

# Coronavirus disease–2019 morbidity and mortality among health care workers in Uganda

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## Abstract

**Background:** Health care workers (HCWs) are at increased risk of acquiring coronavirus disease 2019 (COVID-19). This study aimed to determine and compare the morbidity and mortality rates due to COVID-19 among the HCWs and the general population (non-HCWs).

**Methods:** We conducted a retrospective chart review. We accessed electronic database of participants admitted at Mulago National Referral Hospital COVID-19 Treatment Unit (CTU) between March 2020 and September 2021. Participants with missing occupations were excluded.

**Results:** Of 594 eligible participants, 6.4% ( $n=38$ ) were HCWs. Compared with non-HCWs, HCWs were much younger (48 versus 55 years,  $p=0.020$ ). The proportion of participants with severe disease (73.7% versus 77.6%,  $p=0.442$ ), who had not received COVID-19 vaccine (91.2% versus 94.7%,  $p=0.423$ ), mortality rate (44.7% versus 54.8%,  $p=0.243$ ) and the median length of hospitalization (6 versus 7 days,  $p=0.913$ ) were similar among HCWs and non-HCWs, respectively. A higher proportion of HCWs required oxygen therapy (24.3% versus 9.7%,  $p<0.01$ ). At admission, the presence of cough ( $p=0.723$ ), breathlessness ( $p=0.722$ ), fever ( $p=0.19$ ), sore throat ( $p=0.133$ ), comorbidities ( $p=0.403$ ) and headache ( $p=0.162$ ) were similar across groups. Rhinorrhoea was more common among HCWs (34.4% versus 16.6%,  $p=0.017$ ). Among HCWs, nurses had the highest morbidity (52.6%) and mortality (58.8%).

**Conclusion:** The morbidity and mortality among HCWs in Uganda were substantial, with a low COVID-19 vaccination rate and a higher requirement for oxygen therapy despite a younger age.

**Keywords:** COVID-19, morbidity, mortality, health care workers

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## Introduction

Health care workers (HCWs) are key players in the management of the coronavirus disease 2019 (COVID-19) pandemic.<sup>1</sup> In line of duty, HCWs are exposed to the occupational risk of contracting the severe acute respiratory syndrome–coronavirus 2 (SARS-CoV-2) virus.<sup>1–3</sup> Previous studies have reported specific numbers of confirmed SARS-CoV-2 infections, morbidity patterns and deaths among HCWs in Europe, India, Americas and a few of the middle status African nations.<sup>4–6</sup>

They have found HCWs' morbidity and mortality rates to parallel those of the general population (non-HCWs).<sup>5</sup> Higher mortalities and morbidities have been reported in males, however, further investigations into differences in clinical presentations and outcomes across sexes, racial groups, age groups and specialties are lacking.<sup>1,4,5</sup>

In as much as Uganda lacks a national database and an updated system for the burden of SARS-CoV-2 infection, morbidity and mortality of

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HCWs, there was a single media report by the Uganda Medical Association of nearly 200 HCWs who had tested positive for SARS-CoV-2, constituting about 4% of the 5,123 Ugandans that had tested positive on 16 September 2020.<sup>7</sup>

To-date, no recent report of morbidity and mortality attributed to COVID-19 among HCWs has been published, despite three waves of the pandemic in Uganda.<sup>7,8</sup> The aim of this study was to determine the mortality and morbidity burden of HCW in Uganda and compare their clinical outcomes with those of the non-HCWs.

### Methods

A retrospective chart review was carried out on electronic database available at Mulago National Referral Hospital (MNRH) between March 2020 and September 2021. MNRH is a hospital complex with an official capacity of 1800 beds. It consists of hospitals and affiliated medical institutions. Old Mulago Hospital has 200 beds, Mulago Women's Referral Hospital has 450 beds and Mulago National Specialized Hospital has 1000 beds. The Infectious Diseases Institute, the Uganda Heart Institute has 200 beds and Uganda Cancer Institute has 80 beds. The complex is located in central Uganda, in the Mulago suburb of Kampala, the country's capital. It was established as a public hospital. It now doubles as a teaching hospital for Makerere University College of Health Sciences. The MNRH complex has five intensive care units (ICUs) and 69 ventilators all together. Eight are in the general ICU, and these are Draeger Savina and Draeger Savina 300. Seven are in the Uganda Heart Institute's ICU, and these are Carescape R860 and Draeger Savina. Twenty-seven are in the former COVID-19 ICU, now being turned into a general ICU and these are all Draeger Savina and Draeger Savina 300. Twenty-seven are in the Mulago Specialized Women's and Neonatal Hospital ICUs, and high-dependency unit (HDU). Of these, 15 are in the Women's ICU and HDU, 12 in the neonatal ICU and these are all Carescape R860. The Mulago National Specialized Hospital has the COVID-19 Treatment Unit (CTU), where COVID-19 patients were admitted and treated. It also housed the former COVID-19 specialized ICU that is gradually being transformed into a general ICU. MNRH offers both public and private services. It is a government-funded hospital whose services patients do not

pay for. It also offers private services to patients that can afford. Patients pay for the private services directly out of the pocket and do not use insurance. MNRH CTU is the largest in Uganda and receives referrals from across the country. At the CTU, admitted patients were mildly, moderately, severely or critically ill individuals who were either referrals from anywhere in Uganda or those who were brought by family and others transferred from other departments within the hospital. Asymptomatic or pre-symptomatic patients were not admitted. Data on demographics, clinical presentation at admission, clinical outcomes, length of hospitalization, oxygen requirement, COVID-19 vaccination status and comorbidities were collected electronically. Participants with missing occupation were excluded while reporting morbidity and mortality of HCWs versus the non-HCWs. The entire cohort of admitted patients was included while reporting mortality. We compared clinical presentations and outcomes of HCWs with non-HCWs.

STATA software version 16 was used for analysis. Categorical data were summarized as frequencies and percentages, whereas numerical data as median (interquartile range) to assess the associations between HCW and independent variables. Bivariate analysis was done using chi-square test or Fishers' exact test for categorical variables and Mann-Whitney *U*-test for continuous variables. A  $p < 0.05$  was considered statistically significant. All independent variables with  $p < 0.2$  were taken for multivariable logistic regression,  $p < 0.05$  was considered statistically significant. Mulago Hospital Research and Ethics Committee (MHREC) approved the study (approval number: MHREC 2107). A waiver of consent was provided by MHREC to allow retrospective chart review.

### Results

A total of 594 participants had occupations stated and were included in the analysis. Median age of all the participants was 54 years. Most ( $n = 336$ , 56.6%) participants were male. At admission, 458 (77.4%) participants had severe COVID-19. Most participants ( $n = 502$ , 85.2%) were from central region of Uganda. Overall, 461 (94.5%) participants were not vaccinated against COVID-19 and 22 (5%) were re-infected. A total of 321 (54.1%) participants died. Only 62 (10.6%) participants received oxygen therapy. At admission,

most participants ( $n=548$ , 93.8%) presented with cough, with difficulty in breathing ( $n=535$ , 92.6%), fever ( $n=212$ , 41.1%), headache ( $n=84$ , 18.1%), rhinorrhoea ( $n=81$ , 17.8%) and sore throat ( $n=26$ , 6.1%) (Table 1). Of all the participants, 264 (46.6%) had at least one comorbidity; 197 (36.1%) had hypertension, 116 (22.3%) had diabetes mellitus and 25 (6.4%) had HIV. Of the 594 participants, 38 (6.4%) were HCWs, and all were Ugandans. Compared with non-HCWs, HCWs were younger (48 *versus* 55 years,  $p=0.02$ ), more were female (57.9% *versus* 42.5%,  $p=0.046$ ), a higher proportion required supplemental oxygen (24.3% *versus* 9.7%,  $p=0.01$ ) and presented with rhinorrhoea (34.4 *versus* 16.6%,  $p=0.017$ ). HCWs were 10% younger, had over three-fold higher odds of requiring oxygen therapy and were 2.6-fold more likely to present with rhinorrhoea compared with their non-HCW counterparts (Table 1). Nurses had the highest morbidity (52.6%) and mortality (58.8%) as summarized in Figures 1 and 2, respectively.

## Discussion

HCWs constituted a significant proportion of patients hospitalized with COVID-19 in Uganda. Our findings show that mortality rates among HCWs as compared with the non-HCWs are congruent with previously published data from developed and developing countries during the first and second waves of COVID-19.<sup>1,4,9-11</sup> Albeit not being statistically significant, HCWs in our study were much younger, with a relatively lower mortality rate. Advanced age (50 years and above) is a known risk factor for poor outcomes in COVID-19 illness.<sup>4,11,12</sup> From the data in our study, nurses had the highest morbidity and mortality among HCWs. This is consistent with global mortality burden reported by the World Health Organization (WHO).<sup>13</sup> This is because nurses contribute most of the health care workforce in Uganda and across the world, and have the longest duty coverage predisposing them to SARS-CoV-2.<sup>4,14</sup> Also, despite a high priority for COVID-19 vaccination given to HCWs, it was surprising that over 90% of the HCWs in this study were unvaccinated. Our findings depict low vaccination rates among HCWs reported to be less than 1 in 10 HCWs vaccinated fully in Africa and Western Pacific regions and only two in five on average globally by WHO, in spite of their knowledge of the importance of vaccination, prioritization of HCW by the government and

starting vaccinations on 10 March 2021, a month before the beginning of the second wave in Uganda. We registered a rate lower than 2 in 10 HCWs reported with 1.89% of the 150,000 HCW targeted to be vaccinated by 15 March 2021 with the first dose. Towards the end of April, same year, coverage among HCWs was reported to be at only 16%, 7 weeks after the start of the vaccination, with highlights of afore-mentioned obstacles. However, a recent study reports over 65% coverage among 300 eye care HCWs who also had high COVID-19 vaccine acceptance at 97.6% and low hesitancy at 2.3%. However, the observed ratios could be influenced the high concern eye care specialists have for their high predisposition to contracting COVID-19 due to the closeness in which eye care HCWs examine their patients. In addition, these results are of a single group of HCW that is highly specialized and may be representative of the entire over 150,000 HCWs in the country, as eye care workers are only ( $357/150,000 \times 100\%$ ) 0.24% of the HCW workforce in Uganda.<sup>11,13,15-20</sup>

Ugandan HCWs were younger because about half of the Ugandan population was reported to be below 15 years by the 2014 national population census thus implying a generally young Ugandan population and hence a lower mean of age among Ugandans compared with the global range of age of participants who died due to COVID-19. As depicted by our results, HCWs were unvaccinated due to hesitancy, confidence in ability to self-medicate and a generally delayed access to the vaccines in the country, despite prioritization due to challenges like lack of operationalization funds by the government. The low vaccination in return contributed to the observed severe forms of COVID-19 in 73.7% of HCWs and the deaths at 44.7%. We also point out the scarcity of personal protective equipment especially for the nurses who are given less priority and a general lack of duty in the government to care for HCW as catalysts for the unexpectedly high morbidity and mortality burden in the group.<sup>7,8,14,21,22</sup> Our study shows that vaccination among the non-HCWs was even lower at only 5.5% due to higher rates of hesitancy aggravated by administration of fake vaccines to over 800 people and less ability to access vaccines due to consideration after priority groups of HCW, law enforcers and teachers, who did not utilize the opportunity as expected and led to expiration of over 600,000 vaccines. In Uganda, generally, as of 2 September, 1,385,318 doses of

**Table 1.** Bivariate analysis for factors associated with the morbidity and mortality of HCW in comparison with the non-health care worker.

Variable	All ( <i>n</i> = 594) Freq. (%)	Health care worker		<i>p</i> value
		No ( <i>n</i> = 556) Freq. (%)	Yes ( <i>n</i> = 38) Freq. (%)	
Age, mean ( <i>SD</i> ), years	54 (16.9)	55 (16.9)	48 (16)	<b>0.02</b>
< 18	8 (1.3)	7 (1.3)	7 (18.4)	0.139
18–35	74 (12.7)	67 (12.3)	13 (34.2)	
36–49	152 (26)	139 (25.4)	1 (2.6)	
> 50	351 (60)	334 (61.1)	17 (44.7)	
Female	258 (43.4)	236 (42.5)	22 (57.9)	<b>0.046</b>
Male	336 (56.6)	320 (57.6)	16 (42.1)	
Nationality				
Ugandan	582 (98)	544 (97.8)	38 (100)	> 0.999
Non-Ugandan	12 (2)	12 (2.2)	0 (0)	
Disease category at admission				
Critical	37 (6.3)	36 (6.5)	1 (2.6)	0.442
Mild	11 (1.9)	10 (1.8)	1 (2.6)	
Moderate	86 (14.5)	78 (14.1)	8 (21.1)	
Severe	458 (77.4)	430 (77.6)	28 (73.7)	
Region of residence				
Central	502 (85.2)	468 (84.9)	34 (89.5)	0.737
Eastern	43 (7.3)	42 (7.6)	1 (2.6)	
Foreign	3 (0.5)	3 (0.5)	0 (0)	
North	6 (1)	6 (1.1)	0 (0)	
Western	35 (5.9)	32 (5.8)	3 (7.9)	
Vaccinated, <i>n</i> = 488				
No	461 (94.5)	430 (94.7)	31 (91.2)	0.423
Yes	27 (5.5)	24 (5.3)	3 (8.8)	
Reinfection, <i>n</i> = 443				
No	421 (95)	391 (94.7)	30 (100)	0.386
Yes	22 (5)	22 (5)	0 (0)	

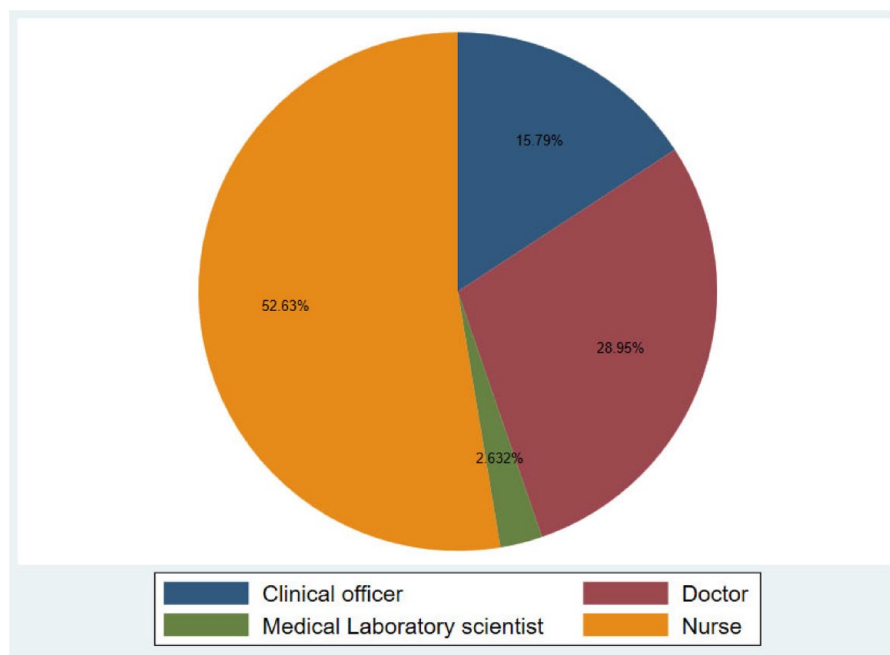
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**Table 1.** (Continued)

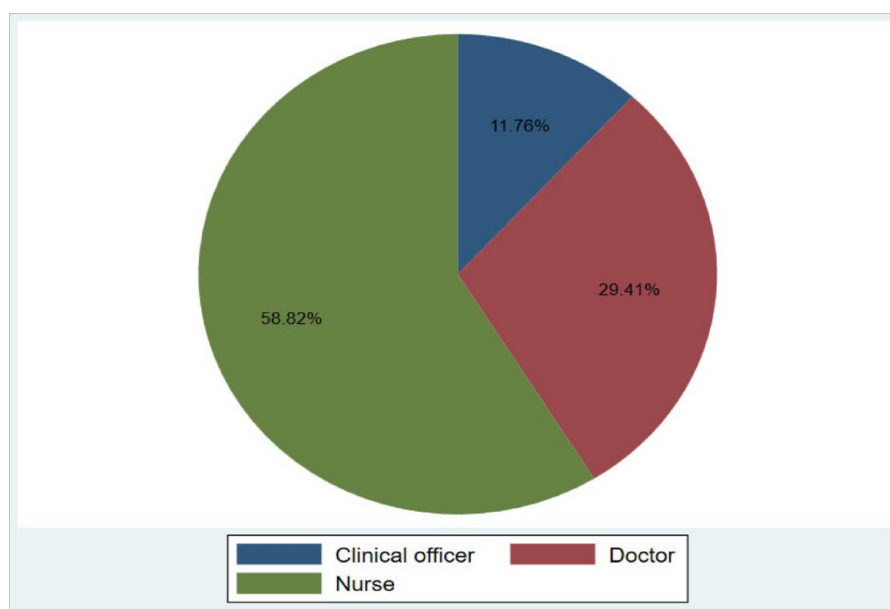
Variable	All ( <i>n</i> = 594) Freq. (%)	Health care worker		<i>p</i> value
		No ( <i>n</i> = 556) Freq. (%)	Yes ( <i>n</i> = 38) Freq. (%)	
Outcome, <i>n</i> = 593				
Alive	272 (45.9)	251 (45.2)	21 (55.3)	0.243
Dead	321 (54.1)	304 (54.8)	17 (44.7)	
Duration of hospitalization, median (IQR), days	7 [2–13]	7 [2–13]	6 [2–16]	0.913
Oxygen therapy, <i>n</i> = 585				
Yes	62 (10.6)	53 (9.7)	9 (24.3)	<b>&lt; 0.01</b>
No	523 (89.4)	495 (90.3)	28 (75.7)	
SpO <sub>2</sub> , median (IQR), percentage	88 (76.8–94)	87 (76–94)	92 (85–97)	0.489
Symptoms at admission				
Fever	212 (41.1)	199 (41.4)	13 (37.1)	0.723
Cough	548 (93.8)	513 (94)	35 (92.1)	0.722
Breathlessness	535 (92.6)	502 (93)	33 (86.8)	0.190
Headache	84 (18.1)	75 (17.4)	9 (27.3)	0.162
Rhinorrhoea	81 (17.8)	70 (16.6)	11 (34.4)	<b>0.017</b>
Sore throat	26 (6.1)	22 (5.6)	4 (12.1)	0.133
Any comorbidity				
No	302 (53.4)	279 (52.8)	23 (60.5)	0.403
Yes	264 (46.6)	249 (47.2)	15 (19.5)	
Hypertension	197 (36.1)	187 (36.6)	10 (28.6)	0.370
Diabetes mellitus	116 (22.3)	107 (22.1)	9 (25.7)	0.674
Human immunodeficiency virus	25 (6.4)	24 (6.6)	1 (3.3)	0.709
HCW: health care worker; IQR: interquartile range. Bold: statistically significant.				

COVID-19 vaccines had been administered. On 6 September, there was arrival of 640,000 Moderna vaccines that were administered during the course of the month, though it is not known when these were finished, though most likely they were depleted before the month ended. By September 2021, Ugandan population was estimated at 45.9 million, establishing the nationwide vaccine

coverage at 3.02% at the time of the study.<sup>15,16</sup> This translated into a higher death rate observed in the non-HCW at 54.1% and severe disease at 77.6%.<sup>1,13,22,23</sup> However, a similar study at the same unit collected data from 1 May to 11 July 2021 (second wave only) and reported a 37% mortality and the 17.1% difference from this study is attributable to the use of data collected over a



**Figure 1.** COVID-19 morbidity across health care workers cadre.



**Figure 2.** Mortality across health care workers cadre.

longer period, which involved both the first and second waves of COVID-19 in Uganda.<sup>23</sup>

The data set was collected at MNRH located in the central part of the country, which was most affected by COVID-19. The hospital receives

patients from all parts of the country and these data are therefore satisfactorily representative of the morbidity and mortality patterns of HCW and the non-HCW in Uganda. Our major limitation came from the electronic data set we accessed. The data set had over 1,000 participants, however,



there were missing information on demographics, comorbidities, vaccination status among others secondary to insufficient documentation, such that after cleaning a set of only 594 participants could be analysed. We also did not gain access to data sets at testing centres to report infection rates. Many HCWs sought treatment from private hospitals while others self-medicated and so that their data are not represented in this study.

## Conclusion

In conclusion, we observed an unexpectedly high proportion of HCW who suffered from COVID-19 at a much younger ages than the non-HCW, higher morbidity and mortality among female HCWs especially nurses, with a higher requirement for supplemental oxygen. More concerning was the low vaccination rate among HCWs. Stakeholders should prioritize resources towards the protection of HCW. Greater vaccine coverage, sensitization and uptake among HCWs and the non-HCWs should be enforced.

## Declarations

### *Ethics approval and consent to participate*

Mulago Hospital Research and Ethics Committee (MHREC) approved the study (approval number: MHREC 2107). A waiver of consent was provided by Mulago Hospital Research and Ethics Committee given the retrospective nature of the study.

### *Consent for publication*

Not applicable.

### *Author contributions*

**Leoson Junior Ssetaba:** Conceptualization; Funding acquisition; Investigation; Methodology; Project administration; Resources; Visualization; Writing – original draft; Writing – review & editing.

**Joy Mirembe:** Conceptualization; Data curation; Funding acquisition; Project administration; Writing – original draft; Writing – review & editing.

**Jotham Omega:** Project administration; Resources; Writing – original draft; Writing – review & editing.

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**Sarah Kiguli:** Funding acquisition; Writing – original draft; Writing – review & editing.

**Frederick Nelson Nakwagala:** Project administration; Writing – original draft; Writing – review & editing.

**Felix Bongomin:** Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Supervision; Validation; Visualization; Writing – original draft; Writing – review & editing.

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### *Competing interests*

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

### *Availability of data and materials*

The data sets generated and/or analysed during the current study are included in this published article and its supplementary information files.

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