* = 2.1], 4.7 [*SD* = 2.0], 3.6 [*SD* = .2.2] respectively; *p*<0.001). The higher the level of education, the higher was one's level PSE *p*<0.001. In relation to COVID-19 variables, the degree of agreement with one's knowledge about COVID-19 management (*p*<0.001), ever receiving a training about COVID-19

**Table 1** Participant Characteristics

Variable	Frequency (n = 418)	Percentage (%)	Mean (SD)	F/t	p-value
<b>Age in years (M = 36.3; SD = 10.0)</b>					
18–24	22	5.26	4.6 (2.0)	1.63	0.181
25–34	198	47.37	5.4 (2.1)		
35–49	143	34.21	5.6 (2.5)		
≥50	55	13.16	5.1 (2.7)		
<b>Gender</b>					
Female	258	61.72	4.9 (0.1)	-5.63	<0.001
Male	160	38.28	6.2 (2.4)		
<b>Marital status</b>					
Not married	155	37.08	5.5 (2.2)	0.38	0.770
Married	220	52.63	5.5 (2.5)		
Divorced/separated/widowed	28	6.70	5.1 (2.2)		
Prefer not to answer	15	3.59	5.1 (1.8)		
<b>Level of education</b>					
*Certificate program	39	9.33	4.5 (2.2)	28.31	<0.001
Diploma	123	29.43	4.5 (2.2)		
Bachelor's degree	197	47.13	5.5 (2.0)		
Master's degree	54	12.92	7.6 (1.8)		
Doctor of philosophy (PhD)	05	1.20	9.3 (0.7)		
<b>Occupation</b>					
Nurse/midwife	213	50.96	4.7 (2.0)	62.11	<0.001
Doctor	170	40.67	6.7 (2.1)		
†Others	35	8.37	3.6 (2.2)		
<b>Employment status</b>					
Full-time	365	87.32	5.4 (2.4)	-0.22	0.829
Part-time	53	12.68	5.5 (1.8)		
<b>Years in medical practice (M = 10.67; SD = 9.27)</b>				$r^2 = -0.01$	0.962
<b>Duration of practice at current facility in years (M = 5.56; SD = 7.01)</b>				$r^2 = 0.07$	0.142
<b>I have knowledge about COVID-19 management</b>					
Completely disagree	00	00	00	28.22	<0.001
Disagree	08	1.91	3.9 (2.6)		
Neither agree or disagree	37	8.85	3.4 (1.1)		
Agree	238	56.94	5.1 (2.3)		
Completely agree	135	32.30	6.6 (2.1)		

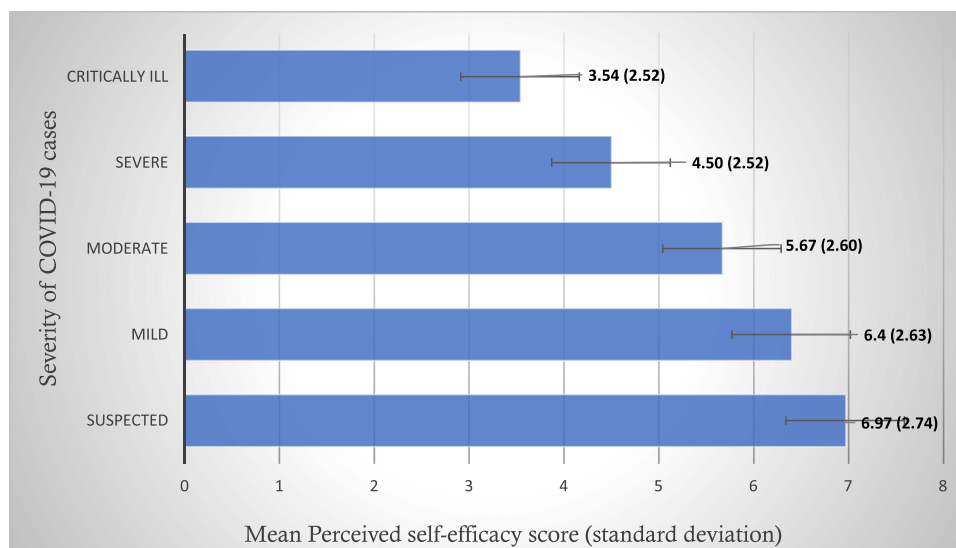
(Continued)

**Table 1** (Continued).

Variable	Frequency (n = 418)	Percentage (%)	Mean (SD)	F/t	p-value
<b>Ever had a training about COVID-19 management</b>					
No	206	49.28	4.9 (2.3)	4.93	<0.001
Yes	212	50.72	6.0 (2.2)		
<b>Ever worked in a COVID-19 treatment center</b>					
No	390	93.30	5.3 (2.3)	2.83	0.005
Yes	28	6.70	6.6 (2.2)		
<b>Ever been involved in management of a suspected case of COVID 19</b>					
No	201	48.09	4.7 (2.1)	6.39	<0.001
Yes	217	51.91	6.1 (2.3)		
<b>Ever been involved in management of a confirmed case of COVID-19</b>					
No	320	76.56	5.1 (2.3)	5.52	<0.001
Yes	98	23.44	6.5 (2.2)		
<b>Level of satisfaction with availability of supplies for prevention of COVID-19 at the facility</b>					
Completely dissatisfied	101	24.16	5.3 (2.7)	1.09	0.365
Mostly dissatisfied	113	27.03	5.6 (2.1)		
Somewhat dissatisfied	114	27.27	5.5 (2.2)		
Neither satisfied nor dissatisfied	12	2.87	3.9 (2.4)		
Somewhat satisfied	62	14.83	5.5 (2.2)		
Mostly satisfied	15	3.59	5.2 (2.4)		
Completely satisfied	01	0.24	4.4 (<0.01)		
<b>Ever tested for SARS-CoV-2 infection</b>					
No	162	38.76	5.2 (2.3)	-2.46	0.014
Yes	256	61.24	5.8 (2.4)		
<b>Ever tested positive for SARS-CoV-2 infection</b>					
No	397	94.98	5.4 (2.4)	0.55	0.584
Yes	21	5.02	5.1 (1.7)		
<b>Likelihood of getting infected with SARS-CoV-2 infection from my workplace</b>					
Extremely likely	182	43.54	5.8 (2.4)	3.42	0.009
Likely	174	41.63	5.1 (2.1)		
Neutral	39	09.33	4.8 (2.7)		
Unlikely	20	04.78	5.1 (2.2)		
Extremely unlikely	03	0.72	7.7 (0.8)		

**Notes:** \*Short-term program usually 2 years of training in health or allied health care services, †Laboratory assistants, Pharmacists, radiographers, and counselors, p<0.05 is statistically significant.

**Abbreviations:** M, mean; SD, standard deviation.



**Figure 1** Health care workers' perceived self-efficacy to manage COVID-19 patients in Central Uganda. Mean perceived self-efficacy scores in the management of COVID-19 cases. The overall mean score was 5.4, SD = 2.3. Mean scores decreased gradually with increase in disease severity.

**Abbreviations:** M, mean self-efficacy score; SD, standard deviation.

management ( $p < 0.001$ ), history of working in a COVID-19 unit ( $p = 0.005$ ), ever been involved in management of suspected ( $p < 0.001$ ), or confirmed ( $p < 0.001$ ), cases of COVID-19 and the degree of likelihood of getting infected with COVID-19 from one's work place ( $p = 0.009$ ) were statistically increased one's level of PSE. There was no statistical difference in the level of satisfaction with the availability of supplies for prevention of COVID-19 at the facility with the level of PSE. [Table 1](#)

## Factors Associated with Perceived Self-Efficacy to Manage COVID-19 Patients

At bivariate analysis ([Table 2](#)), being male ( $\beta = 1.27$ ; 95% confidence interval (CI): 0.83 – 1.72;  $p < 0.001$ ), a medical doctor ( $\beta = 2.03$ ; CI: 1.62 – 2.45;  $p < 0.001$ ), having a master's degree ( $\beta = 3.15$ ; CI: 2.29 – 4.01;  $p < 0.001$ ), or PhD ( $\beta = 4.81$ ; CI: 2.87 – 6.74;  $p < 0.001$ ) and ever testing for COVID-19 ( $\beta = 0.57$ ; CI: 0.12 – 1.03;  $p = 0.014$ ) were significantly associated with one's PSE to manage COVID-19 patients. In addition, participants who either agreed ( $\beta = 1.65$ ; CI: 0.91 – 2.39;  $p < 0.001$ ) or completely agreed ( $\beta = 3.18$ ; CI: 2.40 – 3.96;  $p < 0.001$ ) that they had knowledge about COVID-19 management, and those who had received a training about COVID-19 management ( $\beta = 1.10$ ; CI: 0.66 – 1.53;  $p < 0.001$ ) showed an increase in the level PSE. Furthermore, ever being involved in management of a suspected ( $\beta = 1.39$ ; CI: 0.96 – 1.82;  $p < 0.001$ ) or confirmed cases ( $\beta = 1.44$  (0.93 – 1.95);  $p < 0.001$ ) cases of COVID-19 also increased one's level of PSE. The variables had good collinearity with mean variance inflation factor (VIF) of 1.32, none of the individual VIF were above 3, thus, included in the multivariate analysis. At multivariate analysis, having a PhD ( $\beta = 2.80$ ; CI: 0.99 – 4.60;  $p = 0.002$ ), being a medical doctor ( $\beta = 0.88$ ; CI: 0.31 – 1.45;  $p = 0.003$ ), agreeing ( $\beta = 0.95$ ; CI: 0.27 – 1.63;  $p = 0.006$ ) or completely agreeing that one has knowledge about COVID-19 management ( $\beta = 1.85$ ; CI: 1.11 – 2.57;  $p < 0.001$ ) and having COVID-19 management training ( $\beta = 0.80$ ; CI: 0.42 – 1.19;  $p < 0.001$ ) were significantly associated with increase in the level of PSE. Being a HCW other than a doctor or nurse was associated with a decrease in one's level of PSE ( $\beta = -1.06$ ; CI: -1.79 – -0.33;  $p = 0.005$ ). The final model had an adjusted R square of 0.38, and a  $p$ -value of  $< 0.001$ .

[Table 3](#) presents factors associated with PSE among subgroups of HCWs; nurses/midwives, medical doctors, and HCWs who had ever managed suspected or confirmed cases of COVID-19. For nurses/midwives, having had a training about management of COVID-19, agreeing and completely agreeing with one's knowledge about COVID-19, and being somehow satisfied with availability of supplies of prevention of COVID-19 at the facility was associated with increase in one's level of PSE. For medical doctors, having a PhD and completely agreeing with one's knowledge about COVID-19

**Table 2** Bi-Variate and Multivariate Linear Regression Analysis of Participant Characteristics and Self-Efficacy to Manage COVID-19 Patients

Variable (n=418)	Bivariate Analyses		Multivariate Analyses	
	Crude Beta (95% Confidence Interval)	p-value	Adjusted Beta (95% Confidence Interval)	p-value
<b>Age</b>	0.01 (-0.02 – 0.03)	0.716	-	-
<b>Gender</b>				
Female				
Male	1.27 (0.83 – 1.72)	<0.001*	0.27 (-0.19 – 0.73)	0.250
<b>Marital status</b>				
Not married			-	-
Married	-0.01 (-0.49 – 0.48)	0.986	-	-
Divorced/separated/widowed	-0.40 (-1.34 – 0.54)	0.404	-	-
Prefer not to answer	-0.40 (-1.65 – 0.84)	0.522	-	-
<b>Level of education</b>				
Certificate program				
Diploma	-0.02 (-0.77 – 0.73)	0.962	-0.55 (-1.24 – 0.15)	0.123
Bachelor's degree	1.03 (0.31 – 1.74)	0.005*	-0.08 (-0.80 – 0.63)	0.824
Master's degree	3.15 (2.29 – 4.01)	<0.001*	0.80 (-0.15 – 1.75)	0.099
PhD	4.81 (2.87 – 6.74)	<0.001*	2.80 (0.99 – 4.60)	0.002*
<b>Occupation</b>				
Nurse/midwife				
Doctor	2.03 (1.62 – 2.45)	<0.001*	0.88 (0.31 – 1.45)	0.003*
Others	-1.12 (-1.86 - -0.39)	0.003*	-1.06 (-1.79 - -0.33)	0.005*
<b>Employment status</b>				
Full-time			-	-
Part-time	0.07 (-0.60 – 0.75)	0.829	-	-
<b>Years in medical practice</b>	-0.01 (-0.02 – 0.02)	0.962	-	-
<b>Duration of practice at current facility in years</b>	0.02 (-0.01 – 0.04)	0.142	-	-
<b>I have knowledge about COVID-19</b>				
Completely disagree	00		00	
Disagree	0.44 (-1.20 – 2.07)	0.599	0.22 (-1.21 – 1.65)	0.765
Neither agree or disagree				
Agree	1.65 (0.91 – 2.39)	<0.001*	0.95 (0.27 – 1.63)	0.006*
Completely agree	3.18 (2.40 – 3.96)	<0.001*	1.85 (1.12 – 2.57)	<0.001*

(Continued)



Table 2 (Continued).

Variable (n=418)	Bivariate Analyses		Multivariate Analyses	
	Crude Beta (95% Confidence Interval)	p-value	Adjusted Beta (95% Confidence Interval)	p-value
<b>Ever had a training about COVID-19</b>				
Yes	1.09 (0.66 – 1.53)	<0.001*	0.80 (0.42 – 1.19)	<0.001*
No				
<b>Ever worked in a COVID-19 treatment unit</b>				
Yes	-1.28 (-2.17 - -0.39)	0.005*	-0.01 (-0.79 – 0.79)	0.993
No				
<b>Ever been involved in management of a suspected case of COVID-19</b>				
Yes	1.39 (0.96 – 1.82)	<0.001*	0.17 (-0.26 – 0.60)	0.442
No				
<b>Ever been involved in management of a confirmed case of COVID-19</b>				
Yes	1.44 (0.93 – 1.95)	<0.001*	0.38 (-0.12 – 0.88)	0.139
No				
<b>Level of satisfaction with availability of supplies for prevention of COVID-19 at the workplace</b>				
Completely dissatisfied			-	-
Mostly dissatisfied	0.32 (-0.31 – 0.95)	0.313	-	-
Somewhat dissatisfied	0.24 (-0.38 – 0.87)	0.445	-	-
Neither satisfied nor dissatisfied	-1.33 (-2.73 – 0.06)	0.061	-	-
Somewhat satisfied	0.25 (-0.49 – 0.99)	0.503	-	-
Mostly satisfied	-0.09 (-1.36 – 1.17)	0.884	-	-
Completely satisfied	-0.87 (-5.47 – 3.73)	0.711	-	-
<b>Ever tested for SARS-CoV-2</b>				
Yes	0.57 (0.12 – 1.03)	0.014*	0.14 (-0.24 – 0.53)	0.465
No				
<b>Ever tested positive SARS-CoV-2</b>				
Yes	-0.29 (-1.31 – 0.74)	0.584	-	
No				
<b>Likelihood of getting infected with SARS-CoV-2 from the workplace</b>				
Extremely unlikely	2.83 (0.11 – 5.54)	0.041*	1.82 (-0.38 – 4.02)	0.104
Unlikely	0.23 (-1.02 – 1.47)	0.718	-0.24 (-1.26 – 0.77)	0.637
Neutral				
Likely	0.29 (0.51 – 1.09)	0.478	0.34 (0.31 – 1.01)	0.314
Extremely likely	0.97 (0.17 – 1.77)	0.018*	0.54 (-0.13 – 1.22)	0.119

Notes: \*= p <0.05, statistically significant.

**Table 3** Bi-Variate and Multivariate Linear Regression Analysis of Participant Characteristics and Self-Efficacy to Manage COVID-19 Patients, Among Subgroups of Health Care Workers; Nurses/Midwives, Medical Doctors and Health Care Workers Who Had Ever Managed Suspected/Confirmed Cases of COVID-19

Variable	Nurses/Midwives (n=213)				Doctors (n=170)				Ever Managed Suspected/Confirmed COVID-19 (n=125)			
	Bivariate Analyses		Multivariate Analyses		Bivariate Analyses		Multivariate Analyses		Bivariate Analyses		Multivariate Analyses	
	Crude Beta (95% Confidence Interval)	p-value	Adjusted Beta (95% Confidence Interval)	p-value	Crude Beta (95% Confidence Interval)	p-value	Adjusted Beta (95% Confidence Interval)	p-value	Crude Beta (95% Confidence Interval)	p-value	Adjusted Beta (95% Confidence Interval)	p-value
<b>Age</b>	-0.01 (-0.03 - 0.02)	0.670	-	-	0.10 (0.07 - 0.13)	<0.001*	0.01 (-0.04 - 0.062)	0.751	-0.017 -0.06 - 0.023	0.442	-	-
<b>Gender</b>												
Female												
Male	0.33 (-0.53 - 1.19)	0.450			0.76 (0.10 - 1.42)	0.023*	0.51 (-0.09 - 1.11)	0.098	1.51 (0.72 - 2.29)	< 0.001*	0.30 (-0.50 - 1.09)	0.458
<b>Marital status</b>												
Not married			-	-								
Married	-0.30 (-0.94 - 0.33)	0.345	-	-	1.36 (0.74 - 1.97)	<0.001*	0.47 (-0.25 - 1.19)	0.198	-0.15 (-1.08 - 0.78)	0.753		
Divorced/separated/widowed	-0.44 (-1.44 - 0.56)	0.383	-	-	1.83 (0.06 - 3.61)	0.043*	0.78 (-0.94 - 2.50)	0.372	-0.79 (-2.43 - 0.84)	0.339		
Prefer not to answer	-0.93 (-2.79 - 0.92)	0.323	-	-	-0.29 (-1.64 - 1.07)	0.678	-0.72 (-2.06 - 0.62)	0.288	-0.67 (-5.31 - 3.96)	0.774		
<b>Level of education</b>												
Certificate program					Omitted		Omitted					
Diploma	-0.02 (-0.80 - 0.77)	0.969			Omitted		Omitted		0.20 (-1.36 - 1.77)	0.797	-0.38 (-2.00 - 1.25)	0.648
Bachelor's degree	0.35 (-0.50 - 1.20)	0.419							1.21 (-0.32 - 2.74)	0.119	-0.25 (-1.92 - 1.42)	0.768
Master's degree	0.02 (-2.88 - 2.92)	0.990			1.61 (0.98 - 2.24)	<0.001*	0.30 (-0.50 - 1.09)	0.459	3.84 (2.11 - 5.58)	< 0.001*	1.54 (-0.47 - 3.56)	0.132
PhD	Omitted				3.15 (1.44 - 4.87)	<0.001*	2.16 (0.31 - 4.00)	0.022*	4.94 (2.30 - 7.58)	< 0.001*	2.87 (0.16 - 5.60)	0.038*

Occupation												
Nurse/midwife	NA	NA							I	I		
Doctor	NA	NA							2.15 (1.42 – 2.88)	0.001*	1.33 (0.22 – 2.44)	0.018*
Others	NA	NA							-0.61 (-2.47 – 1.25)	0.519	-80 (-2.64 – 1.05)	0.393
Employment status												
Full-time	I		-	-	I				I			
Part-time	-0.91 (-2.04 – 0.22)	0.116	-	-	-0.59 (-1.38 – 0.21)	0.148			0.39 (-0.99 – 1.77)	0.574		
Years in medical practice	0.01 (-0.01 – 0.03)	0.349	-	-	0.01 (-0.01 – -0.03)	0.263			-0.01 (-0.03 – 0.03)	0.826		
Duration of practice at current facility in years	0.01 (-0.02 – 0.04)	0.516	-	-	0.07 (0.04 – 0.10)	<0.001*	0.03 (-0.01 – 0.06)	0.159	0.03 (-0.1 – 0.07)	0.176		
I have knowledge about COVID-19												
Completely disagree	0	0			0				0		0	
Disagree	0.16 (-1.87 – 2.18)	0.878	0.42 (-1.47 – 2.31)	0.662	3.28 (0.32 – 6.23)	0.030*	1.78 (-1.15 – 4.70)	0.232	Omitted		Omitted	
Neither agree or disagree	I		I		I		I		I		I	
Agree	1.50 (0.68 – 2.32)	<0.001	1.44 (0.64 – 2.23)	<0.001*	2.33 (0.94 – 3.71)	0.001*	1.19 (-0.24 – 2.63)	0.102	0.97 (-.56 – 4.50)	0.126	1.46 (-.82 – 3.74)	0.207
Completely agree	2.33 (1.40 – 3.25)	<0.001*	2.16 (1.26 – 3.05)	<0.001*	3.55 (2.16 – 4.94)	<0.001*	2.09 (0.64 – 3.54)	0.005*	3.36 (0.80 – 5.92)	0.011*	1.86 (-.50 – 4.22)	0.122
Ever had a training about COVID-19												
Yes	1.39 (0.87 – 1.90)	<0.001*	0.98 (0.48 – 1.49)	<0.001*	0.51 (-1.11 – 0.13)	0.106			0.38 (-0.43 – 1.20)	0.353		
No	I		I		I				I			
Ever worked in a COVID-19 treatment unit												
Yes	2.00 (0.38 – 3.63)	0.016*	-1.27 (-2.71 – 0.18)	0.085	0.06 (-0.91 – 1.037)	0.898						

(Continued)

Table 3 (Continued).

Variable	Nurses/Midwives (n=213)				Doctors (n=170)				Ever Managed Suspected/Confirmed COVID-19 (n=125)			
	Bivariate Analyses		Multivariate Analyses		Bivariate Analyses		Multivariate Analyses		Bivariate Analyses		Multivariate Analyses	
	Crude Beta (95% Confidence Interval)	p-value	Adjusted Beta (95% Confidence Interval)	p-value	Crude Beta (95% Confidence Interval)	p-value	Adjusted Beta (95% Confidence Interval)	p-value	Crude Beta (95% Confidence Interval)	p-value	Adjusted Beta (95% Confidence Interval)	p-value
No									-2.55 (-5.76 - 0.66)	0.118		
<b>Ever been involved in management of a suspected case of COVID19</b>												
Yes	0.30 (-0.24-0.85)	0.267			1.46 (0.82-2.10)	<0.001*	0.49 (-0.20-1.18)	0.165				
No									NA	NA		
<b>Ever been involved in management of a confirmed case of COVID-19</b>												
Yes	0.56 (-0.15 - 1.27)	0.120			1.12 (0.49 - 1.76)	0.001*	0.54 (-0.11 - 1.20)	0.104				
No									NA	NA		
<b>Level of satisfaction with availability of supplies for prevention of COVID-19 at the workplace</b>												
Completely dissatisfied												
Mostly dissatisfied	0.42 (-0.34 - 1.17)	0.276	0.08 (-0.61 - 0.76)	0.828	-0.64 (-1.47 - 0.19)	0.132	-0.45 (-1.18 - 0.27)	0.219				
Somewhat dissatisfied	0.49 (-0.23 - 1.22)	0.179	0.21 (-0.46 - 0.88)	0.543	-0.50 (-1.36 - 0.36)	0.256	-0.69 (-1.45 - 0.074)	0.077	-0.49 (-1.57 - 0.60)	0.374	-0.39 (-1.30 - 0.52)	0.399
Neither satisfied nor dissatisfied	-2.45 (-4.44 - -0.47)	0.015*	-2.87 (-4.65 - -1.08)	0.002*	-1.44 (-3.34 - 0.47)	0.138	-0.65 (-2.56 - 1.25)	0.499	0.17 (-0.87 - 1.22)	0.742	-0.22 (-1.08 - 0.65)	0.622
Somewhat satisfied	1.35 (0.53 - 2.17)	0.001*	0.81 (0.05 - 1.57)	0.037*	-0.57 (-1.73 - 0.60)	0.339	-0.85 (-1.89 - 0.19)	0.110	-1.42 (-4.67 - 1.83)	0.390	-1.54 (-4.23 - 1.14)	0.257
Mostly satisfied	1.31 (0.041 - 2.57)	0.043*	1.46 (0.28 - 2.65)	0.016*	-3.70 (-6.10 - 1.30)	0.003*	-2.80 (-4.83 - -0.76)	0.007*	-0.35 (-1.77 - 1.07)	0.630	-0.28 (-1.48 - 0.92)	0.641
Completely satisfied	0.20 (-3.67 - 4.06)	0.920	-1.25 (-4.76 - 2.26)	0.485	Omitted		Omitted		-4.12 (-7.37 - -0.87)	0.013*	-4.56 (-7.23 - -1.89)	0.001*
<b>Ever tested for SARS-CoV-2</b>												

Yes	0.26 (-0.31 – 0.82)	0.370			0.46 (-0.17 – 1.09)	0.154						
No									-0.06 (-.90 – 0.78)	0.887		
<b>Ever tested positive SARS-CoV-2</b>												
Yes	-0.22 (-1.45 – 1.01)	0.724			-0.72 (-2.20 – 0.75)	0.335						
No									-0.39 (-2.16 – 1.38)	0.662		
<b>Likelihood of getting infected with SARS-CoV-2 from the workplace</b>												
Extremely unlikely	3.46 (-0.60 – 7.53)	0.095			1.38 (-1.62 – 4.37)	0.366			Omitted			
Unlikely	0.39 (-1.25 – 2.03)	0.641			-1.04 (-2.70 – 0.62)	0.217			-1.8 (-5.43 – 1.83)	0.329		
Neutral												
Likely	0.13 (-.81 – 1.08)	0.776			0.25 (-0.95 – 1.46)	0.678			1.03 (-0.89 – 2.94)	0.290		
Extremely likely	0.13 (-0.81 – 1.07)	0.785			1.10 (-0.07 – 2.28)	0.066			1.59 (-0.31 – 3.49)	0.101		

Note: \*= p <0.05, statistically significant.

increased one's PSE and among HCWs who had ever been involved in management of suspected or confirmed cases of COVID-19, having a PhD and being a doctor increased one's PSE.

## Discussion

This study explored health care workers' (HCWs) perceived self-efficacy (PSE) to manage COVID-19 patients. Our study findings provide valuable insights and suggestions for improving HCWs confidence in managing patients with COVID-19 as one of the ways to contribute to the fight against the COVID-19 pandemic. Besides, PSE and respective behavior may be a relevant factor for HCWs' performance in the face of pandemic surges. In this study, overall, HCWs reported moderate PSE to manage COVID-19 patients which gradually decreased with increasing severity of the COVID-19 clinical illness. Among nurses, having had a training about management of COVID-19, agreeing or completely agreeing with one's knowledge about COVID-19, and being somehow satisfied with availability of supplies of prevention of COVID-19 at the facility was associated with increase in one's level of PSE. For doctors, having a PhD and completely agreeing with one's knowledge about COVID-19 increased one's level of PSE. Overall, having knowledge about COVID-19 management, having attended a training about COVID-19 management, having a PhD and being a medical doctor were significantly associated increase in the level of PSE to manage COVID-19.

COVID-19 is associated with a sudden emergence and persistence of large numbers of patients in a short time,<sup>32</sup> which presents challenges to the health system including shortages in medical supplies and health professionals resulting heavy workloads, fatigue and stress among HCWs that negatively affect their PSE to manage COVID-19 patients.<sup>33,34</sup> Few studies worldwide have investigated HCWs' self-efficacy to manage patients with COVID-19 infection with varying results. A cross-sectional study among clinical nurses and physicians providing hospice care to dying COVID-19 patients in China reported moderate hospice care self-efficacy, results consistent with the current study.<sup>19</sup> Another study conducted in Jordan also agrees with our study findings as it reported moderate levels of self-efficacy among HCWs during caring for COVID-19 patients.<sup>35</sup> However, a study investigating the general self-efficacy of Chinese nurses in the face of COVID-19 during February 2020, reported lower self-efficacy compared to this study.<sup>36</sup> In addition, a study conducted in first three months of the pandemic by Muhammed et al involving 21 healthcare centers in Libya found that over 80% of the physicians and nurses working the emergence, respiratory and infectious disease departments and intensive care units had little or no confidence to manage COVID-19 patients.<sup>18</sup> This variation could be explained by the fact that the current study was conducted later in the pandemic when more information had been discovered about COVID-19 and with the development of COVID-19 treatment protocols,<sup>29</sup> introduction and high acceptance rate of vaccination in low and middle income countries that could boost HCWs confidence,<sup>37</sup> which were short of the earlier studies. On the contrary, one study in Poland reported higher levels of health workers' self-efficacy to manage COVID-19 patients than that reported in this study.<sup>20</sup> The difference could be due to the fact that Poland is a high-income country with advanced technology to provide complex care to patient like those suffering from severe and critical COVID-19 illness.

In this study, PSE to manage COVID-19 patients significantly increased when an individual agreed that they had knowledge about COVID-19 management. Individuals' knowledge has a positive effect on self-efficacy.<sup>38</sup> Moreover, HCWs' knowledge is one of the factors that are paramount in personal protection and the containment of COVID-19.<sup>39</sup> A study by Wang et al also supports the positive mediating effect of COVID-19 related knowledge on self-efficacy.<sup>40</sup> This could be attributed to the fact that HCWs with high levels of knowledge may have trust in the health system and its capacity to manage COVID-19 patients including themselves in the event that they become infected. HCWs who had attended a training about COVID-19 management had a significantly higher self-efficacy to manage such patients compared to their untrained counterparts. Continuous education of medical personnel especially through scenario simulations may equip HCWs with skills of facing difficult situations in real time.<sup>41,42</sup> A study assessing PSE among operating room (OR) staff in OR-specific procedures for patients with COVID-19 also affirms increase in self-efficacy post-training.<sup>43</sup> Surprisingly, having had a training about COVID-19 management did not show any influence on the level of PSE among HCWs who had ever managed suspected or confirmed cases of COVID-19. This may suggest confounding factors; perhaps the nature of training, methods used in training, level of satisfaction with the training, and provision

of reinforcement trainings may influence HCWs PSE. However, these important aspects were not explored in the current study hence a need for further studies to deeply explore the interaction between PSE and training.

It was not surprising that HCWs with a PhD had a higher level of PSE in comparison with those with lower levels of education in this study. Senior HCWs with more years of experience and postgraduate degrees show higher levels of self-efficacy while caring for patients with COVID-19.<sup>35</sup> In addition, highly educated HCWs are more competent in integrating evidence-based practice in the clinical environment, taking up responsibility and control and coping with challenging situations, are efficient while working in teams, executing leadership roles and balancing patients' health care demands with those of HCWs.<sup>44</sup> Furthermore, in the face of difficult cases in the hospital, senior HCWs could be the first to be called on to take charge of the situation, hence most likely to gain experience and confidence in the management of a new disease like COVID-19 before lower carder HCWs. This makes lower carder HCWs less confident in the management of these cases as it was found in our study that HCWs who had ever managed COVID-19 cases scored higher PSE compared to those with no experience, also, lower carder HCWs, such as nurses and midwives scored less on the PSE scale than senior HCWs.

In this study, being a medical doctor also increased HCWs' PSE level to manage patients with COVID-19 compared to nurses and other HCWs. This study agrees with findings by Kadoya et al, indicating low self-confidence among non-doctor HCWs in offering COVID-19 care.<sup>45</sup> Another study from Uganda and Zambia also reported higher self-efficacy among medical doctors providing obstetric care compared to other HCWs.<sup>46</sup> This could be because medical doctors are usually trained in the management of more complex cases that may present similar to COVID-19. Despite the fact that medical doctors had higher PSE to manage patients with COVID-19 in this study, nurses and other lower carder HCWs have a major role in the COVID-19 management especially in providing critical care to COVID-19 patients.<sup>44,47,48</sup> Thus, the need to empower non-doctor HCWs to be more self-efficacious in treating COVID-19 patients through structured training tailored to their knowledge needs about COVID-19 management as they make the majority of the health care work force. This could be reinforced by creating a safe working environment through provision of supplies for prevention of COVID-19 at their facilities as these have shown to increase nurses' PSE in the current study. Moreover, most of the participants in this study reported likely or extremely likely to get infected with SARS CoV-2 from their workplace. This could have reduced their PSE levels as HCWs who view themselves at high risk of getting infected with a life-threatening illness like COVID-19 may be less confident to manage such cases due to fear of infection and its complications.

According to Albert Bandura, individuals with high levels of self-efficacy approach threatening situations like the COVID-19 pandemic with a strong belief that they can control them.<sup>49</sup> He suggested four ways of improving self-efficacy that could be adopted by HCWs: (i) staying in the stretch zone, (ii) setting simple goals, (iii) looking at the big picture and (iv) reframing obstacles.<sup>50</sup> Given the significant association between HCWs' knowledge, education attainment and training on HCWs self-efficacy to manage COVID-19 patients, we recommend training more HCWs about clinical management of COVID-19 irrespective of their carder as a strategy to increase self-efficacy to manage patients with COVID-19. Employers should take on the responsibility of training their staff in COVID-19 treatment. However, HCWs should also have the responsibility of updating themselves with current COVID-19 guidelines and participating in trainings about COVID-19.<sup>45</sup> This will reduce the burden of patient care on the highly trained but few HCWs in LMICs. In addition, training should specifically focus on lower carder HCWs and clinical management aspects of the severe and critically ill patients with COVID-19. Another strategy to increase HCWs' self-efficacy to manage COVID-19 patients could be through improving the mental health of HCWs by interventions aimed at combating psychological distress (anxiety, stress, and depression), that decreases HCWs' self-efficacy by several researchers.<sup>36,51</sup> This could be done by providing social support to HCWs especially those directly involved in treating COVID-19 patients.<sup>52,53</sup>

## Limitations of the Study

Our findings should be interpreted with caution due its several limitations: First, since majority of the study participants did not have actual experience in taking care of patients with COVID-19, we report perceived self-efficacy (PSE) which is an assumption of actual self-efficacy among HCWs, which may not reflect the actual experience of health workers actively managing COVID-19 patients. Therefore, we suggest future researchers to conduct a similar study among HCWs

who are actively caring for COVID-19 patients. Secondly, this was a cross-sectional study that based on self-report which could have introduced respondent bias, for instance, confidence is a virtue of a good HCW, one would intuitively think they are confident due to the fact that they are HCWs. Third, due to the study design, we could not ascertain causality for the levels of PSE among HCWs. We recommend future researchers to conduct large prospective studies to understand the causes of the different levels of PSE among the various groups of HCWs. Fourth, we adopted a convenience sampling technique making generalizability of the study findings limited. Fifth, the perceived self-efficacy scale adapted in the study had not been previously validated for use in our setting. Sixth, the use of trained research assistants in data collection could have introduced selection bias since a research assistant will most likely approach the less busy HCW and invite them to participate, in contrast, the busiest one may be avoided, and probably those may have more experience in dealing with COVID-19. This could have led to underestimation of the level of PSE among HCWs. Seventh, over 90% of the study participants were nurses/midwives and doctors, this limits generalization of study findings to other categories of health workers. However, we conducted sensitivity analysis to explore this limitation. Lastly, we also did not assess for symptoms of psychological distress, which have been previously found to be associated with self-efficacy.<sup>36,51</sup>

## Conclusion

This study highlights an unsatisfactory moderate overall perceived self-efficacy among HCWs in the management of patients with COVID-19 in central Uganda. The health sector should focus on improving HCWs' self-efficacy through continuous training of all HCWs in the clinical management of the severe and critically ill cases of COVID-19. Non-doctor HCWs should be given priority as scored lower levels of PSE in management of COVID-19; yet they are the cornerstone of the primary health care system and make majority of the health human resource in low- and middle-income countries. Interventions towards creating a safe working environment for HCWs through provision of adequate infection prevention and control strategies are essential in boosting HCWs confidence to manage COVID-19 patients.

## Patient and Public Involvement

Patients and the public were not involved in the design, or conduct, or reporting or dissemination plans of our research.

## Data Sharing Statement

The raw data supporting the conclusions of this study will be made available by the corresponding author, without undue reservations on reasonable request.

## Ethical Consideration

This study complies with the declaration of Helsinki. The study was reviewed and approved by the Mulago Hospital Research and Ethics Committee (MHREC) under reference number (MHREC 1908), administrative clearance was also provided by all the four hospitals in involved in the research. All study participants provided written informed consent prior to participation in the study.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.



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## Disclosure

All authors declare no conflicts of interest in relation to this work.

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