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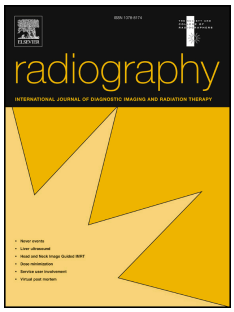

Impact of the COVID-19 pandemic on clinical radiography practice in low resource settings: The Ghanaian Radiographers' Perspective

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Impact of the COVID-19 pandemic on clinical radiography practice in low resource settings: The Ghanaian Radiographers' Perspective

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Abstract

Introduction

The COVID-19 pandemic has altered the professional practice of all healthcare workers, including radiographers. In the pandemic, clinical practice of radiographers was centred mostly on chest imaging of COVID-19 patients and radiotherapy treatment care delivery to those with cancer. This study aimed to assess the radiographers' perspective on the impact of the pandemic on their wellbeing and imaging service delivery in Ghana.

Methods

A cross-sectional survey of practising radiographers in Ghana was conducted online from March 26th to May 6th, 2020. A previously validated questionnaire that sought information regarding demographics, general perspectives on personal and professional impact of the pandemic was used as the research instrument. Data obtained was analysed using Microsoft Excel® 2016.

Results

A response rate of 57.3% (134/234) was obtained. Of the respondents, 75.4% (n=101) reported to have started experiencing high levels of workplace-related stress after the outbreak. Three-quarters (n=98, 73.1%) of respondents reported limited access to any form of psychosocial support systems at work during the study period. Half (n=67, 50%) of the respondents reported a decline in general workload during the study period while only a minority (n=18, 13.4%) reported an increase in workload due to COVID-19 cases.

Conclusion

This national survey indicated that majority of the workforce started experiencing coronavirus-specific workplace-related stress after the outbreak. Albeit speculative, low patient confidence and fear of contracting the COVID-19 infection on hospital attendance contributed to the decline in general workload during the study period.

Implications for practice

In order to mitigate the burden of workplace-related stress on frontline workers, including radiographers, and in keeping to standard practices for staff mental wellbeing and patient safety, institutional support structures are necessary in similar future pandemics.

Introduction

On 31st December 2019, the World Health Organisation (WHO) was informed of cases of pneumonia of unknown cause, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), later known as COVID-19, detected in Wuhan City in China[1,2]. The WHO declared the outbreak as a global health emergency on January 30th, 2020 and subsequently, a global pandemic on March 11th, 2020[2]. As at 31st August 2020, there were 25,259,201 cases and 847,107 deaths reported worldwide according to the COVID-19 Dashboard by the Centre for Systems Science and Engineering at Johns Hopkins University[3]. The first two cases relating to the COVID-19 pandemic were confirmed in Ghana on 13th March 2020[4] and has since recorded 44,205 confirmed cases and 276 related deaths as at 31st August 2020[3,4]. See Figure 1 for the regional distribution of the reported COVID-19 cases across Ghana as of 31st August 2020.

Ghana is a democratically stable developing country in West Africa with a population of about 30 million[5,6], however, the medical system is heavily centred in the major cities including Accra (the capital) and Kumasi, in the centre of the country. Most of the other regions of the country are faced with limited medical resources including diagnostic medical imaging equipment and infrastructure[5]. However, in line with international guidelines[7,8], chest imaging is key in the diagnosis and management of COVID-19 in Ghana. Evidence of pulmonary involvement in the pathogenesis of the COVID-19 infection can be detected on both chest X-ray (CXR) and computed tomography (CT), typically, as multifocal, bilateral, peripheral ground-glass opacities and crazy paving consolidations[9,10]. These pulmonary findings have also been widely reported in asymptomatic/presymptomatic patients[11-13]. Of note, incidental findings suggestive of COVID-19 were previously reported in some asymptomatic patients[11-13]. In the pandemic, radiographers have been regularly involved in the acquisition of these CXR or CT scans and sometimes image reporting as part of the care of patients with known or suspected COVID-19. Thus, they are a part of the multidisciplinary patient-facing staff in the management of COVID-19 patients. The recently released multinational consensus statement from the Fleischner Society also highlighted the essential role of chest imaging for the management of COVID-19 patients including diagnosis and monitoring of the disease and triaging of severely ill patients for appropriate treatment pathways[13]. Furthermore, radiographers were involved in other diagnostic and radiotherapeutic work, including imaging patients with emergency conditions such as trauma or daily radiotherapy treatment delivery.

Despite limited medical resources[5], all routine clinical imaging work, including non-urgent care such as elective screening continued during the pandemic in Ghana. In other settings, for example in the

United Kingdom (UK), all screening programmes were temporarily paused[14,15] and resources re-assigned to departments anticipated to experience extreme pressure. Of note, the pandemic response adopted in radiology departments elsewhere included repurposing and streamlined coordination of resources to enhance flow of workload and minimise infection risk[16-19]. The pandemic has potentially altered the working patterns and professional practice of radiographers significantly including those in relatively low resource settings like Ghana. Our findings from the recent radiography workforce survey in the UK demonstrated that these changes to clinical practice during the pandemic contributed to workplace-related stress[20]. It is therefore important to understand whether the impact of COVID-19 pandemic on radiography practice (including imaging services and radiographer wellbeing) in relatively low resource settings like Ghana has followed that of the UK and other developed countries to guide in the development of education and training resources for radiographers in preparation for similar future pandemics.

Methods

This work is a part of the international study [COVID-19 Response in Radiology (CORIRA)], aimed at assessing the global impact of the COVID-19 pandemic on radiology workforce and practice. This arm of the study aimed to assess the perceptions of the clinical radiography workforce on the COVID-19 pandemic in Ghana. A cross-sectional survey of radiographers practising in Ghana was conducted online, over a six-week period (March 26th to May 6th, 2020). At the time of the study, the Allied Health Professions Councils' (AHPC) database indicated a population of 234 registered radiographers in Ghana. Of note, some radiographers who were not registered with the AHPC were engaged in practice temporarily and were considered eligible for this study. Special and/or limited registration provisions were made available for healthcare professionals who were practising before the inception of the AHPC and others who were unable to renew their registrations in the past because of special circumstances[33] during the period. Although not clearly stated, this registration provisions are efforts to mitigate the effects of the anticipated reduction in workforce and the expected surge in COVID-19 related workload.

The professional body of radiographers [Ghana Society of Radiographers (GSR)] promoted the study among its members with weekly reminders on social media platforms by the researchers. In addition, a network of colleagues' personal contacts was also employed to promote the survey to maximise response. Our previously validated questionnaire[20] (Appendix 1) was adapted for this study to obtain information relating to basic demographics, general perspectives on the personal and professional impact of the pandemic. The survey was hosted online using Google forms (Google, Mountain View, CA) and GSR members were mainly reached via the official social media platforms.

The online survey was piloted among four radiographers from the Korle-Bu Teaching Hospital in Accra to ensure the questionnaire was explicit and clear.

Ethical approval for the study was obtained from the Bournemouth University Research Ethics Committee (ID: 31818). Prior to participation, electronic informed consent was obtained from all respondents. Due to the nature of the questionnaire which specifically asked about stress/anxiety relating to the coronavirus pandemic and other concerns, a link was provided on completion of the questionnaire to a support page, which encouraged participants to engage with a self-help survival guide[21] developed by a certified clinical psychologist. Data from the survey was downloaded from Google Forms into Microsoft Excel 2016 (Microsoft Inc, Redmond, WA) for analyses.

Results

A response rate of 57.3% (134/234) was obtained for this study. Apart from five radiographers who had not registered with the regulatory body, the rest were registered professionals at the time of the study. The age of the respondents ranged from 18-59 years with the 30-39 year group forming the majority (n=69, 51.5%). Male respondents were also in the majority (n=91, 76.9%). The respondents worked in private, public and quasi-government institutions, however, most (n= 44, 33.8%) were affiliated to facilities classified to be in the public-urban setting. Almost all (n=126, 94.0%) of the respondents were registered diagnostic radiographers with a few (n= 2, 1.5%) registered sonographers and a registered therapeutic radiographer. Half of the respondents worked in the Greater Accra region of Ghana (Table 1).

Figure 2 presents the medical imaging/therapy modalities available and their usage by the respondents at their workplaces during the study period. Most respondents were using general X-ray (n=125, 93.3%), CT (n=63, 47.0%) and ultrasound equipment (n=44, 32.8%) during the study period. The general perspectives of the respondents in relation to the COVID-19 pandemic are presented in Table 2. Briefly, most of the respondents (n=93, 69.4%) strongly agreed that radiographers were a part of the major frontline healthcare management team in response to the pandemic. Similarly, most of the radiographers (n=83, 61.9%) had a great understanding of how the virus is transmitted. Figure 3 presents the responses on modalities mostly used at various facilities as well as those used for the management of COVID-19 patients. Of the respondents, only 9.7% (n=13) were redeployed to use other imaging modalities during the study period. Figure 3 show that the majority (n=90, 73.1%) of the respondents have not had any training specifically to prepare them for handling COVID-19 patients during the outbreak. Participants' responses about the impact of COVID-19 pandemic on their work and family is presented in Table 3. Of the respondents, 41.8% (n=56) indicated that they have always or sometimes (n=45, 33.6%) felt stressed about work after the

COVID-19 outbreak. In relation to workplace-related stressors during the pandemic, nearly half of respondents (n= 45, 44.6%) identified fear of contracting the infection as the major stressor during the study period (Figure 4).

Discussions

This study provides an insight into the perspective of radiographers on the impact of the COVID-19 pandemic on clinical radiography practice in Ghana. Imaging, particularly, CXR and CT remained a core diagnostic and management tool for COVID-19 in Ghana, in line with international guidelines[7,22]. The current study showed that the primary imaging protocol during the study period was the use of CXR as the initial tool of assessment and CT in severely ill patients for triaging and follow-up investigations. Thus, it is likely that almost all COVID-19 patients have had at least a CXR as part of their clinical management, as diagnostic chest imaging remains a high priority in the clinical work-up of all suspected COVID-19 patients[7,22]. In the pandemic, there has been continuous issuance of coronavirus-specific recommendations by various health authorities and professional bodies for safe clinical imaging and management of radiology departments[34]. These recommendations mostly relate to the clinical practice conditions/environments pertaining to high-income countries, with assumptions, such as adequate imaging resource availability worldwide. Despite the numerous recommendations, some respondents (n=16, 11.9%) of the current study indicated that their departments had no specific imaging protocols in place for the management of COVID-19 cases at the time of the study.

Radiographers are the key patient-facing staff involved in radiotherapy treatment delivery, diagnostic image acquisition and its preliminary clinical evaluation, with others involved in the diagnostic reporting of these images[18, 32] as part of their advanced practice roles[5,38]. In the pandemic, most of their work was focused on chest imaging. They were also involved in other diagnostic and radiotherapeutic work, including imaging patients with emergency conditions such as trauma or daily radiotherapy treatment delivery. Our findings indicate that most respondents (n=124, 92.5%) agreed they were considered as a part of the key frontline personnel in recognition of the essential roles in the management of patients during the pandemic. This has been highlighted in the recent multinational consensus statement from the Fleischner Society[13] to indicate that the radiographer is indeed a part of the essential frontline response workforce in the management of COVID-19 patients.

The study also demonstrate an increase in workload relating to COVID-19 among a minority (n=18, 13.4%) of respondents (mostly in the Greater Accra and Ashanti Regions) with half (n=67, 50%) of respondents reporting a decline in general workload. This finding is in line with the regional distribution of the COVID-19 case intensities across the country (Figure 1). The reported decline in general workload is consistent with other similar reports[20,23] from North America and Europe and could be due, partly to adherence to guidelines from elsewhere[14,15] by some facilities in Ghana on the need to minimise non-urgent imaging. Albeit speculative, low patient confidence and fear of contracting the infection on hospital attendance has also contributed to non-COVID workload decline during the study period. In anticipation of an increase in COVID-19 cases and management of routine clinical imaging workload, 9.7% (n=13) of respondents were redeployed or re-assigned to other imaging modalities during the study period.

Interestingly, majority of respondents (n=90, 73.1%) contend they were not given any prior training on how to specifically manage COVID-19 cases as patient-facing healthcare professionals in the preparatory phase of the campaign against the pandemic. However, only 54.5% (n=73) respondents felt their previously acquired knowledge on infection control was adequate in helping with the fight against the global pandemic. This finding broadly disagrees with other studies[24-26] that reported a higher (approximately 80%) understanding of infection control, prevention and compliance among healthcare workers. This potentially implies that more focus on infection control is required through maintenance of specialised continuous professional development (CPD) activities among radiographers practising in Ghana. Furthermore, a significant number of respondents (44.8%) perceived the availability of personal protective equipment (PPE) to aid their clinical practice during the study period as inadequate in line with other studies conducted in the UK[20,27,28]. During the initial stages of the pandemic, shortage of PPE amongst healthcare workers seemed like a global phenomenon due to the high demands. The Government of Ghana resorted to local production and distribution of PPEs to various healthcare facilities[29] to mitigate the level of shortage. Whilst this has improved availability, the respondents indicated that this was a major source of worry, demotivation and a key contributor to stress during the period as they felt exposed to relatively high risk for the infection. A recent report[37] demonstrates that compared to the general population, frontline healthcare workers were at an increased risk for reporting a positive COVID-19 test partly due to PPE inadequacy. Furthermore, perceived PPE inadequacy has also been reported as a contributor to low morale amongst healthcare personnel working during this pandemic[28].

The process of image acquisition requires radiographers coming into close proximity with patients, exposing them to an alarming risk for the infection considering the high infectivity of the disease especially through personal contact[1,2]. Although, this study did not explore reasons why a significant number of radiographers were not given adequate training in handling COVID-19 patients within the study period, it is acknowledged that such training and adequate protection with PPE is critical for radiographers and other healthcare professionals in readiness for similar future pandemics. Several experiences from various countries have been outlined in technical notes[16-19] advocating for stricter infection control in the management of suspected or confirmed COVID-19 patients within radiology departments, including strict adherence to PPE protocols[35,37]. Although strict adherence to these protocols are thought to increase examination times per patient and workload and/or stress[20,35], they are fundamental for keeping both patients and the workforce safe.

Despite the relatively decreased workload, majority of the respondents (n=101, 75.4%) reported to have started experiencing high levels of workplace-related stress after the outbreak. This finding agrees with a report by Rana and colleagues[30] of an increased risk of mental health problems during the current pandemic among frontline healthcare personnel. Some of the main workplace-related stressors identified from the study included fear of contracting the virus, perceived inadequacy of PPEs and the relatively weak response from authorities to concerns relating to staff testing. The pool effect of all these stressors potentially contributed to the reported workplace-related stress during the study period. A significant proportion of participants (n=54, 40.3%) felt they needed professional help in dealing with this workplace-related stress. However, 73.1% (n=98) of respondents do not have access to any form of psychosocial/mental health support systems at the workplace during the study period. Xiang et al advocated for regular evaluation of the mental health and general wellbeing of all frontline healthcare personnel especially during pandemics[31]. Furthermore, 57.4% (n=77) of respondents agreed that the workplace-related stress that they experience due to the pandemic affected their family and friends. This is consistent to the findings of another recent study[36] from South Africa that reported the negative impact of the pandemic on diagnostic radiography staff wellbeing and changes to their home and family dynamics. Thus, in order to mitigate the burden of workplace-related stress on frontline workers, including radiographers, and in keeping to standard practices for staff mental wellbeing, institutional support structures are necessary.

To the best of our knowledge, this is the first single and largest survey that comprehensively assessed the impact of COVID-19 on clinical radiography practice in relation to changes in service

delivery and wellbeing of radiographers recruited in Ghana over a relatively long period during the pandemic. However, the study is limited by the nature of the geographical spread of the workforce and the very poor response from some regions and particularly the radiotherapy wing of the respondents. Of note, there are already very few radiotherapists in Ghana with only three centres across the country. We acknowledge the limitations associated with the use of a subjective stress rating scale and our inability to quantify the actual changes in procedural volumes of the various imaging modalities over the survey period. It is further acknowledged that future studies would benefit from both the use of a standardised stress assessment tool and acquisition of data relating to the actual procedural volume changes.

Conclusions

In the pandemic, health regulating authorities and professional bodies around the world are continuously issuing guidelines for staff protection and patient management within radiology departments. These guidelines mostly relate to the conditions pertaining to high income countries with assumptions such as prior adequate staff COVID-19 patient management training, availability of dedicated mobile radiography units, ability to reserve one of many CT scanners only for COVID-19 cases and supply of a whole range of PPEs etc. However, at the time of the study, there have been limited training and perceived inadequate availability of resources (including PPEs), consequently resulting in elevated levels of workplace-related stress among the clinical radiography workforce in Ghana, despite relative decline in general workload.

This study has highlighted the critical need for a region-specific guidance/recommendation in relation to global pandemics for safe and easy implementation, especially in low-resource settings. We envisage that our findings – the perspectives of radiographers working in Ghana – would be similar to the experiences of radiographers from other low- and middle-income countries, especially in Africa, considering the similar COVID-19 case distributions and the relatively similar imaging resource availability across the continent at the time of the study.

In conclusion, this national survey highlighted changes to radiography practice, in terms of imaging service delivery and staff wellbeing, due to the COVID-19 pandemic in a relatively low resource setting from the perspective of radiographers practising in Ghana during the study period. It is therefore critical for radiology departments to recognise the need to protect all staff, including the radiography workforce, to ensure patient safety by providing adequate training, appropriate PPE and strengthen institutional structures for the management of workplace-related stress and anxiety in similar future pandemics.

References

1. World Health Organization: Pneumonia of unknown cause: China. 2020. [updated 2020 Jan 5; cited 2020 April 20]. Available from: www.who.int/csr/don/05-january-2020-pneumonia-of-unkown-cause-china/en/

2. World Health Organization: Coronavirus disease (COVID-19) technical guidance: The Unity Studies: Early investigations. 2020. [updated 2020 May 5; cited 2020 April 20]. Available from: www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/early-investigations

3. Coronavirus Resource Centre. COVID-19 Dashboard by the Centre for Systems Science and Engineering at Johns Hopkins University. 2020. [updated 2020 June 10; cited 2020 Aug 31]. Available from: https://coronavirus.jhu.edu/map.html

4. Ghana Health Service. Regional Distribution of COVID-19 cases. 2020. [updated 2020 June 10; cited 2020 Aug 31]. Available from: https://ghanahealthservice.org/covid19/

5. Wuni, A.-R. et al. 2019. Opportunities for radiographer reporting in Ghana and the potential for improved patient care. Radiography, Volume 26, Issue 2, e120 - e125

6. DAC List of ODA Recipients - Effective for reporting on 2018, 2019 and 2020 flows [updated 2020 April 13; cited 2020 June 19]. Available from: https://www.oecd.org/dac/financing-sustainable-development/development-finance-standards/DAC_List_ODA_Recipients2018to2020_flows_En.pdf

7. Nair A, Rodrigues JC, Hare S, Edey A, Devaraj A, Jacob J, Johnstone A, McStay R, Denton E, Robinson G. A British Society of Thoracic Imaging statement: considerations in designing local imaging diagnostic algorithms for the COVID-19 pandemic. *Clinical Radiology*. 2020; 75 (5): p.329-34.

8. World Health Organization. COVID-19 technical guidance: Infection prevention and control/WASH. 2020. [updated 2020 May 15; cited 2020 April 20]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/infection-prevention-and-control

9. Bernheim A, Mei X, Huang M, Yang Y, Fayad ZA, Zhang N, Diao K, Lin B, Zhu X, Li K, Li S. Chest CT findings in coronavirus disease-19 (COVID-19): relationship to duration of infection. *Radiology*; 2020, p.200463.

10. Poyiadji N, Shahin G, Noujaim D, Stone M, Patel S, Griffith B. COVID-19–associated acute hemorrhagic necrotising encephalopathy: CT and MRI features. *Radiology*. 2020, p.201187.

11. Zhao H, Shen D, Zhou H, Liu J, Chen S. Guillain-Barré syndrome associated with SARS-CoV-2 infection: causality or coincidence? *The Lancet Neurology*. 2020; 19 (5): p.383-4.

12. Inciardi RM, Lupi L, Zaccone G, Italia L, Raffo M, Tomasoni D, Cani DS, Cerini M, Farina D, Gavazzi E, Maroldi R. Cardiac involvement in a patient with coronavirus disease 2019 (COVID-19). *JAMA cardiology*. 2020.

13. Rubin GD, Ryerson CJ, Haramati LB, Sverzellati N, Kanne JP, Raoof S, Schluger NW, Volpi A, Yim JJ, Martin IB, Anderson DJ. The role of chest imaging in patient management during the COVID-19 pandemic: a multinational consensus statement from the Fleischner Society. Chest. 2020.

14. Scottish Government 2020. Health screening programmes paused. [updated 2020 March 30; cited 2020 April 25]. Available from: https://www.gov.scot/news/health-screening-programmes-paused/

15. Department of Health 2020. Temporary pause of routine screening programmes. [updated 2020 April 7; cited 2020 April 25]. Available from: https://www.health-ni.gov.uk/news/temporary-pause-routine-screening-programmes

16. Stogiannos N, Fotopoulos D, Woznitza N, Malamateniou C. COVID-19 in the radiology department: What radiographers need to know [published online ahead of print, 2020 Jun 4]. Radiography (Lond). 2020;S1078-8174(20)30084-5.

17. Mossa-Basha M, Medverd J, Linnau K, Lynch JB, Wener MH, Kicska G, Staiger T, Sahani D. Policies and Guidelines for COVID-19 Preparedness: Experiences from the University of Washington. Radiology 2020. 0 0:0

18. Zanardo M, Monti CB, Cattaneo F, Ciaralli C, Cornacchione P, Durante S. Management of patients with suspected or confirmed COVID-19, in the radiology department. Radiography. 2020.

19. Tsou IYY, Liew CJY, Tan BP, Chou H, Wong SBS, Loke KSH, Quah RCW, Tan AGS, Tay KH. Planning and coordination of the radiological response to the coronavirus disease 2019 (COVID-19) pandemic: the Singapore experience. Clinical Radiology, Volume 75, Issue 6, 415 – 422

20. Akudjedu TN, Lawal O, Sharma M, Elliott J, Stewart S, Gilleece T, et al. Impact of the COVID-19 pandemic on radiography practice: findings from a UK radiography workforce survey. BJR Open 2020; 2: 20200023.

21. Cooper, J. Corona-Anxiety your self-help survival guide. 2020. Available from: https://www.gcu.ac.uk/media/documents/Corona-Anxiety-GCU.pdf

22. British Thoracic Society 2020. *COVID-19: Information for The Respiratory Community; Better Lung Health for All*. [online] [updated 2020 April 21; cited 2020 May 15]. Available from: https://brit-thoracic.org.uk/about-us/covid-19-information-for-therespiratory-community/

23. AuntMinnie.com. Pandemic paralysis: COVID-19 has major impact on imaging. 2020. [updated 2020 May 1; cited 2020 April 20]. Available from: https://www.auntminnie.com/index.aspx?sec=nws&sub=rad&pag=dis&ItemID=128865

24. Desta M, Ayenew T, Sitotaw N, Tegegne N, Dires M, Getie M. Knowledge, practice and associated factors of infection prevention among healthcare workers in Debre Markos referral hospital, Northwest Ethiopia. *BMC health services research*. 2018; 18 (1): p.465.

25. Adegboye MB, Zakari S, Ahmed BA, Olufemi GH. Knowledge, awareness and practice of infection control by health care workers in the intensive care units of a tertiary hospital in Nigeria. *African health sciences*. 2018; 18 (1):72-8.

26. Stein AD, Makarawo TP, Ahmad MF. A survey of doctors' and nurses' knowledge, attitudes and compliance with infection control guidelines in Birmingham teaching hospitals. *Journal of Hospital infection*. 2003; 54 (1): p.68-73.

27. The British Institute of Radiology. British Institute of Radiology online survey of imaging and oncology professionals. 2020. Retrieved from https://www.bir.org.uk/media/425533/covid-19_-_survey-_imaging__oncology_professionals_may_2020.pdf

28. Action Radiotherapy. Impact of COVID-19 on UK Radiotherapy. 2020. Retrieved from https://ebf9be9c-890d-4dca-b67e-2c40c584e614.filesusr.com/ugd/b68571_5a27d1bd9d434ebb898facc3199de2e8.pdf

29. Africa Global Radio. Local companies make progress in PPE production for COVID-19 fight [updated 2020 April 13; cited 2020 June 19]. Available from: https://www.africaglobalradio.com/local-companies-make-progress-in-ppe-production-for-covid-19-fight/

30. Rana, W., Mukhtar, S. and Mukhtar, S., 2020. Mental health of medical workers in Pakistan during the pandemic COVID-19 outbreak. *Asian journal of psychiatry*, *51*, p.102080.

31. Xiang, Y.-T., Yang, Y., Li, W., Zhang, L., Zhang, Q., Cheung, T., Ng, C.H., 2020. Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. Lancet Psychiatry.

32. Woznitza, N. et al. 2020. COVID-19: A case series to support radiographer preliminary clinical evaluation. Radiography, Volume 26, Issue 3, e186 - e188

33. Allied Health Professions Council (AHPC). 2020. Special registration and limited pin renewal extension of deadline. [updated 2020 Aug 28; cited 2020 Sept 1]. Available from: http://ahpc.gov.gh/special-registration-and-limited-pin-renewal-extension-of-deadline/

34. Mendel JB. COVID-19 pandemic and radiology: facts, resources, and suggestions for near-term protocols. J Glob Radiol. 2020;6(1):1100.

35. Elshami W, Akudjedu TN, Abuzaid M, David LR, Tekin HO, Cavli B, Issa B, The radiology workforce's response to the COVID-19 pandemic in the Middle East, North Africa and India, Radiography, https://doi.org/10.1016/j.radi.2020.09.016.

36. Lewis S, Mulla F, Diagnostic radiographers' experience of COVID-19, gauteng south africa, Radiography, https://doi.org/10.1016/j.radi.2020.09.009.

37. Nguyen, Long HAlbert, Christine M. et al. Risk of COVID-19 among front-line health-care workers and the general community: a prospective cohort study. The Lancet Public Health, Volume 5, Issue 9, e475 - e483

38. Field LJ, Snaith BA. Developing radiographer roles in the context of advanced and consultant practice. *J Med Radiat Sci*. 2013;60(1):11-15. doi:10.1002/jmrs.2

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Tables

Table 1: Demographic distribution of participants

Variables	Head Count (*n*)	Percent, %
Age group (yrs)		
18 - 29	36	26.9
30 - 39	69	51.5
40 - 49	24	17.9
50 – 59	5	3.7
Gender		
Male	91	67.9
Female	43	32.1
Work setting		
Public: Community clinic	7	5.2
Public: Rural/ District	27	20.1
Public: Urban	44	32.8
Public: University/ Academic	21	15.7
Private Facility	34	25.4
Quasi-Government	1	0.8
Registration status with the regulatory body		
Registered Diagnostic Radiographer	126	94.0
Registered Therapeutic Radiographer	1	0.8
Registered Sonographer	2	1.5
Currently not registered	5	3.7
Geographical distribution/region of participants		
Ahafo	1	0.8
Western North	2	1.5
Western	8	6.0
Volta	8	6.0
Upper West	1	0.8
Upper East	1	0.8
Savannah	1	0.8
Oti	2	1.5
Northern	3	2.2
Greater Accra	67	50.0
Eastern	7	5.2
Central	9	6.7
Bono East	2	1.5
Bono	4	3.0
Ashanti	18	13.4
North East	0	0.0

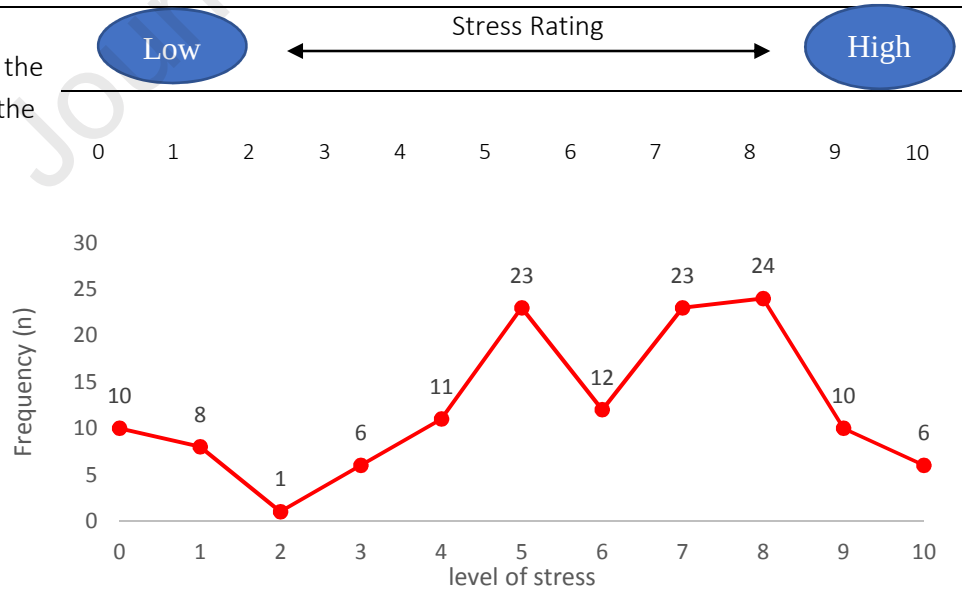
*Note: Percentages may not total 100 due to rounding

Table 2: Respondents' General Perspectives on COVID-19

Statement/Question	Response				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Radiographers are a part of the major frontline healthcare management team in response to COVID-19.	93(69.4%)	31(23.1%)	5(3.7%)	4(3.0%)	1(0.8%)
My personal radiation exposure has changed as imaging protocols have changed after COVID-19 outbreak.	13(9.7%)	30(22.4%)	53(39.6%)	23(17.2%)	15(11.2%)
I have a great understanding of how the COVID-19 virus is transmitted.	83(61.9%)	48(35.8%)	1(0.8%)	2(1.5%)	0 (0.0%)
My understanding of the principles of infection prevention and control as a radiographer is adequate to deal with the COVID-19 outbreak.	17(12.7%)	56(41.8%)	6(4.5%)	12(9.0%)	43(32.1%)
My facility has made available adequate personal protective equipment (PPE) for work during the COVID-19 outbreak.	12(9.0%)	39(29.1%)	23(17.2%)	33(28.4%)	22(16.4%)
Which of the following best describes your workload pattern after the COVID-19 outbreak in Ghana?	Response				
	Increasing	Decreasing	Not changed	Irregular	
	18(13.4%)	67(50.0%)	27(20.1%)	22(16.4%)	

*Note: Percentages may not total 100 due to rounding

Table 3: Impact of COVID-19 pandemic on participants.

Statement/Question	Response				
	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I feel I may be in need of professional help to deal with stress during the COVID-19 outbreak.	12(9.0%)	42(31.3%)	41(30.6%)	26(19.4%)	13(9.7%)
My family/partner/friends are being significantly affected by this recent work-related stress.	14(10.4%)	63(47.0%)	27(20.1%)	22(16.4%)	8(6.0%)
There are adequate social and psychological support structures at work for dealing with stress.	4(3.0%)	8(6.0%)	24(17.9%)	63(47.0%)	35(26.1%)
	Response				
	Yes, always	Sometimes	No		
Do you feel stressed about work lately due to the COVID-19 outbreak?	56(41.8%)	45(33.6%)	33(24.6%)		
	Stress profile of the workforce during the study period				
Please rate how stressed you feel at the moment regarding the COVID-19 outbreak while at work.					

*The embedded figure predicts stress (the in-between numbers) along the continuum of the scale.

Figure Titles

Figure 1: Regional distribution of COVID-19 case intensities across Ghana

Figure 2: Medical imaging/therapy modalities available (Graph A) and used by participants (Graph B) at workplaces during the study period

Figure 3: Modalities mostly used/under procedural pressure (A), redeployment/re-assignment to use other modalities following the COVID-19 outbreak (B), modalities used during the study period for COVID-19 management (C) and training offered to radiographers (D)

Figure 4: Some of the major workplace stressors during the study period

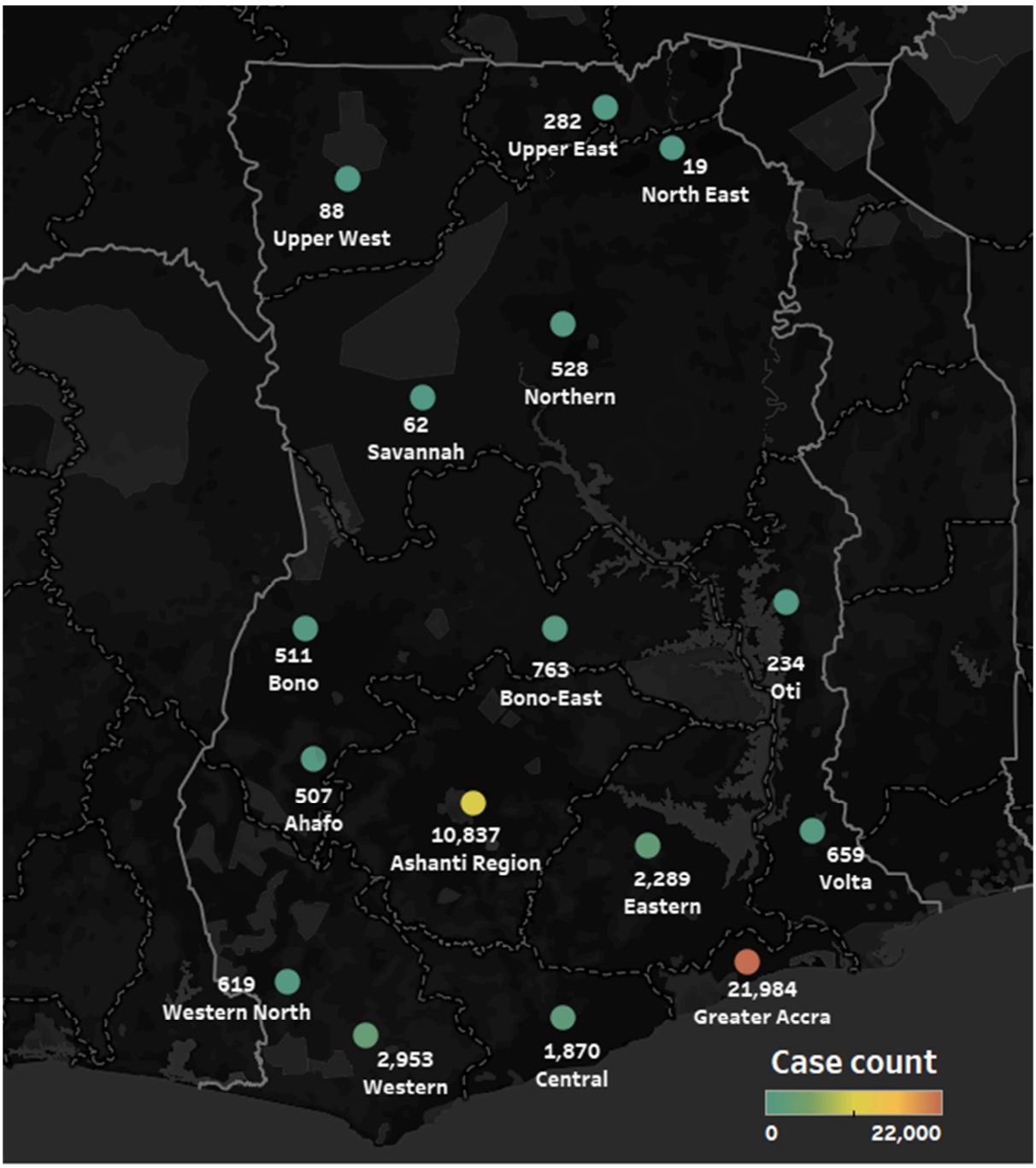
Figure Legends

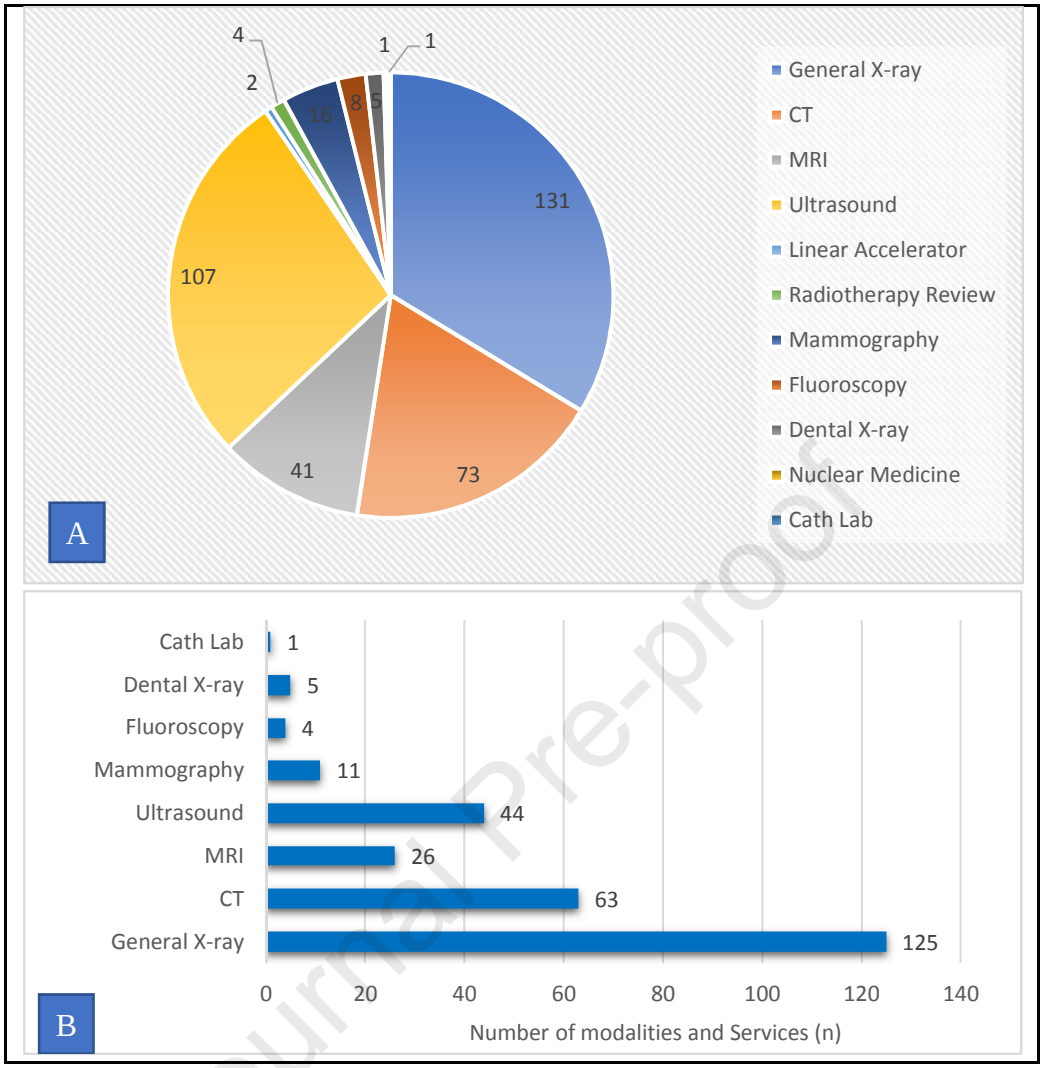
Figure 1 Legend: The green/red colour depicts low/high intensity of reported cases of people who have had a positive test result confirmed by a designated Ghana Health Service facility as at Aug 31, 2020, respectively. (Ghana Health Service: ghanahealthservice.org).

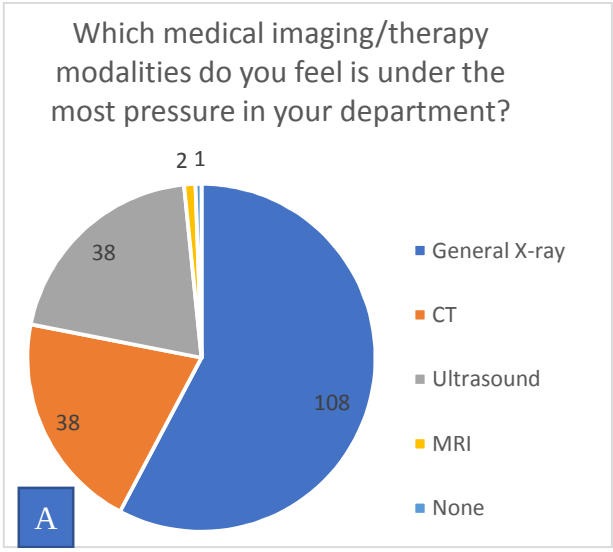
Figure 2 Legend: CT: computed tomography, MRI: Magnetic resonance imaging. Note: participants selected multiple options when responding to questions relating to graphs A and B.

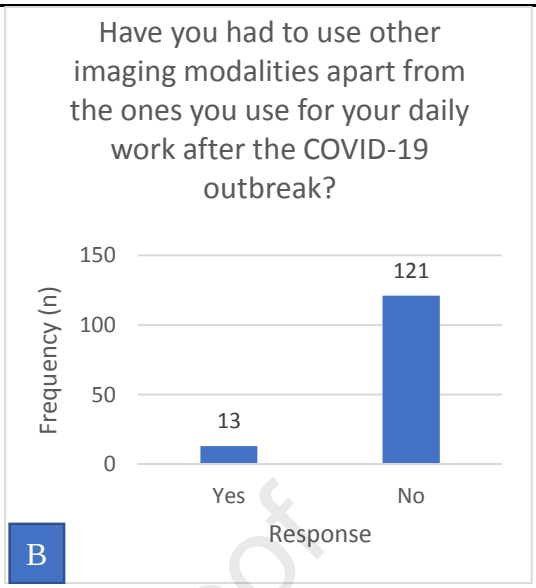
Figure 3 Legend: CT: Computed tomography, MRI: Magnetic resonance imaging. Note: In Figure 3C, none applicable refers to respondents whose centres have no specific protocols in place and therapy radiographers.

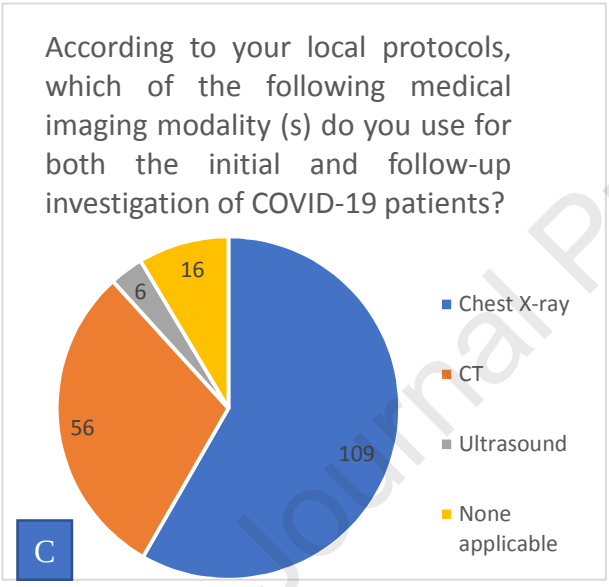
Figure 4 Legend: PPE: personal-protective equipment, GHS: Ghana Health Service.

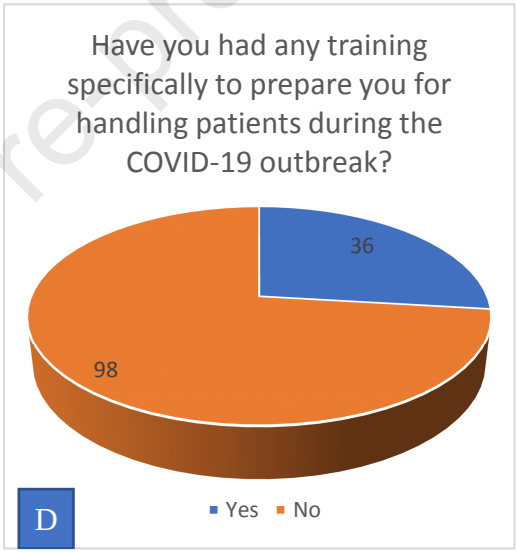

282
Upper East
19
North East
88
Upper West
528
Northern
62
Savannah
511
Bono
763
Bono-East
234
Oti
507
Ahafo
10,837
Ashanti Region
2,289
Eastern
659
Volta
619
Western North
21,984
Greater Accra
2,953
Western
1,870
Central
Case count
0
22,000

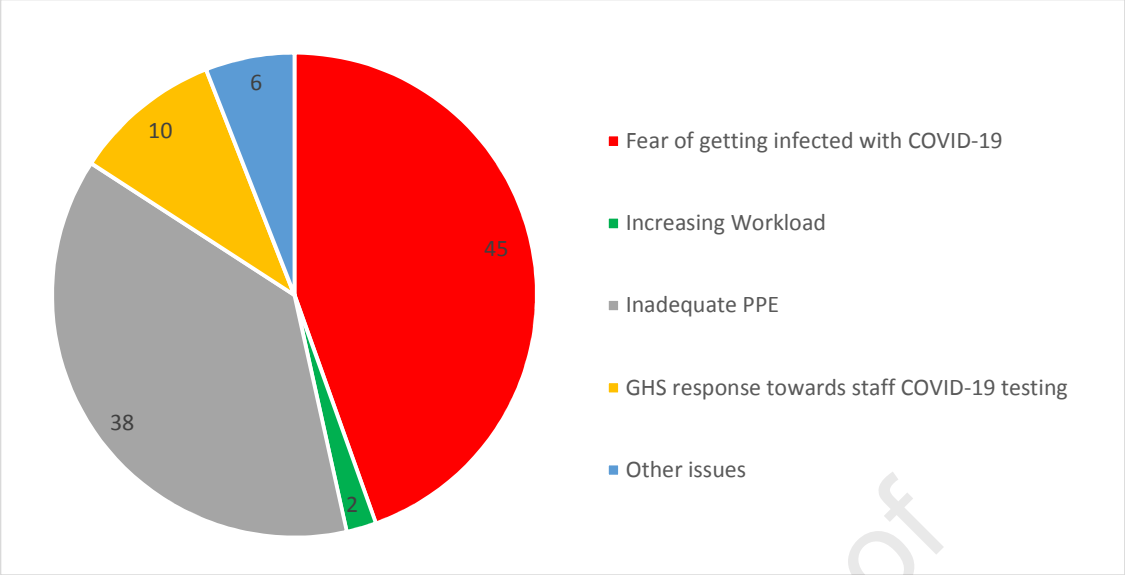












Appendix 1 – Summary of the Questionnaire

Participant Demographics

1. What is your gender?
    a. Female
    b. Male
    c. Prefer not to say
2. What is your age?
    a. 18 – 29 years old
    b. 30 – 39 years old
    c. 40 – 49 years old
    d. 50 – 59 years old
    e. 60 years and above
    f. Prefer not to say
3. Which region of Ghana do you work in?
    a. Greater Accra
    b. Ashanti
    c. Bono
    d. Bono East
    e. Ahafo
    f. Central
    g. Eastern
    h. Northern
    i. Savannah
    j. North East
    k. Upper East
    l. Upper West
    m. Volta
    n. Oti
    o. Western
    p. Western North
4. Which setting best describes your workplace?
    a. Public: Community Clinic Setting
    b. Public: Rural/District Setting
    c. Public: Urban Setting
    d. Public: University/Academic Setting
    e. Private Facility
    f. Others ……
5. Which best describes your status on the Allied Health Professions Register?
    a. Registered Diagnostic Radiographer
    b. Registered Therapeutic Radiographer
    c. Registered Sonographer
    d. Currently not registered
    e. Other
6. Which medical imaging/therapy facilities are available at your place of work? (Tick all that apply)
    a. General X-ray

b. Computed Tomography
c. Magnetic Resonance Imaging
d. Ultrasound
e. Linear Accelerator
f. Proton Therapy
g. Rad Review
h. Others …….

7. Which medical imaging/therapy facilities do you use for your daily work or are you competent at using for your assigned roles? (Tick all that apply)
    a. General X-ray
    b. Computed Tomography
    c. Magnetic Resonance Imaging
    d. Ultrasound
    e. Linear Accelerator
    f. Proton Therapy
    g. Others …….

General Perspectives on COVID-19

8. Radiographers are a part of the major frontline healthcare management team in response to COVID-19.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree
9. Which of the following best describes your workload pattern after the COVID-19 outbreak in Ghana?
    a. Increasing pattern
    b. Decreasing pattern
    c. No change
    d. Irregular pattern
    e. Others …….
10. Which medical imaging/therapy facilities do you feel is under the most pressure at your department?
    a. General X-ray
    b. Computed Tomography
    c. Magnetic Resonance Imaging
    d. Ultrasound
    e. Linear Accelerator
    f. Proton Therapy
    g. Brachytherapy
    h. Rad Review
    i. Others……
11. Have you had to use other imaging modalities apart from the ones you use for your daily work after the COVID-19 outbreak?
    a. Yes
    b. No

12. According to your local protocols, which of the following medical imaging modality (s) do you use for both the initial and follow-up investigations of COVID-19 patients?
    a. General X-ray
    b. Computed Tomography
    c. Magnetic Resonance Imaging
    d. Ultrasound
    e. Others …….
13. My personal radiation exposure has changed as imaging protocols have changed after the COVID-19 outbreak.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree
14. I have a great understanding of how the COVID-19 virus is transmitted.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree
15. My understanding of the principles of infection prevention and control as a radiographer is adequate to deal with the COVID-19 outbreak.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree
16. Have you had any training specifically to prepare you for handling patients during the COVID-19 outbreak?
    a. Yes
    b. No
17. My facility has made available adequate personal protective equipment (PPE) for work during the COVID-19 outbreak.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree

Impact of COVID-19

18. Do you feel Stressed about work lately due to the COVID-19 outbreak?
    a. Yes
    b. No
    c. Sometimes

19. Please rate how stressed you feel at the moment regarding the COVID-19 outbreak while at work.

    No stress 0 1 2 3 4 5 6 7 8 9 10 Extreme stress

20. What do you consider as the major stressor at work since the COVID-19 outbreak?
    a. Fear of getting infected with the COVID-19 virus
    b. Increasing workload
    c. Inadequate personal protective equipment
    d. Ghana Heatlh Services' response towards staff COVID-19 testing
    e. Other issues ……..
21. I feel I may be in need of professional help to deal with stress during the COVID-19 outbreak.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree
22. My family/partner/friends are being significantly affected by this recent work-related stress.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree
23. There are adequate social and psychological support structures at work for dealing with stress.
    a. Strongly agree
    b. Agree
    c. Neutral
    d. Disagree
    e. Strongly disagree

Comments (Optional)
Kindly provide comments about this study/topic in the space below.

Conflict of Interest

All the authors declare no financial relationships with any organisations that might have an interest in the submitted work; no other relationships or activities that could appear to have influenced the submitted work.

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