Telemedicine in Ghana: Insight into the past and present, a narrative review of literature amidst the Coronavirus pandemic

Gideon Dzando,[1] Hope Akpeke,[2] Augustine Kumah,[3] Ernest Agada,[2] Augustina Akua Lartey,[4] Joseph Nortu,[5] Hillary Selassi Nutakor,[6] Anthony Bimba Donyi,[7] Rebecca Dordunu[8]

[1]College of Nursing and Health Sciences, Flinders University, Adelaide, Australia; [2]Department of Nursing, Jasikan Government Hospital, Jasikan, Ghana; [3]Quality Directorate, Nyaho Healthcare Limited, Accra Ghana; [4]Department of Nursing, Mamprobi Hospital, Mamprobi, Accra, Ghana; [5]Department of Anaesthesia, Krachi West District Hospital, Kete Krachi, Ghana; [6]Department of Addiction, Recovery and Rehabilitation, Accra Psychiatric Hospital, Accra, Ghana; [7]Presbyterian University College, Asante Akyem Agogo, Ghana; [8]School of Nursing and Midwifery, University of Ghana, Legon, Accra, Ghana

Abstract

The Coronavirus pandemic has destabilized many healthcare systems globally since the outbreak was announced. The mode of transmission of the virus has affected the traditional face-to-face mode of seeking healthcare. The world health organization recommends measures, including limiting physical contact as a means of preventing the spread of the virus. Many countries across the world are utilizing telemedicine during this pandemic to provide basic healthcare to their citizens. The implementation of telemedicine in sub–Saharan Africa has encountered many challenges. The surge in the number of covid-19 cases in Ghana calls for drastic measures to contain the repercussions of the pandemic. The Government of Ghana and other private organizations continue to scale up efforts to integrate telemedicine into the mainstream healthcare system. This study seeks to explore and provide insight into the state of telemedicine in Ghana prior to and during the Coronavirus pandemic. This study is a narrative review of literature on the use of telemedicine in Ghana. Data was obtained from PubMed, Embase, ScienceDirect, Scopus and Google Scholar. A secondary search was conducted on government of Ghana health agencies' websites and other relevant websites that published information on telemedicine in Ghana. Literature was analysed and topically discussed based on identified themes. There is an improvement in the number of information and communication technology coordinated healthcare services in Ghana since the outbreak was confirmed. Public-private partnership is required to boost the integration of telemedicine into mainstream healthcare in Ghana.

Introduction

The coronavirus (Covid-19) pandemic is among the worst outbreaks that have affected the world in the last decade.[1] From what started as a flu-like disease in Wuhan China, the Coronavirus pandemic has affected over 220 countries and territories worldwide, accounting for more than 4 million deaths as of August 17, 2021.[2] The World Health Organization (WHO) declared the outbreak a Public Health Emergency of International Concern (PHEIC) on January 30, 2020, when there were less than 100 cases outside China with no reported deaths.[3] This measure according to WHO was to prevent the virus from spreading to countries with poor healthcare systems.

The mode of transmission and the constant mutation of the virus remains a public health concern even at a time when vaccines are being rolled out.[4] Understanding the mode of transmission continues to guide public health officials in instituting measures that aim at preventing the spread of the virus. The WHO has established that transmission of Covid-19 is mainly by contact, droplets, airborne and fomite.[5] People infected with the virus, with or without symptoms can infect others.[6] Guidelines for preventing the spread of the disease include physical distancing, ensuring adequate ventilation, wearing masks, avoiding crowds, and adopting best coughing etiquettes.[7] These precautionary measures, especially avoiding crowds and physical distancing has reshaped the social and cultural lives of individuals and their communities. Seeking healthcare during the Coronavirus pandemic has remained a challenge across the globe due to the overbearing need to adhere to safety protocols and the intermittent lockdowns that have been widespread globally. Healthcare providers across the world are adopting multifaceted approaches in providing general healthcare, and at the same time treating patients diagnosed with Covid-19.[8] People living in low- and middle-income countries encounter various challenges when seeking healthcare, including having to travel long distances to attend healthcare facilities. Ensuring equal and adequate healthcare all over the world, especially in developing countries is one of the topmost priorities of the World Health Organization. Telemedicine in the wake of the pandemic has seen a facelift in many parts of the world. Ministries of health worldwide are instituting measures to provide remote healthcare to their citizens as a means of reducing patients' exposure and at the same time safeguarding the healthcare workforce.[9] The WHO defines telemedicine as *"The delivery of health care services,*

where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities".[10]

Developed countries such as The United Kingdom, Australia, Canada, United States of America had existing functional systems and were able to improve access and utilization of telemedicine to augment the traditional face-to-face method of seeking healthcare in the early days of the pandemic. Patients attend virtual appointments for counselling and for reporting other minor ailments to their doctors without being physically present. Patients with Covid-19 symptoms can report their symptoms online, book appointments for testing and self-isolate whilst waiting for their results. Covid-19 mobile applications have been very instrumental in contact tracing and follow-ups in Australia, Singapore, and other parts of the world.[11] These applications promote effective communication and enhance real-time public health response when new cases are detected at new locations.

The concept of telemedicine also allows healthcare workers to effectively communicate with each other regarding progress reports, and at the same time disseminate covid-19 related information, including updates on restrictions and the availability of vaccines.

Healthcare personnel can undertake e-learning programs for professional development as part of the concept of telemedicine. There are covid-19 modules available online for healthcare personnel, which include infection prevention and responding to suspected cases of covid-19.

The benefits of telemedicine are enormous and can provide expansive benefits to citizens of developing countries, especially where equity, quality and access to mainstream healthcare remain an ongoing challenge.[12] Telemedicine has also helped to address the problem of inadequate healthcare professionals, most importantly specialists in underprivileged communities.[13] Telemedicine initiatives in sub-Saharan Africa are often not resourced enough, with few surviving beyond the pilot phases to be incorporated into mainstream healthcare.[14] In the early days of the outbreak in Africa, ministries of health in Mali, Botswana, Senegal, South Africa, and Ghana advised their citizens to seek healthcare online where possible.[15] Although there are no

streamlined standards to achieving a complete telemedical practice due to variations in national capacities, the adoption and utilization of telemedicine in developing countries during the pandemic has been noticeably faced with challenges.[15] There are currently no documented policy guidelines in the public domain regarding the use of telemedicine during Covid-19 in most developing countries.[16,17] The health advice often comes by words of mouth during regular national updates by governments and their health agencies.

There is currently an increasing number of Covid-19 related morbidity and mortality in Ghana, with an emergence of the very transmissible Delta variant which the president of the republic attributed to having "*let their guards down*".[18] As of June 2, 2021, Ghana recorded a total number of 94,011 confirmed cases and 785 deaths.[19] The number of confirmed cases has increased exponentially, and by August 11, 2021, Ghana has recorded 108,677 confirmed cases with 880 deaths.[2] The Covid-19 vaccine rollout is faced with many challenges, especially in the African sub-region which could increase the risk of burden of disease in Ghana.[20] Many hospitals and healthcare facilities in Ghana operate on a paper-based patient record management system, where hospital records management staff spend many hours to locate and retrieve patients' medical records which ultimately lead to increased waiting time for patients to access prescriber services.[21] This often causes congestion and traffic in hospitals, even during the ongoing pandemic. There is currently a surge in the number of people requiring hospitalization for Covid-19, and the number of people requiring care in the intensive care unit also continues to rise.[18]

The increasing number of cases, coupled with low rates of vaccination necessitates an urgent need to prioritize and intensify the use of telemedicine to decrease the risk of spread of Covid-19 infection among clients and healthcare providers in Ghana. This narrative review explores the concept of telemedicine before, and during the Coronavirus pandemic and its applicability as part of Ghana's management plan. This review will offer new insight and provide a road map for policymakers to as a matter of urgency institute measures that will enhance the use of telemedicine on a broader scope during and after the Coronavirus pandemic to improve the overall health of Ghanaians.

Materials and methods

This study is a narrative literature

review in which data was extracted from electronic databases, namely PubMed, Embase, ScienceDirect, Scopus and Google Scholar that published research articles on telemedicine in Ghana. The literature search was done between April and August 2021 by all the authors. Words such as telemedicine, Coronavirus, pandemic, healthcare, Ghana, telehealth, mHealth, mobile health and digital health were used either alone or in combination to locate available literature. Studies that reported on telemedicine, telehealth, digital health, and electronic healthcare in Ghana were included in the study. A secondary search was conducted on ministry of health and Ghana health service websites as well as other private company websites that reported on telemedicine in Ghana. Themes were developed from existing literature, highlighting the progress, gaps, and challenges of the implementation of telemedicine in Ghana. These themes provided the framework for the ensuing discussion.

Discussion

Telemedicine in Ghana through the national history lens

The quest to incorporate telemedicine into the healthcare system in Ghana started decades ago. An exploratory study conducted in the year 2000 for instance concluded that healthcare workers expressed interest in the concept of using technology to deliver healthcare.[22] There has been a continuous revision of the electronic health (eHealth) motives in Ghana since 2003.[23] The current eHealth strategy was launched in July 2010 by the government of Ghana, which sought to among other things bridge the equity gap and increase access to quality care. By 2014, there were about 22 eHealth projects at various stages of piloting and implementation in various parts of the country.[24] These projects primarily focused on developing systems that allow continuous workflow through effective communication among healthcare personnel.

The most recent piloting of telemedicine in Ghana by the Novartis Foundation in collaboration with national and international organizations in the Ashanti region recorded many successes. Telemedical health was utilized in 10 communities with a total population of about 35,000 until 2016 when the pilot project ended.[25]

Vodafone, a mobile telecommunication operator also launched Vodafone Healthline, a platform that sought among other things to educate Ghanaians on perti-

nent health-related issues, and at the same time promote healthy living among the populace.[26]

In 2015, a Swedish insurance company (Bima), originally tasked to provide affordable insurance solutions, began providing electronic healthcare in Ghana. Bima received the first telemedicine licence in Ghana, issued by the Health Facility Regulatory Agency. Their mHealth/eHealth service brings affordable and accessible health advice and succinct health education to the doorsteps of Ghanaians.[27]

The Ministry of Health, Ghana, since 2016 has been working tirelessly to scale up coverage of telemedicine across the country. This upscaling has been a rather slow process with only little public records available to measure success or otherwise. The Government of Ghana, in 2018 announced plans to introduce medical drones to augment challenges in the timely distribution of essential medical supplies to the underserved communities. The program was officially launched in 2019 with four main distribution centres. The four distribution centres, as per the agreement between the Government of Ghana and the San Francisco based company, Zipline, are mandated to complete at least 600 distributions per day.[28] Currently, these drones complement the government's efforts to transport samples to be tested for the Coronavirus. These drones also transport blood and essential medications to far to reach and deprived communities. Although the use of drones for medical purposes has been faced with challenges in other parts of Africa,[29] its benefits during the Coronavirus pandemic cannot be overstated.

The new era for mobile health (mHealth)

In the wake of the pandemic, Ghana, like many other developing countries, remain vulnerable to the devastating effects of the virus.[30] The need to strengthen the healthcare system and to provide basic needs for citizens has become a matter of urgency. As part of efforts to improve surveillance, trace contacts and limit the spread of the Coronavirus, the government of Ghana through the ministry of communication launched a Covid-19 tracker application on April 12, 2020.[31] Individuals with the application can among other things identify hotspots, manage event capacities, and register attendance at events, track government's updates and monitor symptoms. The initiative sparked mixed reactions among the citizenry with concerns about the unavailability of the application on android and iOS platforms. These concerns were duly addressed, and the application became

available on both android and iOS platforms for download. As of August 17, 2021, total downloads of the Ghana Covid-19 tracker mobile application on android devices were a little over 10,000 on google play store. The cost of internet services in Ghana is relatively high and only a small fraction of the population can afford to use mobile internet data on an ongoing basis. This could account for the low usage of the Ghana covid-19 tracker mobile application.

The Ghana Health Service in collaboration with KT., a Korea based telecommunication provider launched a mobile application in 2019 as part of efforts to boost Ghana's health information system.[32] The Global Epidemic Prevention Platform (GEPP), a notification system, currently functions to notify individuals visiting an epidemic-prone zone, enhance real-time reporting, and boost the government's efforts to monitor and gauge public health data during outbreaks. Like the Ghana Covid-19 tracker application, total downloads of GEPP have been relatively low, with about 1000 downloads on google play store as of August 17 2021.

The mobile health application, 'mClinic' which was designed to facilitate midwives' access to the Millennium Village-Global Network continues to support the quest to achieve enhanced maternal healthcare.[33] Expanding this specialised service to cover the entirety of maternal and child health amidst the Coronavirus pandemic will strengthen the quest to achieve the Sustainable Development Goal 3.[34]

The Opine health system, privately launched on March 26, 2021, remains a significant part of the fight against the spread of the Coronavirus. The platform collects information about possible Coronavirus symptoms and locations through an Unstructured Supplementary Service Data (USSD) shortcode. This service does not require individuals to have airtime or internet services, hence the increasing usage among the populace.[35]

Socioeconomic factors have adversely affected health systems in developing countries over the years, including measures to fight against the Coronavirus pandemic.[15,36,37] The government of Ghana in collaboration with other health agencies can work together to initiate mHealth services across the regions to proactively serve the lower-level healthcare facilities.

The need for infrastructure

Like mainstream medical practice, the success or otherwise of telemedicine during the Coronavirus pandemic will largely depend on infrastructure. Ghana is one of the few African countries that shifted away

from government-controlled telecommunication system to a more deregulated system that allows participation of private entities. The government however has an oversight responsibility over these telecommunication companies to ensure quality delivery of services. With the quest to expand telemedicine, the government of Ghana must ensure the extension of mobile telecommunication services to deprived communities. By the end of the year 2019, about 15.1 million Ghanaians owned smartphones.[38] There were about 40 million cellular subscriptions by the end of 2020 in a country with a little over 30 million people.[39] MTN, the largest telecommunication network provider in Ghana currently serves about 25 million subscribers.[40] Ordinarily, these high rates of subscriptions are expected to reflect in the useability of covid-19 related mobile applications. A surge in the number of mobile subscribers has drastically affected the quality of telecommunication services, including the sluggish internet services, currently at 46.48mbps for broadband and 15.37mbps for mobile internet services.[41]

Public-private partnership in upscaling healthcare delivery systems across the world has been well documented.[42,43] The government of Ghana can facilitate improved services through effective collaboration with the telecommunication companies, offering tax reliefs, and providing other incentives to expand access and increase the usage of these services.

Providing healthcare institutions, both private and public with computerized systems to enhance teleconsulting during the pandemic can significantly reduce human movement and curtail the spread of the virus. The world health organization intimated from the start of the pandemic that, overcoming the effects of the pandemic require partnership at all levels.[44]

Education, social media, and telemedicine

The role of education in developing and sustaining telemedicine in Ghana cannot be overstated. There is a need to train healthcare professionals and the public on the importance of telemedicine. The lack of education has accounted for many failed health policies across the world.[45,46] The Novartis piloting project in the Ashanti region was partly successful due to the intensity of education provided to both the public and the healthcare personnel. Many countries and organizations across the globe have reverted to online training for their personnel which has yielded positive results.[47] There is currently a surge in the number of online continuous professional

development (CPD) programs available for healthcare professionals in Ghana. For instance, the Nursing and Midwifery council of Ghana in partnership with their international partners are providing online CPD for nurses.[48] Continuous Education Service (CES) also provides a platform that offers CPD programs to medical and allied health professionals.[49] This has reduced the risk of travelling to attend workshops and face-to-face training sessions. Introducing and integrating these sessions into the Ghanaian healthcare system has significantly improved healthcare delivery, especially at a time when infection prevention and standard precautions have become the golden standard.

Public education is paramount to the successful implementation of telemedical policies. There are often cultural beliefs that hamper the use of technology and orthodox medical practices in developing countries.[50] Working closely with consumers of healthcare especially in rural communities is important to achieve a wider coverage of telemedical practice. Education via social media has been a game-changer during the coronavirus pandemic in many countries.[51,52] The use of social media during the Coronavirus pandemic has increased, especially due to sporadic lockdowns and 'stay at home' restrictions. Many families and friends' resort to social media as a means of communication.

The World Health Organization, national and other international health bodies regularly update their official social media handles to communicate the current Covid-19 situation. Ghana currently has about 8 million social media users,[53] with about 5.9 million Facebook users.[54] Misinformation and conspiracy theories surrounding the Coronavirus pandemic have been mainly spread via social media.[55] These same media can be used to demystify misconceptions about the pandemic and ongoing vaccination to boost public confidence and enhance adherence to protocols. The Ministry of Health Ghana has about 88,000 followers on Facebook as of August 17, 2021, and this medium has since been used to provide regular updates on the ongoing pandemic. There are private individuals (celebrities) with many followers numbering millions on social media in Ghana. Effectively, these followings outnumber the followers of the official pages of government health institutions. The government can collaborate with these individual celebrities to propagate the news about the importance of telemedicine, as well as disseminate relevant health information during this pandemic. Providing education about the Coronavirus pandemic on social media,

including the need to patronize telemedicine will go a long way to ease the burden on the healthcare delivery system in Ghana.

Conclusions

The Coronavirus pandemic has necessitated a shift from the traditional face-to-face healthcare model to the use of technology. Countries with advanced technologies before the pandemic continue to provide high quality care, and at the same time collect public health information to limit the spread of the virus. Ghana is currently experiencing the third wave of the pandemic with an increasing number of confirmed cases and mortality. Ghana, like many other developing countries, is faced with challenges in the healthcare system, which ostensibly affect the quality of care provided to its citizens. The government of Ghana has embraced the need to integrate telemedicine into mainstream healthcare, especially during this time of the pandemic. This process has not been without challenges. Socio-economic, lack of infrastructure and lack of education has adversely affected the large-scale implementation of telemedicine in Ghana. Public-private partnerships can play a significant role in championing the course of telemedicine in Ghana.

References

1. Tashiro A, Shaw R. COVID-19 Pandemic Response in Japan: What Is behind the Initial Flattening of the Curve? Sustainability 2020;12:5250.
2. WHO Coronavirus (COVID-19) Dashboard. [cited 2021 May 21]. Available from: https://covid19.who.int
3. WHO. COVID 19 Public Health Emergency of International Concern (PHEIC). Global research and innovation forum: towards a research roadmap. 2020 Feb 12 [cited 2021 Aug 23]; Available from: https://covid19-evidence.paho.org/handle/20.500.12663/714
4. van Oosterhout C, Hall N, Ly H, Tyler KM. COVID-19 evolution during the pandemic – Implications of new SARS-CoV-2 variants on disease control and public health policies. Virulence 2021;12:507–8.
5. Transmission of SARS-CoV-2: implications for infection prevention precautions [Internet]. [cited 2021 Aug 23]. Available from: https://www.who.int/newsroom/commentaries/detail/transmission-of-sars-cov-2-implications-for-infection-

prevention-precautions
6. Gao Z, Xu Y, Sun C, et al. A systematic review of asymptomatic infections with COVID-19. J Microbiol Immunol Infect 2021;54:12–6.
7. Becker K, Gurzawska-Comis K, Brunello G, Klinge B. Summary of European guidelines on infection control and prevention during COVID-19 pandemic. Clin Oral Implants Res 2021;32:353-81..
8. Monaghesh E, Hajizadeh A. The role of telehealth during COVID-19 outbreak: a systematic review based on current evidence. BMC Public Health 2020;20: 1193.
9. Bokolo AJ. Exploring the adoption of telemedicine and virtual software for care of outpatients during and after COVID-19 pandemic. Ir J Med Sci 2021;190:1–10.
10. WHO Global Observatory for eHealth. Telemedicine: opportunities and developments in Member States: report on the second global survey on eHealth [Internet]. World Health Organization; 2010 [cited 2021 Aug 23]. Available from: https://apps.who.int/iris/handle/10665/44497
11. Tapera R, Singh Y. A bibliometric analysis of medical informatics and telemedicine in sub-Saharan Africa and BRICS nations. J Public Health Res 2021;10. Available from: https://jphres.org/index.php/jphres/article/view/1903
12. Nagra MH, Ehsan S, Ahmad U, et al. Implementation of a telemedicine service during COVID-19 pandemic in Pakistan. Int J Clin Pract 2021;75: e14310.
13. Ho M, Luk R, Aoki PM. Applying user-centered design to telemedicine in Africa. In Conference on Human Factors in Computing Systems 2007.
14. Mars M. Telemedicine and Advances in Urban and Rural Healthcare Delivery in Africa. Prog Cardiovasc Dis 2013; 56:326–35.
15. David KB, Solomon JK, Yunusa I, et al. Telemedicine: an imperative concept during COVID-19 pandemic in Africa. Pan Afr Med J 2020;35.
16. Das DN, Narnoli DS, Kaur DA, et al. Attitude to telemedicine in the times of COVID 19 pandemic: Opinion of medical practitioners from India. Psychiatry and Clinical Neurosciences 2021. Available from: https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC7404339/
17. Doraiswamy S, Abraham A, Mamtani R, Cheema S. Use of Telehealth During the COVID-19 Pandemic: Scoping Review. J Med Internet Res 2020;22:e24087.
18. Ghana President Says Delta Variant Driving New Covid-19 Wave. Bloomberg.com [Internet]. 2021 Jul 25 [cited 2021 Aug 23]; Available from:

https://www.bloomberg.com/news/articles/2021-07-25/ghana-says-delta-variant-driving-nation-s-third-covid-19-wave

19. Dzando G, Salifu S, Donyi AB, et al. Healthcare in Ghana amidst the coronavirus pandemic: a narrative literature review. J Public Health Res 2021:2448.
20. Nachega JB, Sam-Agudu NA, Masekela R, et al. Addressing challenges to rolling out COVID-19 vaccines in African countries. Lancet Global Health 2021;9:e746–8.
21. Adjorlolo S, Ellingsen G. Readiness Assessment for Implementation of Electronic Patient Record in Ghana: A Case of University of Ghana Hospital. J Health Informatics Devel Countries 2013;7.
22. An exploratory survey of the applications of telemedicine in Ghana. J Telemed Telecare 2000;6:177–83.
23. Afagbedzi SK, Obuobi H, Aryeetey R, Bosomprah S. A Review of Ghana's E-health Strategy. J Health Informatics Africa 2013;1.
24. Afagbedzi SK, Obuobi H, Aryeetey R, Bosomprah S. A Review of Ghana's E-health Strategy. J Health Informatics Africa 2013;1.
25. Ghana Telemedicine. Novartis Foundation. [cited 2021 Aug 23]. Available from: https://www.novartis-foundation.org/past-programs/digital-health/ghana-telemedicine
26. Healthline [Internet]. [cited 2021 Aug 23]. Available from: https://vodafone.com.gh/explore-vodafone/healthline/
27. Home [Internet]. BIMA Ghana. [cited 2021 Aug 23]. Available from: https://bima.com.gh/
28. Vice President launches Ghana's drone delivery service at Omenako - Ministry Of Health [Internet]. [cited 2021 Aug 23]. Available from: https://www.moh.gov.gh/vice-president-launches-ghanas-drone-delivery-service-at-omenako/
29. Lockhart A, While A, Marvin S, et sl. Making space for drones: The contested reregulation of airspace in Tanzania and Rwanda. Transactions of the Institute of British Geographers. 2021. Available from: https://rgs-ibg.onlinelibrary.wiley.com/doi/abs/10.1111/tran.12448
30. Smith JA, Judd J. COVID-19: Vulnerability and the power of privilege in a pandemic. Health Promot J Austr 2020;31:158–60.
31. Launch of GH COVID-19 Tracker App | Ministry of Communications [Internet]. [cited 2021 Aug 23]. Available from: https://www.moc.gov. gh/launch-gh-covid-19-tracker-app

32. Delport J. Big-data healthcare service launches in Ghana - IT News Africa - Up to date technology news, IT news, Digital news, Telecom news, Mobile news, Gadgets news, Analysis and Reports. 2019. Available from: https://www.itnewsafrica.com/2019/08/big-data-healthcare-service-launches-in-ghana/
33. Vélez O, Okyere PB, Kanter AS, Bakken S. A Usability Study of a Mobile Health Application for Rural Ghanaian Midwives. J Midwifery Women's Health 2014;59:184–91.
34. Agbozo F, Jahn A. COVID-19 in Ghana: challenges and countermeasures for maternal health service delivery in public health facilities. Reprod Health 2021;18:151.
35. This tech company is tracking coronavirus symptoms and hotspots in Ghana - CNN. Available from: https://edition.cnn.com/2020/05/04/africa/ghana-coronavirus-hotspots/index.html
36. Oyediran KA, Makinde OA, Adelakin O. The Role of Telemedicine in Addressing Access to Sexual and Reproductive Health Services in sub-Saharan Africa during the COVID-19 Pandemic. Afr J Reprod Health 2020;24:49–55.
37. Dodoo JE, Al-Samarraie H, Alzahrani AI. Telemedicine use in Sub-Saharan Africa: Barriers and policy recommendations for Covid-19 and beyond. Int J Med Informat 2021;151:104467.
38. The state of mobile in Ghana's tech ecosystem. Mobile for Development. 2020. Available from: https://www.gsma.com/mobilefordevelopment/blog/the-state-of-mobile-in-ghanas-tech-ecosystem/
39. Ghana Mobile cellular subscriptions, 2000-2020 - knoema.com. Available from: https://knoema.com/atlas/ Ghana/topics/Telecommunication/Telecomm-Services/Mobile-cellular-subscriptions
40. O'Grady V. MTN commits to Ghana's digital development. Developing Telecoms. 2021 Available from: https://developingtelecoms.com/telecom-business/telecom-investment-mergers/11285-mtn-commits-to-ghana-s-digital-development.html
41. Internet Speeds By Country 2021. Available from: https://worldpopulation-review.com/country-rankings/internet-speeds-by-country
42. Ganapathy K, Das S, Reddy S, et al. Digital Health Care in Public Private Partnership Mode. Telemedicine and e-Health 2021. Available from:

https://www.liebertpub.com/doi/full/10.1089/tmj.2020.0499
43. Riaz BK, Ali L, Ahmad SkA, et al. Community clinics in Bangladesh: A unique example of public-private partnership. Heliyon 2020;6:e03950.
44. COVID-19 contributions tracker. 2020. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/donors-and-partners/funding
45. Butt M, Mohammed R, Butt E, Butt S, Xiang J. Why Have Immunization Efforts in Pakistan Failed to Achieve Global Standards of Vaccination Uptake and Infectious Disease Control? Risk Manag Healthc Policy 2020;13:111–24.
46. Correa VC, Lugo-Agudelo LH, Aguirre-Acevedo DC, et al. Individual, health system, and contextual barriers and facilitators for the implementation of clinical practice guidelines: a systematic metareview. Health Res Policy Sys 2020;18:74.
47. Bhattacharya S, Singh A, Hossain MM. Health system strengthening through Massive Open Online Courses (MOOCs) during the COVID-19 pandemic: An analysis from the available evidence. J Educ Health Promot 2020;9:195.
48. Nursing and Midwifery Council of Ghana. 2021. Available from: https://engagement.wcea.education/nmcg
49. CPD Blog. Continuous Education Services (CES). 2021. Available from: https://ces.edu.gh/cpd-blog/
50. Luciano E, Mahmood MA, Mansouri Rad P. Telemedicine adoption issues in the United States and Brazil: Perception of healthcare professionals. Health Informatics J 2020;26:2344–61.
51. Bernardino M, Bacelar Nicolau L. The importance of reliable social media information during the COVID-19 pandemic. Eur J Public Health 2020;30:5.
52. Cuello-Garcia C, Pérez-Gaxiola G, van Amelsvoort L. Social media can have an impact on how we manage and investigate the COVID-19 pandemic. J Clin Epidemiol 2020;127:198–201.
53. Ghana: active social media users 2017-2021. Statista. 2021. Available from: https://www.statista.com/statistics/1171445/number-of-social-media-users-ghana/
54. Facebook users in Ghana - February 2020. 2020. Available from: https://napoleoncat.com/stats/facebook-users-in-ghana/2020/02
55. Ahmed Siddiqui MY, Mushtaq K, Mohamed MFH, et al. Social Media Misinformation: An Epidemic within the COVID-19 Pandemic. Am J Trop Med Hyg 2020;103:920.