



THE AGA KHAN UNIVERSITY

eCommons@AKU

Internal Medicine, East Africa

Medical College, East Africa

7-2021

COVID-19 and mental well-being of nurses in a tertiary facility in Kenya

Sayed Karar

Jasmit Shah

Zohray Talib

Follow this and additional works at: https://ecommons.aku.edu/eastafrica_fhs_mc_intern_med



Part of the [Internal Medicine Commons](#), and the [Psychiatric and Mental Health Commons](#)

RESEARCH ARTICLE

COVID-19 and mental well-being of nurses in a tertiary facility in Kenya

Sayed K. Ali¹*, Jasmit Shah¹, Zohray Talib²

1 Department of Medicine, Aga Khan University Hospital, Nairobi, Kenya, **2** Department of Medical Education, California University of Science and Medicine, Colton, California, United States of America

✉ These authors contributed equally to this work.

* sayed.karar@aku.edu

Abstract

Background

The 2019 coronavirus disease (COVID-19) epidemic is a global health emergency which has been shown to pose a great challenge to mental health, well-being and resilience of healthcare workers, especially nurses. Little is known on the impact of COVID-19 among nurses in sub-Saharan Africa.

Methods

A cross sectional study was carried out between August and November 2020 among nurses recruited from the Aga Khan University Hospital, Nairobi. The survey questionnaire consisted of six components- demographic and work title characteristics, information regarding care of COVID-19 patients, symptoms of depression, anxiety, insomnia, distress and burn-out, measured using standardized questionnaires. Multivariable logistic regression analysis was performed to identify factors associated with mental health disorders.

Results

Of 255 nurses, 171 (67.1%) consented to complete the survey. The median age of the participants was 33.47 years, 70.2% were females and 60.8% were married. More than half, 64.9% were frontline workers directly engaged in COVID-19 care. Only 1.8% reported a prior history or diagnosis of any mental health disorder. Depression, anxiety, insomnia, distress, and burnout were reported in 45.9%, 48.2%, 37.0%, 28.8% and 47.9% of all nurses. Frontline nurses reported experiencing more moderate to severe symptoms of depression, distress and burnout. Furthermore, females reported more burnout as compared to males. Multivariate logistic regression analysis showed that after adjustment, working in the frontlines was an independent risk variable for depression and burnout.

Conclusion

This is one of the few studies looking at mental health outcomes among nurses during the COVID-19 pandemic in Kenya. Similar to other studies from around the world, nurses directly involved with COVID-19 patients reported higher rates of mental health symptoms.



OPEN ACCESS

Citation: Ali SK, Shah J, Talib Z (2021) COVID-19 and mental well-being of nurses in a tertiary facility in Kenya. PLoS ONE 16(7): e0254074. <https://doi.org/10.1371/journal.pone.0254074>

Editor: Jenny Wilkinson, Endeavour College of Natural Health, AUSTRALIA

Received: February 12, 2021

Accepted: June 19, 2021

Published: July 1, 2021

Copyright: © 2021 Ali et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Data Availability Statement: All relevant data are within the manuscript and its [S1 File](#).

Funding: The author(s) received no specific funding for this work.

Competing interests: The authors have declared that no competing interests exist.

Burnout threatens to exacerbate the pre-existing severe nursing workforce shortage in low-resource settings. Cost-effective and feasible mitigating strategies, geared to low-middle income countries, are urgently needed to help cope with mental health symptoms during such a pandemic.

Introduction

According to the World Health Organization (WHO), Kenya, in 2020, confirmed over 95,000 COVID-19 cases with about 1,655 deaths [1]. Healthcare workers historically play a critical role in addressing the medical and psychological needs of patients during a pandemic. A robust healthcare system is required to adequately attend to the mental well-being needs of not only the patients, but healthcare workers too.

The Kenyan health system is defined by the following 6 levels of care provided to patients: level 1: community services, level 2: dispensaries and clinics, level 3: health centres, level 4: sub-county hospitals, level 5: county referral hospitals and large private hospitals and level 6: national referral hospital and large private teaching hospitals. Kenya's health budget accounts for 4% of the total budget and the funds are primarily used for curative services. Government funds are solely distributed to the sub-county and government clinical facilities and hospitals [2]. In Kenya, the total number of healthcare workers employed by public as well and private institutions is approximately 31,412 as per the 2016 Training Needs Assessment. This number remains way below the required 138,266 healthcare workers suggested by the Ministry of Health's Norm and Standard Guidelines [3].

Nurses remain a critical part of the work force in Kenya often on the frontline providing initial and key services to patients. There are approximately 51,649 nurses below the age of 60 with majority being female between the ages of 21–30 years. Majority of the nursing training institutions are government sponsored and may offer three levels of training programs including: certificate, diploma and a bachelor's degree. A majority of the nurses (65%) in Kenya are diploma holders [4]. Multiple studies have consistently reported an overall shortages of nurses in Kenya especially in the public sector countrywide with major variations in nurse densities and skills around the various geographic areas in Kenya [3, 5].

Prior to the COVID-19 pandemic, the Ebola pandemic nearly demolished an already fragile healthcare system in West Africa. Healthcare workers were 20–30 times more likely than the general population to contract the virus, and mortality among healthcare workers was reported as high as 69% [6, 7]. Despite these alarming facts, little was published on the effects of the Ebola pandemic on the mental health and well-being of healthcare workers in West Africa. Similarly, the COVID-19 pandemic in sub-Saharan Africa (SSA) continues to pose many challenges to the mental well-being of healthcare workers. This is augmented by the fact that many countries in SSA have limited resources including healthcare workers, intensive care units (ICUs) and ventilators to deal with the increasing number of COVID-19 patients. SSA has approximately 11% of the world population and 24% of the global disease burden but on 3% of the world's healthcare workers [8]. WHO in 2018 reported approximately 0.2 physicians and 1.2 nurses per 1,000 population in Kenya, in contrast to 2.6 physicians and 11.9 nurses per 1,000 people in the United States [9, 10]. The limited health care resources and increasing workload within a fragile health care system exacerbate the mental health strain faced by many healthcare workers, especially nurses, taking care of COVID-19 patients.

The pandemic has been linked to various psychological disorders especially in healthcare workers involved in the direct care of COVID-19 patients, with many studies showing increased levels of depression, anxiety, stress and burnout most notably among frontline nurses [11–18]. A study looking at the prevalence of mental health disorders among nurses in China during the COVID-19 outbreak, found that COVID-19 related stress (such as workload and fear of infection) was associated with higher risk of depression and anxiety. A similar study looking at mental health impact among health workers in a low resource setting (Nepal) during the COVID-19 pandemic also found significant levels of depression, anxiety and insomnia. Nurses showed a higher level of anxiety when compared to other healthcare workers [19]. Furthermore, a survey of 502 healthcare workers in Saudi Arabia during the COVID-19 outbreak similarly showed higher levels of anxiety among the nurses while a study looking at Canadian critical care nurses involved in the early phase of the pandemic also found significant symptoms of post-traumatic stress, depression and anxiety related to taking care of COVID-19 patients [20, 21].

Unfortunately, one year into the pandemic, little is known about the effects of COVID-19 on mental well-being of healthcare workers especially nurses in SSA. Due to the paucity in data and limited resources, including mental health care in sub-Saharan Africa when compared to western countries, we sought to explore the mental wellbeing of nurses taking care of COVID-19 patient at a tertiary healthcare facility in Kenya.

Methods

We carried out a cross sectional survey between August and November, 2020. Email invitations with a link to a voluntary, de-identified survey was sent to all the nurses at the Aga Khan University Hospital, Nairobi (AKUHN). Email reminders were sent out twice a week from REDCap for participation in the survey. The link to the survey could only be used once. Responses from the nurses remained anonymous. Approval for this study was obtained from the Institutional Ethics and Review Committee AKHUN and online survey data was collected through the Research Electronic Data Capture—REDCap platform (Vanderbilt and National Institute of Health) [22].

There was a steady increase in COVID-19 cases from October into November. Kenya recorded the highest number of cases in a single month (~29,000 confirmed cases, ~470 deaths) in November 2020. Based on the 7-day average from John Hopkins University data dashboard, the peak of the first wave occurred in early August whereas the peak of the second wave occurred in mid-November in Kenya [23].

Data collection

The survey questionnaire, in English, consisted of demographic characteristics, job title, experiences providing care to patients with COVID-19, symptoms of depression, anxiety, insomnia, distress and burnout. The mental health symptoms were measured using validated questionnaires that would allow for comparison across different populations: the 9-item Patient Health Questionnaire (PHQ-9) [24], the 7-item Generalized Anxiety Disorder Questionnaire (GAD-7) [25], the 7-item Insomnia Severity Index Questionnaire (ISI) [26], the 22-item Impact of Event Scale–Revised (IES-R) [27] and the 16-item Stanford Professional Fulfillment Index Questionnaire (SPFI) [28]. The cut-off score for detecting symptoms of major depression, anxiety, insomnia, and distress were 10, 7, 15, and 26 respectively [16]. On conclusion of the survey, a score for each mental health disorder was computed and shared with the participant. If the scores indicated a mental health issue such as mild moderate or severe symptoms or any suicidal thoughts, the participants were directed to seek medical

consultation with their primary care provider or the counselling services at the hospital. A hotline was specifically available for all participants with urgent mental health related to the COVID-10 pandemic. In addition, participants were encouraged to contact the principal investigator for any questions or concerns regarding their survey scores or unavailability to access mental health services.

Statistical analysis

Categorical data was presented as frequencies and percentages whereas continuous data was presented as medians with interquartile ranges (IQR). Normality tests were employed using the Shapiro-Wilk test. Kruskal-Wallis test and Fisher's Exact test was utilized to compare the continuous and categorical variables. Logistic regression analysis was performed, and the associations between risk factors and outcomes are presented as odds ratios (ORs) and 95% CIs, after adjustment for confounders, including age, gender, and marital status. Data analysis was performed using SPSS statistical software version 20.0 (IBM Corp). The significance level was set at $\alpha = .05$, and all tests were 2-tailed.

Results

Between August 2020 and November 2020, 255 nurses from AKUHN were invited to participate in the study and 171 (67.1%) consented to complete the survey. The median age of the participants was 33.47 years (IQR: 29.80–35.82). Majority of the nurses were females (70.2%) and married (60.8%). A total of 111 nurses (64.9%) were frontline workers directly engaged in COVID-19 care. Majority of the nurses (64.0%) had cared for about 5–20 patients and 66.7% had lost a patient to COVID-19. Approximately, 60.0% of the nurses reported having enough resources to care for COVID-19 whereas 71.2% reported to have been adequately trained for COVID-19. Only 1.8% had reported a prior history or diagnosis of any mental health disorder.

Depression, anxiety, insomnia, distress, and burnout were reported (mild to severe) in 45.9%, 48.2%, 37.0%, 28.8% and 47.9% of all nurses. Frontline nurses reported experiencing more moderate to severe symptoms of all the mental health disorders than the second line nurses. Moderate to severe; depression among frontline vs second line nurses was 17.3% vs 3.4% ($p = 0.026$); anxiety among frontline vs second line nurses was 11.1% vs 5.1% ($p = 0.681$); insomnia among frontline vs second line nurses was 9.1% vs 0.0% ($p = 0.052$); distress among frontline vs second line nurses was 20.4% vs 11.9% ($p = 0.039$); burnout among frontline vs second line nurses was 56.1% vs 32.8% ($p = 0.005$) (Table 1). Continuous data such as age and the mental health scores were not normally distributed where the p values based on Shapiro-Wilk test was all < 0.05 . The questionnaires demonstrated good internal consistency with a Cronbach alpha of 0.835, 0.837, 0.871, 0.955 and 0.837 for PHQ-9, GAD-7, ISI, IES-R and SPFI respectively.

On comparing the differences between gender and mental health symptoms, females reported experiencing more symptoms of all the mental health disorders than males. However, only burnout was found to be statistically significantly higher in females (female vs male nurses: 53.9% vs 34.0% ($p = 0.027$)) (Table 2).

Multivariate logistic regression analysis showed that after adjustment, working in the frontlines was an independent risk variable for depression and burnout (depression, OR 5.98; 95% CI, 1.31–27.33; $p = 0.021$; burnout: OR, 3.37, 95% CI, 1.63–6.97) (Table 3).

Discussion

To the best of our knowledge, this is the first study of its kind looking at the mental wellbeing of nurses taking care of COVID-19 patient in a tertiary healthcare facility in Kenya. Comparable

Table 1. Comparison of demographic and mental health disorders among the frontline and second line nurses.

	<i>Total</i>	<i>Frontline</i>	<i>Secondline</i>	<i>P value</i>
Age (n = 164) (median [IQR])	33.47 [29.80, 35.32]	33.49 [29.52, 36.09]	33.30 [29.97, 35.81]	0.817
<u>Gender</u>				0.741
Male	50 (29.2%)	34 (30.6%)	16 (26.7%)	
Female	120 (70.2%)	76 (68.5%)	44 (73.3%)	
Prefer not to disclose	1 (0.6%)	1 (0.9%)	0 (0.0%)	
<u>Marital Status</u>				0.506
Single	61 (35.7%)	37 (33.3%)	24 (40.0%)	
Married	104 (60.8%)	69 (62.2%)	35 (58.3%)	
Other	6 (3.5%)	5 (4.5%)	1 (1.7%)	
<u>History of Mental Health Disorder</u>				0.553
Yes	3 (1.8%)	3 (2.7%)	0 (0.0%)	
No	168 (98.2%)	108 (97.3%)	60 (100.0%)	
<u>Depression</u>		(n = 110)	(n = 60)	0.026
None	92 (54.1%)	52 (47.3%)	50 (66.7%)	
Mild	57 (33.5%)	39 (35.5%)	18 (30.0%)	
Moderate	12 (7.1%)	11 (10.0%)	1 (1.7%)	
Severe	9 (5.3%)	8 (7.3%)	1 (1.7%)	
Score	4.00 [2.00, 7.00]	5.00 [2.00, 9.00]	3.00 [1.00, 6.00]	0.009
<u>Anxiety</u>		(n = 109)	(n = 59)	0.681
Minimal	87 (51.8%)	55 (50.5%)	32 (54.2%)	
Mild	66 (39.3%)	42 (38.5%)	24 (40.7%)	
Moderate	12 (7.1%)	9 (8.3%)	3 (5.1%)	
Severe	3 (1.8%)	3 (2.8%)	0 (0.0%)	
Score	4.00 [2.00, 7.00]	4.00 [2.00, 7.00]	4.00 [2.00, 6.00]	0.383
<u>Insomnia</u>		(n = 109)	(n = 59)	0.052
None	106 (63.1%)	69 (63.3%)	37 (62.7%)	
Subthreshold	52 (31.0%)	30 (27.5%)	22 (37.3%)	
Moderate	9 (5.4%)	9 (8.3%)	0 (0.0%)	
Severe	1 (0.6%)	1 (0.9%)	0 (0.0%)	
Score	6.00 [2.00, 9.00]	6.00 [1.00, 9.00]	6.00 [3.00, 9.00]	0.533
<u>Distress</u>		(n = 108)	(n = 59)	0.039
Normal	119 (71.3%)	74 (68.5%)	45 (76.3%)	
Mild	19 (11.4%)	12 (11.1%)	7 (11.9%)	
Moderate	9 (5.4%)	4 (3.7%)	5 (8.5%)	
Severe	20 (12.0%)	18 (16.7%)	2 (3.4%)	
Score	15.00 [6.00, 26.00]	16.00 [5.00, 28.50]	14.00 [7.00, 23.00]	0.501
Avoidance	0.90 [0.30, 1.40]	0.90 [0.30, 1.70]	0.70 [0.30, 1.10]	0.205
Intrusion	0.80 [0.30, 1.30]	0.80 [0.20, 1.30]	0.80 [0.40, 1.30]	0.900
Hyperarousal	0.50 [0.20, 1.00]	0.50 [0.20, 1.20]	0.50 [0.20, 0.80]	0.619
<u>Burnout</u>		(n = 107)	(n = 58)	0.005
≤ 1.33	86 (52.1%)	47 (43.9%)	39 (67.2%)	
> 1.33	79 (47.9%)	60 (56.1%)	19 (32.8%)	
<u>Professional Fulfillment</u>		(n = 107)	(n = 57)	0.298
≤ 3.00	133 (81.1%)	84 (78.5%)	49 (86.0%)	
> 3.00	31 (18.9%)	23 (21.5%)	8 (14.0%)	
<i>Professional Fulfillment</i>	54.17 [41.67, 75.00]	54.17 [37.50, 75.00]	54.17 [45.83, 70.83]	0.967

(Continued)

Table 1. (Continued)

	<i>Total</i>	<i>Frontline</i>	<i>Secondline</i>	<i>P value</i>
<i>Work Exhaustion</i>	50.00 [25.00, 62.50]	50.00 [25.00, 75.00]	37.50 [25.00, 56.25]	0.011
<i>Interpersonal Disengagement</i>	16.67 [0.00, 37.50]	25.00 [0.00, 37.50]	12.50 [0.00, 25.00]	0.027

* N was not the same down the column because variable availability of results.

<https://doi.org/10.1371/journal.pone.0254074.t001>

to other studies, we found over 40% of front-line nurses at our facility who took care of COVID-19 patients suffered from mild to severe depression [14, 29, 30]. Only 1.8% of the participants in our study reported ever having mental health disorders previously. To help put this into perspective, prior to COVID-19, the WHO on world mental health situation placed Kenya as the sixth most depressed country in Africa with a depression rate of 4.4% [31], while a recent study conducted by Nyongesa and colleagues found a prevalence of 13.8% of depressive symptoms in adults living with HIV in rural Kilifi in Kenya [32].

Our study also aligns with a number of other studies showing that front-line nurses, especially females, suffer from poor sleep, depression and anxiety [11, 15, 33, 34]. Furthermore, similar to a study conducted by Huang and colleagues, we also found that females nurse at our

Table 2. Comparison of mental health disorders among the male and female nurses.

	<i>Males</i>	<i>Females</i>	<i>P value</i>
<u>Depression</u>	(n = 50)	(n = 120)	0.323
None	26 (52.0%)	66 (55.0%)	
Mild	21 (42.0%)	36 (30.0%)	
Moderate	2 (4.0%)	10 (8.3%)	
Severe	1 (2.0%)	8 (6.7%)	
<u>Anxiety</u>	(n = 50)	(n = 118)	0.516
Minimal	30 (60.0%)	57 (48.3%)	
Mild	17 (34.0%)	49 (41.5%)	
Moderate	3 (6.0%)	9 (7.6%)	
Severe	0 (0.0%)	3 (2.5%)	
<u>Insomnia</u>	(n = 50)	(n = 118)	0.214
None	37 (74.0%)	69 (58.5%)	
Subthreshold	12 (24.0%)	40 (33.9%)	
Moderate	1 (2.0%)	8 (6.8%)	
Severe	0 (0.0%)	1 (0.8%)	
<u>Distress</u>	(n = 50)	(n = 117)	0.063
Normal	39 (78.0%)	80 (68.4%)	
Mild	8 (16.0%)	11 (9.4%)	
Moderate	1 (2.0%)	8 (6.8%)	
Severe	2 (4.0%)	18 (15.4%)	
<u>Burnout</u>	(n = 50)	(n = 115)	0.027
≤ 1.33	33 (66.0%)	53 (46.1%)	
> 1.33	17 (34.0%)	62 (53.9%)	
<u>Professional Fulfillment</u>	(n = 49)	(n = 115)	0.514
≤ 3.00	38 (77.6%)	95 (82.6%)	
> 3.00	11 (22.4%)	20 (17.4%)	

* N was not the same down the column because variable availability of results.

<https://doi.org/10.1371/journal.pone.0254074.t002>

Table 3. Multivariate logistic regression analysis.

<i>Variable</i>	<i>Adj OR</i>	<i>95% CI</i>	<i>P value</i>
<i>PHQ-9: Depression</i>			
Covid Care: Frontline	5.98	1.31–27.33	0.021
<i>GAD-7: Anxiety</i>			
Covid Care: Frontline	2.20	0.58–8.33	0.247
<i>IES-R: Distress</i>			
Covid Care: Frontline	1.95	0.88–4.32	0.098
<i>SPFI: Burnout</i>			
Covid Care: Frontline	3.37	1.63–6.97	0.001
<i>SPFI: Professional Fulfillment</i>			
Covid Care: Frontline	1.72	0.70–4.22	0.234

* Adjusted for age, gender, and marital status.

Adj OR: adjusted odds ratio, CI: confidence interval.

<https://doi.org/10.1371/journal.pone.0254074.t003>

institution showed higher rates of all mental disorders compared to their male counterparts [15].

Tu and colleagues looked at sleep quality and mood symptoms in front-line nurses in Wuhan, China during the COVID-19 outbreak and found that 60% had poor sleep, 46% suffered depression symptoms and 40% reported anxiety symptoms [11]. Similarly, Zhan and colleagues reported a prevalence of insomnia in 52.8% of the frontline nurses in Wuhan, China during the COVID-19 pandemic [33]. In our study, front-line nurses had higher scores for moderate to severe anxiety and insomnia, but these were not statistically significant when compared to second-line nurses who were not involved in care of COVID-19 patients. Our results could potentially have been affected by the smaller size of our study population as compared to other studies.

Similar to other studies [12, 35–37], we also found that front-line nurse at our institution were more prone to burnout compared to second-line nurses who were not involved in the care of COVID-19 patients. Hu and colleague reported that 50% of nurses in their study reported moderate to high burnout with regards to emotional exhaustion, depersonalization and personal accomplishment [35]. We also found that female nurses at our institution expressed more burnout than their male counterparts. This is not unique to our study as other studies have also shown that female healthcare workers, especially nurses are more prone to psychological disorders, including burnout due to the COVID-19 pandemic [16]. More importantly, burnout in nurses has been linked to an increase in turnover rates which can have major implications in countries with an already fragile healthcare work force and system [38].

Shechter and colleagues in their study looking at a psychological distress among New York healthcare workers during the COVID-19 pandemic found 57% of their participants screened positive for acute stress. In addition, nurses and advanced practice providers had a higher percentage of psychological symptoms compared to attending physicians [39]. In contrast, Liu and colleagues in their study looking at psychological impact of COVID-19 on nurses in China found second line nurses had a higher incidence of distress than frontline nurses [13]. In our study, we found that front-line nurses at our institution had higher rates of distress compared to second-line nurses not involved in the care of COVID-19 patients. However, we did not find any significant association between sociodemographic variable age or marital status and mental well-being of nurses at our facility. This is contrary to what other studies have found and our findings could have been influenced by our study population size.

Our study has several limitations. All the participants were from one institution and this limits the generalization of our findings to other healthcare institutions in Kenya. In addition, psychological outcomes among nurses could certainly have been more pronounced if the study had been conducted in a larger cohort for a longer duration. Thirdly, an online survey is often skewed by a selective population that is technologically familiar with the use of internet and email. Finally, even though our response rate was 67%, response bias may still exist especially if the nurses who did not respond were either too stressed to respond or not stressed at all to respond to the survey.

Conclusion

The current pandemic is weighing heavily on our healthcare workforce. In Kenya, this burden is particularly concerning given the acute shortage of nurses' even prior to the pandemic. As many countries in SSA struggle with limited medical resources and fragile health care systems amidst the COVID-19 pandemic, the mental health burden on all healthcare workers especially in resource-limited settings must be appropriately measured and addressed. Our study sheds light on the mental well-being among nurses in Kenya and similar to other studies reflects on the psychological burden that frontline nurses are encountering during this pandemic. However, further research to understand the long-term effects of COVID-19 on the mental well-being of nurses, especially in sub-Saharan Africa, are warranted. Our study has major implications including the need for cost-effective and easy to implement strategies across the healthcare system to support the mental well-being of healthcare workers especially nurses.

Supporting information

S1 File.
(XLSX)

Author Contributions

Conceptualization: Sayed K. Ali, Zohray Talib.

Data curation: Jasmit Shah.

Formal analysis: Jasmit Shah.

Methodology: Sayed K. Ali, Jasmit Shah.

Software: Jasmit Shah.

Supervision: Sayed K. Ali, Zohray Talib.

Validation: Sayed K. Ali, Jasmit Shah, Zohray Talib.

Visualization: Jasmit Shah.

Writing – original draft: Sayed K. Ali, Jasmit Shah.

Writing – review & editing: Sayed K. Ali, Jasmit Shah, Zohray Talib.

References

1. World Health Organization. WHO Coronavirus Disease (COVID-19) Dashboard [cited 2021 9 Jan]. <https://covid19.who.int/>.
2. World Health Organization. Primary health care systems (PRIMASYS): case study from Kenya, abridged version. 2017.

3. Miseda MH, Were SO, Muriangi CA, Mutuku MP, Mutwiwa SN. The implication of the shortage of health workforce specialist on universal health coverage in Kenya. *Human resources for health*. 2017; 15(1):80. Epub 2017/12/02. <https://doi.org/10.1186/s12960-017-0253-9> PMID: 29191247
4. Kenya Ministry of Health. Kenya Health Workforce Report: The Status of Healthcare Professionals in Kenya, 2015. 2015.
5. Wakaba M, Mbindyo P, Ochieng J, Kiriinya R, Todd J, Waudo A, et al. The public sector nursing workforce in Kenya: a county-level analysis. *Human resources for health*. 2014; 12:6. Epub 2014/01/29. <https://doi.org/10.1186/1478-4491-12-6> PMID: 24467776
6. Kamara S, Walder A, Duncan J, Kabbedijk A, Hughes P, Muana A. Mental health care during the Ebola virus disease outbreak in Sierra Leone. *Bulletin of the World Health Organization*. 2017; 95(12):842–7. Epub 2017/12/05. <https://doi.org/10.2471/BLT.16.190470> PMID: 29200525
7. Waterman S, Hunter ECM, Cole CL, Evans LJ, Greenberg N, Rubin GJ, et al. Training peers to treat Ebola centre workers with anxiety and depression in Sierra Leone. *The International journal of social psychiatry*. 2018; 64(2):156–65. Epub 2018/02/13. <https://doi.org/10.1177/0020764017752021> PMID: 29432085.
8. World Health Organization. Working together for health: The World Health Report 2006. 2006.
9. World Health Organization. The Global Health Observatory [2020]. 30 Dec]. <http://www.who.int/hrh/statistics/hwfstats/>.
10. OECD. OECD Health Indicators, OECD [cited 2021 9 Jan]. <https://data.oecd.org/health.htm>.
11. Tu ZH, He JW, Zhou N. Sleep quality and mood symptoms in conscripted frontline nurse in Wuhan, China during COVID-19 outbreak: A cross-sectional study. *Medicine*. 2020; 99(26):e20769. Epub 2020/06/27. <https://doi.org/10.1097/MD.00000000000020769> PMID: 32590755
12. Sarbooz Hoseinabadi T, Kakhki S, Teimori G, Nayyeri S. Burnout and its influencing factors between frontline nurses and nurses from other wards during the outbreak of Coronavirus Disease –COVID-19 in Iran. *Investigacion y educacion en enfermeria*. 2020; 38(2). Epub 2020/10/14. <https://doi.org/10.17533/udea.iee.v38n2e03> PMID: 33047546.
13. Liu Y, Long Y, Cheng Y, Guo Q, Yang L, Lin Y, et al. Psychological Impact of the COVID-19 Outbreak on Nurses in China: A Nationwide Survey During the Outbreak. *Frontiers in psychiatry*. 2020; 11:598712. Epub 2020/12/29. <https://doi.org/10.3389/fpsy.2020.598712> PMID: 33362609
14. Zheng R, Zhou Y, Fu Y, Xiang Q, Cheng F, Chen H, et al. Prevalence and associated factors of depression and anxiety among nurses during the outbreak of COVID-19 in China: A cross-sectional study. *International journal of nursing studies*. 2020; 114:103809. Epub 2020/11/19. <https://doi.org/10.1016/j.ijnurstu.2020.103809> PMID: 33207297
15. Huang JZ, Han MF, Luo TD, Ren AK, Zhou XP. [Mental health survey of medical staff in a tertiary infectious disease hospital for COVID-19]. *Zhonghua lao dong wei sheng zhi ye bing za zhi = Zhonghua laodong weisheng zhiyebing zazhi = Chinese journal of industrial hygiene and occupational diseases*. 2020; 38(3):192–5. Epub 2020/03/05. <https://doi.org/10.3760/cma.j.cn121094-20200219-00063> PMID: 32131151.
16. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors Associated With Mental Health Outcomes Among Health Care Workers Exposed to Coronavirus Disease 2019. *JAMA network open*. 2020; 3(3):e203976. Epub 2020/03/24. <https://doi.org/10.1001/jamanetworkopen.2020.3976> PMID: 32202646
17. Han L, Wong FKY, She DLM, Li SY, Yang YF, Jiang MY, et al. Anxiety and Depression of Nurses in a North West Province in China During the Period of Novel Coronavirus Pneumonia Outbreak. *Journal of nursing scholarship: an official publication of Sigma Theta Tau International Honor Society of Nursing*. 2020; 52(5):564–73. Epub 2020/07/12. <https://doi.org/10.1111/jnu.12590> PMID: 32652884
18. Xiong H, Yi S, Lin Y. The Psychological Status and Self-Efficacy of Nurses During COVID-19 Outbreak: A Cross-Sectional Survey. *Inquiry: a journal of medical care organization, provision and financing*. 2020; 57:46958020957114. Epub 2020/09/10. <https://doi.org/10.1177/0046958020957114> PMID: 32900271
19. Khanal P, Devkota N, Dahal M, Paudel K, Joshi D. Mental health impacts among health workers during COVID-19 in a low resource setting: a cross-sectional survey from Nepal. *Globalization and health*. 2020; 16(1):89. Epub 2020/09/27. <https://doi.org/10.1186/s12992-020-00621-z> PMID: 32977818
20. AlAteeq DA, AlJhani S, Althiyabi I, Majzoub S. Mental health among healthcare providers during coronavirus disease (COVID-19) outbreak in Saudi Arabia. *Journal of infection and public health*. 2020; 13(10):1432–7. Epub 2020/09/17. <https://doi.org/10.1016/j.jiph.2020.08.013> PMID: 32933881
21. Crowe S, Howard AF, Vanderspank-Wright B, Gillis P, McLeod F, Penner C, et al. The effect of COVID-19 pandemic on the mental health of Canadian critical care nurses providing patient care during the early phase pandemic: A mixed method study. *Intensive & critical care nursing*. 2021; 63:102999. Epub 2020/12/22. <https://doi.org/10.1016/j.iccn.2020.102999> PMID: 33342649

22. Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: Building an international community of software platform partners. *Journal of biomedical informatics*. 2019; 95:103208. Epub 2019/05/13. <https://doi.org/10.1016/j.jbi.2019.103208> PMID: 31078660
23. Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time. *The Lancet Infectious diseases*. 2020; 20(5):533–4. Epub 2020/02/23. [https://doi.org/10.1016/S1473-3099\(20\)30120-1](https://doi.org/10.1016/S1473-3099(20)30120-1) PMID: 32087114
24. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *Journal of general internal medicine*. 2001; 16(9):606–13. Epub 2001/09/15. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x> PMID: 11556941
25. Spitzer RL, Kroenke K, Williams JB, Löwe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine*. 2006; 166(10):1092–7. Epub 2006/05/24. <https://doi.org/10.1001/archinte.166.10.1092> PMID: 16717171.
26. Morin CM, Belleville G, Bélanger L, Ivers H. The Insomnia Severity Index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep*. 2011; 34(5):601–8. Epub 2011/05/03. <https://doi.org/10.1093/sleep/34.5.601> PMID: 21532953
27. Motlagh H. Impact of Event Scale-revised. *Journal of physiotherapy*. 2010; 56(3):203. Epub 2010/08/28. [https://doi.org/10.1016/s1836-9553\(10\)70029-1](https://doi.org/10.1016/s1836-9553(10)70029-1) PMID: 20795930.
28. Trockel M, Bohman B, Lesure E, Hamidi MS, Welle D, Roberts L, et al. A Brief Instrument to Assess Both Burnout and Professional Fulfillment in Physicians: Reliability and Validity, Including Correlation with Self-Reported Medical Errors, in a Sample of Resident and Practicing Physicians. *Academic psychiatry: the journal of the American Association of Directors of Psychiatric Residency Training and the Association for Academic Psychiatry*. 2018; 42(1):11–24. Epub 2017/12/03. <https://doi.org/10.1007/s40596-017-0849-3> PMID: 29196982
29. Xing LQ, Xu ML, Sun J, Wang QX, Ge DD, Jiang MM, et al. Anxiety and depression in frontline health care workers during the outbreak of Covid-19. *The International journal of social psychiatry*. 2020;20764020968119. Epub 2020/10/27. <https://doi.org/10.1177/0020764020968119> PMID: 33100114.
30. An Y, Yang Y, Wang A, Li Y, Zhang Q, Cheung T, et al. Prevalence of depression and its impact on quality of life among frontline nurses in emergency departments during the COVID-19 outbreak. *Journal of affective disorders*. 2020; 276:312–5. Epub 2020/09/03. <https://doi.org/10.1016/j.jad.2020.06.047> PMID: 32871661
31. World Health Organization. Depression and Other Common Mental Disorders: Global Health Estimates. 2017.
32. Nyongesa MK, Mwangi P, Wanjala SW, Mutua AM, Newton C, Abubakar A. Prevalence and correlates of depressive symptoms among adults living with HIV in rural Kilifi, Kenya. *BMC psychiatry*. 2019; 19(1):333. Epub 2019/11/05. <https://doi.org/10.1186/s12888-019-2339-5> PMID: 31675938
33. Zhan Y, Liu Y, Liu H, Li M, Shen Y, Gui L, et al. Factors associated with insomnia among Chinese frontline nurses fighting against COVID-19 in Wuhan: A cross-sectional survey. *Journal of nursing management*. 2020; 28(7):1525–35. Epub 2020/07/14. <https://doi.org/10.1111/jonm.13094> PMID: 32657449
34. Labrague LJ, De Los Santos JAA. COVID-19 anxiety among front-line nurses: Predictive role of organizational support, personal resilience and social support. *Journal of nursing management*. 2020; 28(7):1653–61. Epub 2020/08/10. <https://doi.org/10.1111/jonm.13121> PMID: 32770780
35. Hu D, Kong Y, Li W, Han Q, Zhang X, Zhu LX, et al. Frontline nurses' burnout, anxiety, depression, and fear statuses and their associated factors during the COVID-19 outbreak in Wuhan, China: A large-scale cross-sectional study. *EClinicalMedicine*. 2020; 24:100424. Epub 2020/08/09. <https://doi.org/10.1016/j.eclinm.2020.100424> PMID: 32766539
36. Wu Y, Wang J, Luo C, Hu S, Lin X, Anderson AE, et al. A Comparison of Burnout Frequency Among Oncology Physicians and Nurses Working on the Frontline and Usual Wards During the COVID-19 Epidemic in Wuhan, China. *Journal of pain and symptom management*. 2020; 60(1):e60–e5. Epub 2020/04/14. <https://doi.org/10.1016/j.jpainsymman.2020.04.008> PMID: 32283221
37. Zhang Y, Wang C, Pan W, Zheng J, Gao J, Huang X, et al. Stress, Burnout, and Coping Strategies of Frontline Nurses During the COVID-19 Epidemic in Wuhan and Shanghai, China. *Frontiers in psychiatry*. 2020; 11:565520. Epub 2020/11/17. <https://doi.org/10.3389/fpsy.2020.565520> PMID: 33192686
38. Kelly LA, Gee PM, Butler RJ. Impact of nurse burnout on organizational and position turnover. *Nursing outlook*. 2021; 69(1):96–102. Epub 2020/10/08. <https://doi.org/10.1016/j.outlook.2020.06.008> PMID: 33023759
39. Shechter A, Diaz F, Moise N, Anstey DE, Ye S, Agarwal S, et al. Psychological distress, coping behaviors, and preferences for support among New York healthcare workers during the COVID-19 pandemic. *General hospital psychiatry*. 2020; 66:1–8. Epub 2020/06/27. <https://doi.org/10.1016/j.genhosppsy.2020.06.007> PMID: 32590254.