

Coronavirus Pandemic

COVID-19 pandemic in resource-poor countries: challenges, experiences and opportunities in Ghana

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Abstract

The novel coronavirus, SARS-CoV-2, which causes COVID-19, is seen world-wide. In developing countries, adequate health facilities and staff numbers are a concern. Ghana recorded its first 2 cases of COVID-19 on 12 March 2020. On 30 March 2020, a partial lockdown for 14 days was imposed and later extended along with other measures. By the end of the initial lockdown, 19 April 2020, an estimated 86,000 people had been traced and 68,591 tests performed. Of the 68,591 tests, there were 1,042 (1.5%) positive cases, 9 deaths, and 99 recoveries, with Ghana ranked number one among African countries in administering tests per million people. Ghana's effective track and trace system, as well as lockdown and other measures, have helped limit mortality with only 85 recorded deaths by 23 June 2020. Scientists from three facilities of the University of Ghana have also successfully sequenced the genomes of COVID-19 from 15 confirmed cases, and the Food and Drugs Authority in Ghana have also helped address shortages by fast-tracking certification of hand sanitizers and local production of 3.6 million standardized personal protective equipment. There has also been the development of prototypes of locally-manufactured mechanical ventilators to meet local need at intensive care units. Most people have also resorted to changing diets and the use of supplements to boost their immune system. Although initial results are encouraging, further research is needed to understand the dynamics of COVID-19 in Ghana and provide additional guidance.

Key words: Novel SARS-CoV-2; COVID-19; Ghana; challenges; opportunities.

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Introduction

Severe acute respiratory syndrome (SARS), an international epidemic which occurred between 2002 and 2003, was attributed to a coronavirus, SARS-CoV, a novel zoonotic coronavirus [1]. Another coronavirus named SARS-CoV-2, that is responsible for coronavirus disease 2019 (COVID-19) was first reported in Wuhan, China, in December 2019 [2]. Governments across the world have instigated measures to help contain the spread of COVID-19 including quarantining citizens who have travelled from high risk countries or made contact with positive tested patients, mass testing of citizens, as well as enforcement of national or partial lock downs in line with World Health Organization (WHO) guidance [3]. Scientists are also currently seeking to develop potential medicines for the

management of COVID-19, which includes repurposing existing drugs and making vaccines against COVID-19. There has been controversy surrounding the use of hydroxychloroquine, with the WHO removing it from the ongoing Solidarity Trial [4,5]. However, more promising results with remdesivir have been found [6].

We are aware that health facilities in high-income countries including the United States of America (U.S.A), United Kingdom (U.K), Italy, France and Spain have come under heavy patient work loads that have placed a considerable burden on intensive care unit (ICU) beds, health care workers, personal protective equipment (PPEs) and ventilators [7,8].

In developing countries, especially sub-Saharan African countries, there are concerns with their ability

to adequately deal with COVID-19; partly due to few health facilities, medicine availability and research capacity. For instance, in Kenya there are just 200 ICU beds for a population of 50 million, and in Mali and Liberia there are only a few ventilators for their population of several millions [9]. There is also a concern that low- and middle-income countries (LMICs) are less able to cope with pandemics despite experience with infectious diseases. This includes Africa which is already struggling with high rates of both infectious and non-infectious diseases [10,11], alongside a fragile health system. As a result, the United Nations and WHO predicted that at the end of April or beginning of May there could be up to 44 million cases of COVID-19 in the first year of the pandemic in Africa, with up to 190,000 deaths if containment measures failed [12]. This was despite the WHO on 7 April 2020, reporting that “There have been almost 1,000 deaths and more than 19,000 infections across Africa so far, although these rates are far lower than those seen in parts of Europe and the US” [13]. In the wake of the pandemic, 1,400 U.S citizens in Ghana requested to be repatriated with the assistance of their Embassy, even though death rates attributed to COVID-19 in Africa and Ghana were much lower compared to the U.S.A [14]. It is noteworthy that the first case of COVID-19 in sub-Saharan Africa was reported in Nigeria on 28 February 2020 [15].

There were initial concerns that face masks, gloves, hand sanitizers, and diagnostic materials for testing COVID-19 may be in short supply in most LMICs. Additionally, most LMICs are not manufacturers of PPE and diagnostic materials. There were also concerns that a pandemic like COVID-19 may turn attention away from other high priority diseases such as human immunodeficiency virus (HIV), malaria and tuberculosis in sub-Saharan Africa [10,16]. Consequently, we wanted to document the experiences of a LMIC country that has implemented measures to help reduce the spread of COVID-19 virus, as well as has addressed some of the concerns with PPE for frontline healthcare staff. The findings can potentially help with future activities aimed at reducing the spread of COVID-19 virus and the management of COVID-19 patients, not only in Ghana, but other countries.

The experience of LMICs: the case of Ghana

As mentioned, in view of the on-going pandemic, we wanted to document activities that have been implemented to help reduce the impact of COVID-19 especially in a sub-Saharan African country with high rates of both infectious and non-infectious diseases. In

Ghana, there are ongoing activities to tackle infectious diseases such as reducing antimicrobial resistance, as well as national action plans to reduce morbidity and mortality associated with non-communicable diseases [10,17]. However, there are concerns that such activities may be compromised when attention is turned towards containing COVID-19.

Ghana recorded its first two cases of COVID-19 infection on 12 March 2020. On 28 March 2020, the President of Ghana announced a partial lockdown from 01:00 (local time) beginning 30 March 2020, for 14 days. On the day of the announcement, the Greater Accra, Ashanti, and Upper West Regions of Ghana had all reported cases of the virus, and 141 COVID-19 cases had been confirmed nationwide, with 5 fatalities. Citizens were only permitted to leave their homes for essential items such as food, medicine, water, pay their utility bills, as well as visit the hospital, pharmacies or bank, among others. The government established five key objectives to address the potential effects of the COVID-19 pandemic in Ghana. These were (1) limit and stop the importation of the virus, (2) contain its spread, (3) provide adequate care for the sick, (4) limit the impact of the virus on social and economic life and (5) expand domestic production capability to strengthen self-reliance [18].

Lockdown and testing in Ghana

The partial lockdown in Ghana was further extended for another one week starting 13 April 2020. As at 15 April 2020, there were 641 confirmed cases of COVID-19 in Ghana out of the 50,719 tested samples [15]. Of the confirmed positive cases, 548 had mild to moderate symptoms and 2 had severe symptoms. Death was seen among 8 of the positive tested cases. Of the 641 positive cases, 66 later tested negative upon treatment and had to wait for a second test, whilst 17 had been treated and were negative on repeated testing. As at 17 April 2020, 10 out of 16 regions in Ghana had COVID-19 cases; Greater Accra (541), Ashanti (53), Eastern (42), Northern (10), Upper West (7), and Central, North East, Volta and Western regions had one case each. During the extended partial lockdown in certain high risk regions in the country; Greater Accra Region (Accra, Tema), Ashanti Region (Kumasi) and Central Region (Kasoa), there was enhanced surveillance, public education, and restriction to movement.

By the end of the 3 weeks partial lockdown (19 April 2020), there was an estimated 86,000 people contact traced. Furthermore, 68,591 tests had so far been undertaken, and the outcome of a further 18,000

results were yet to be received [18,19]. Of the 68,591 screened; 1,042 (1.5%) were positive and 67,549 (98.5%) were negative. Nine deaths and 99 recoveries were recorded by 19 April 2020 [18]. Furthermore, 930 persons had been isolated, and were responding to treatment in their homes or in treatment-designated centers. For these categories, after treatment, they were to undergo two mandatory tests to ascertain recovery. The majority of the positive COVID-19 cases during contact tracing and testing were travelers who had recently arrived in Ghana or persons who may have had contact with these travelers. As at 19 April 2020, Ghana was the only country in Africa to have conducted more than 60,000 tests, and was ranked number one in Africa in terms of administering tests per million people [20].

During the period of partial lockdown, disinfection exercises against the potential spread of COVID-19 were also undertaken at market places, educational institutions and public and private facilities.

After partial lockdown

The President of Ghana announced the end of the partial lockdown on 19 April 2020, and this was to take effect at 1:00 am, 20 April 2020. The President also reiterated that the Ministry of Health will continue to monitor the spread of COVID-19 throughout Ghana, as well as urge citizens to practice social distancing and continue to wear face masks. Additionally, citizens were urged to frequently wash their hands with soap under running water and apply alcohol-based hand rubbing lotion after drying hands. Furthermore, the Government announced that it would impose lockdown in COVID-19 infection hotspots, if necessary [18,21]. The reasons for lifting the partial lockdown were based on a number of reasons. These included (1) better understanding of the nature of COVID-19, (2) success to date in containing its spread, (3) an enhanced testing programme, (4) the identification of potential hotspots, and (5) the expansion of isolation and treatment centers across the country. Despite the lifting of the partial lockdown, restrictions on religious and social gatherings were to continue, and closure of schools was still in force. Ghana's borders were also to remain closed.

Two hospitals in the Greater Accra Region of Ghana, Ga East Municipal and Bank of Ghana Hospitals, had been fully dedicated as COVID-19 treatment centers, whilst other major hospitals across the country had been identified as centers to support the management of this disease if needed. In addition, 3 major laboratories in the country; Noguchi Memorial Institute for Medical Research (NMIMR), Kumasi

Centre for Collaborative Research (KCCR) and the National Public Health Reference Laboratory (NPHRL), as well as 9 other state or government hospital laboratories, had been identified for logistical support to perform tests on samples to help with track and trace testing [20].

Opportunities in the midst of the pandemic in Ghana

A notable feat has been achieved by scientists at the University of Ghana's Noguchi Memorial Institute for Medical Research (College of Health Sciences), and the West African Centre for Cell Biology of Infectious Pathogens (College of Basic and Applied Sciences), with support from University of Ghana Computing Systems. The scientists successfully sequenced the genomes of SARS-CoV-2 from 15 of the samples obtained from confirmed COVID-19 cases in Ghana with the aid of Next Generation Sequencing (NGS) Core and a High-Performance Computing system [22]. Analysis of the data revealed that whilst some differences between the strains from various countries have been observed, all the 15 genomes generally resembled (> 92% similarity) the original strain found in Wuhan Province, China. Out of the 15 samples, 6 were from travelers who arrived from the United Kingdom (2), United States/United Arab Emirates (1), Norway (1), Hungary (1) and India (1), and 9 Ghanaian patients who had no travel history.

The government of Ghana instructed the Food and Drugs Authority (FDA) to issue certificates to local manufacturing companies and importers to source potential antivirals. The Government of Ghana has also introduced measures to facilitate increased local production of PPEs following the inability to import sufficient equipment due to lockdown measures in most exporting nations coupled with shortages within developed nations. For example, the government contracted local manufacturers to use local materials to produce 3.6 million pieces of PPE including nose masks, medical scrubs, hospital gowns and head gears [23]. The FDA has also provided guidelines and specifications for local manufacturers to produce affordable face masks. There was also an urgent need to seek indigenous solutions at least in the short-term to address shortages of hand sanitizers, which has resulted in the production and use of locally made hand sanitizers. To facilitate this, the FDA in Ghana fast-tracked testing and approval of alcohol (> 70 %) based hand sanitizers. However, post-market surveillance by the FDA revealed the presence of sub-standard alcohol

sanitizers (with alcohol content below 50%), and this is being addressed.

The Government of Ghana has also introduced the use of drones to enhance delivery of samples from suspected cases, as well as part of a new rapid results testing programme. With respect to the availability of ventilators in the country to manage critically ill COVID-19 patients, Ghana had over 100 in health facilities as of January, 2020. This was before the arrival of recently procured 307 ambulances for the National Ambulance Service equipped with mobile ventilators [24]. Arrangements have also been made for the procurement of 50 more ventilators [24]. Furthermore, a team of local professionals from Academic City University College, Ghana, has developed a baseline prototype of a mechanical ventilator to support the national efforts towards treating patients who develop severe symptoms of COVID-19 [25]. The power-controlled system should enable these locally-made mechanical ventilators to run on electricity, and can be built in 25 minutes once components become available.

Alongside this, most people in LMICs have resorted to improving their diets as well as using medicinal plant products or nutritional supplements with known immune boosting potential to help keep healthy during the pandemic. LMICs, such as Ghana could also explore the possibility of using medicinal plants (or their extracts) with known immune boosting and/or antiviral activities similar to other countries such as China [26]. However, care is needed.

Care is also needed with the use of hydroxychloroquine as studies have failed to show any clinical benefit whilst potentially harming patients resulting in, as mentioned, removal from WHO and Solidarity Trial [5,27]. The early hype though has resulted in shortages and price increases of hydroxychloroquine in pharmacies in LMICs including Ghana, and we will be exploring this further in future studies as it is now recommended in the national treatment guidelines [28-30].

Conclusion and recommendations

As the fight against COVID-19 continues; we believe countries need to apply setting-specific approaches to deal with the pandemic and also build on recommendations from the WHO and others [3]. These include dealing with potential issues regarding ethnicity and mortality as they arise, as well as learning from other countries [31]. We believe Ghana serves as a good example for LMICs including sub-Saharan African countries regarding potential steps that can be

introduced to minimize the impact of COVID-19. This is because as of 23 June 2020, there were 14,154 confirmed cases in Ghana with only 85 recorded deaths due to COVID-19 [32]. This compares with substantially more deaths seen among for instance Western European countries including Italy, Spain and the U.K with their substantially greater resourced healthcare systems. However, the authorities in Ghana cannot be complacent as lockdown measures ease [33]. Continuous research is also important to understand the dynamics of COVID-19 in all settings for prevention of future coronavirus outbreaks. We will be exploring further the potential impact of the current focus on COVID-19 on the management of other infectious and non-infectious diseases, including unintended consequences, as well as issues such as ethnicity and its subsequent impact on morbidity and mortality.

References

1. Drosten C, Gunther S, Preiser W, van der Werf S, Brodt HR, Becker S, Rabenau H, Panning M, Kolesnikova L, Fouchier RA, Berger A, Burguière AM, Cinatl J, Eickmann M, Escriou N, Grywna K, Kramme S, Manuguerra JC, Müller S, Rickerts V, Stürmer M, Vieth S, Klenk HD, Osterhaus DMEA, Schmitz H, Doerr HW (2003) Identification of a novel coronavirus in patients with severe acute respiratory syndrome. *N Engl J Med* 348: 1967–1976.
2. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, Ren R, Leung KS, Lau EH, Wong JY, Xing X, Xiang N, Wu Y, Li C, Chen Q, Li D, Liu T, Zhao J, Liu M, Tu W, Chen C, Jin L, Yang R, Wang Q, Zhou S, Wang R, Liu H, Luo Y, Liu Y, Shao G, Li H, Tao Z, Yang Y, Deng Z, Liu B, Ma Z, Zhang Y, Shi G, Lam TTY, Wu JT, Gao GF, Cowling BJ, Yang B, Leung GM, Feng Z (2020) Early transmission dynamics in Wuhan, China, of novel coronavirus–infected pneumonia. *New Engl J Med* 382: 1199-1207.
3. World Health Organization (WHO) (2020) Operational considerations for case management of COVID-19 in health facility and community: interim guidance, 19 March 2020. Available: <https://apps.who.int/iris/handle/10665/331492>. Accessed 30 March 2020.
4. World Health Organization (WHO) (2020) “Solidarity” clinical trial for COVID-19 treatments. Available: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/global-research-on-novel-coronavirus-2019-ncov/solidarity-clinical-trial-for-covid-19-treatments>. Accessed 12 April 2020.
5. World Health Organization (WHO) (2020) Coronavirus disease (COVID-19) Situation Report – 151. Available: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200619-covid-19-sitrep-151.pdf?sfvrsn=8b23b56e_2. Accessed 23 June 2020.
6. Beigel JH, Tomashek KM, Dodd LE, Mehta AK, Zingman BS, Kalil AC, Hohmann E, Chu HY, Luetkemeyer A, Kline S, Lopez de Castilla D, Finberg RW, Dierberg K, Tapson V, Hsieh L, Patterson TF, Paredes R, Sweeney DA, Short WR, Touloumi G, Lye DC, Ohmagari N, Oh MD, Ruiz-Palacios GM, Benfield T, Fätkenheuer G, Kortepeter MG, Atmar RL,

- Creech CB, Lundgren J, Babiker AG, Pett S, Neaton JD, Burgess TH, Bonnett T, Green M, Makowski M, Osinusi A, Nayak S, Lane HC; ACTT-1 Study Group Members (2020) Remdesivir for the Treatment of Covid-19 - Preliminary Report. Published online ahead of print. Available: <https://www.nejm.org/doi/10.1056/NEJMoa2007764>. Accessed 23 June 2020.
7. Institute for Health Metrics and Evaluation (IHME) (2020) New COVID-19 forecasts for Europe: Italy & Spain have passed the peak of their epidemics; UK, early in its epidemic, faces a fast-mounting death toll. 2020. Available: <http://www.healthdata.org/news-release/new-covid-19-forecasts-europe-italy-spain-have-passed-peak-their-epidemics-uk-early-its>. Accessed 13 April 2020.
 8. Institute for Health Metrics and Evaluation (IHME) (2020) New COVID-19 forecasts: US hospitals could be overwhelmed in the second week of April by demand for ICU beds, and US deaths could total 81,000 by July. 2020. Available: <http://www.healthdata.org/news-release/new-covid-19-forecasts-us-hospitals-could-be-overwhelmed-second-week-april-demand-icu>. Accessed 21 April 2020.
 9. El-Sadr WM, Justman J (2020) Africa in the Path of Covid-19. *N Engl J Med* 383: e11.
 10. Godman B, Basu D, Pillay Y, Mwita JC, Rwegera GM, Anand Paramadhas BD, Tiroyakgosi C, Okwen PM, Niba LL, Nonvignon J, Sefah I, Oluka M, Guantai AN, Kibuule D, Kalemeera F, Mubita M, Fadare J, Ogunleye OO, Distiller LA, Rampamba EM, Wing J, Mueller D, Alfiadl A, Amu AA, Matsebula Z, Kalungia A, Zaranyika T, Masuka N, Wale J, Hill R, Kurdi A, Timoney A, Campbell S, Meyer JC (2020) Review of Ongoing Activities and Challenges to Improve the Care of Patients With Type 2 Diabetes Across Africa and the Implications for the Future. *Front Pharmacol* 11: 108.
 11. Palombi L, Moramarco S (2018) Health in Sub-Saharan Africa: HIV, TB and Malaria Epidemiology. In Bartolo M, Ferrari F, editors. *Multidisciplinary Teleconsultation in Developing Countries*. Cham: Springer International Publishing AG. 3-16.
 12. United Nations Africa Renewal (2020) Coronavirus Updates and Resources. 7 May 2020. Available: <https://www.un.org/africarenewal/news/coronavirus/new-who-estimates-190-000-people-could-die-covid-19-africa-if-not-controlled>. Accessed 23 June 2020.
 13. World Health Organization (WHO) (2020) Coronavirus: Africa could be next epicentre, WHO warns. Available: <https://www.bbc.com/news/world-africa-52323375>. Accessed 10 April 2020.
 14. Nyabor J (2020) COVID-19: Over 1,400 Americans evacuated from Ghana. Available: <https://citinewsroom.com/2020/04/covid-19-over-1400-americans-evacuated-from-Ghana>. Accessed 15 April 2020.
 15. World Health Organization (WHO) (2020) WHO Coronavirus disease (COVID-2019) situation reports. Available: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>. Accessed 2 April 2020.
 16. Thornton J (2020) Covid-19: Keep essential malaria services going during pandemic, urges WHO. *BMJ* 369: m1637.
 17. Godman B, Haque M, McKimm J, Abu Bakar M, Sneddon J, Wale J, Campbell S, Martin AP, Hoxha I, Abilova V, Anand Paramadhas BD, Mpinda-Joseph P, Matome M, de Lemos LLP, Sefah I, Kurdi A, Oponga S, Jakupi A, Saleem Z, Hassali MA, Kibuule D, Fadare J, Bochenek T, Rothe C, Furst J, Markovic-Pekovic V, Bojanić L, Schellack N, Meyer JC, Matsebula Z, Phuong TNT, Thanh BN, Jan S, Kalungia A, Mtapuri-Zinyowera S, Sartelli M, Hill R (2020) Ongoing strategies to improve the management of upper respiratory tract infections and reduce inappropriate antibiotic use particularly among lower and middle-income countries: findings and implications for the future. *Curr Med Res Opin* 36: 301-327.
 18. Ghana News Agency (2020) Successful testing regime and controls inform lifting of lockdown. Issued April 20 2020. Available: <https://newsghana.com.gh/successful-testing-regime-and-controls-inform-lifting-of-lockdown/>. Accessed 21 April 2020.
 19. Classfm (2020) Backlog of 18,000 COVID-19 samples being cleared–Akufo-Addo. Available: <https://www.Classfmonline.com/news/politics/Backlog-of-18-000-COVID-19-samples-being-cleared-Akufo-Addo-13128>. Accessed 20 April 2020.
 20. Ghana News Agency (2020) Ghana tops Africa’s ranking for COVID-19 testing. Available: <https://newsghana.com.gh/ghana-tops-africas-ranking-for-covid-19-testing>. Accessed 20 April 2020.
 21. Zurek K (2020) COVID-19: President Akufo-Addo lifts partial lockdown effective Monday. Available: <https://www.graphic.com.gh/news/general-news/prez-akufo-addo-covid-update-7.html>. Accessed 20 April 2020.
 22. Public Affairs, University of Ghana (2020) New Release - University of Ghana scientists sequence genomes of novel coronavirus. Available: <https://www.ug.edu.gh/news/news-release-university-ghana-scientists-sequence-genomes-novel-coronavirus>. Accessed 20 April 2020.
 23. Ngenbe T (2020) Companies ready to deliver PPE mid-May. Available: <https://www.graphic.com.gh/news/general-news/ghana-news-companies-ready-to-deliver-ppe-mid-may-managers.html>. Accessed 23 April 2020.
 24. Zurek K (2020) Coronavirus: Ghana has over 400 ventilators. Available: <https://www.graphic.com.gh/news/general-news/coronavirus-ghana-has-over-400-ventilators.html>. Accessed 1 April 2020.
 25. Ghana News Agency (2020) Ghana’s locally made mechanical ventilator needs support. Available: <https://newsghana.com.gh/ghanas-locally-made-mechanical-ventilator-needs-support>. Accessed 9 April 2020.
 26. Li Y, Liu X, Guo L, Zhong D, Zhang Y, Clarke M, Jin R (2020) Traditional Chinese herbal medicine for treating novel coronavirus (COVID-19) pneumonia: protocol for a systematic review and meta-analysis. *Syst Rev* 9: 75.
 27. Nuffield Department of Population Health (2020) RECOVERY Trial: No clinical benefit from use of hydroxychloroquine in hospitalised patients with COVID-19. Available: <https://www.recoverytrial.net/news/statement-from-the-chief-investigators-of-the-randomised-evaluation-of-covid-19-therapy-recovery-trial-on-hydroxychloroquine-5-june-2020-no-clinical-benefit-from-use-of-hydroxychloroquine-in-hospitalised-patients-with-covid-19>. Accessed 23 June 2020.
 28. Debrah EK (2020) Chloroquine, coronavirus and Ghana’s preparedness: old hero to the rescue. Available: <https://www.myjoyonline.com/news/health/chloroquine-coronavirus-and-ghanas-preparedness-old-hero-to-the-rescue/>. Accessed 23 June 2020.
 29. Abena PM, Declodt EH, Bottieau E, Suleman F, Adejumo P, Sam-Agudu NA, Muyembe Tamfum JJ, Seydi M, Eholie SP, Mills EJ, Kallay O, Zumla A, Nachega JB (2020) Chloroquine and Hydroxychloroquine for the Prevention or Treatment of

- COVID-19 in Africa: Caution for Inappropriate Off-label Use in Healthcare Settings. *Am J Trop Med Hyg* 102: 1184-1188.
30. Haque M, Islam S, Iqbal S, Urmi UL, Kamal ZM, Shuvo SA, Rahman A, Kamal M, Haque M, Jahan I, Islam Z, Hossain MM, Munzur-E-Murshid, Sefah I, Kurdi A, Godman B (2020) Availability and price changes of potential medicines and equipment for the prevention and treatment of COVID-19 among pharmacy and drug stores in Bangladesh; findings and implications. *Bangladesh J Med Sci* 19: S36-S50.
 31. Kirby T (2020) Evidence mounts on the disproportionate effect of COVID-19 on ethnic minorities. *Lancet Respir Med* 8: 547-548.
 32. World Health Organization (WHO) (2020) Coronavirus disease (COVID-19) Situation Report – 155. Available: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200623-covid-19-sitrep-155.pdf?sfvrsn=ca01ebe_2. Accessed 23 June 2020.
 33. Shaban ARA (2020) Ghana coronavirus: 8,070 cases, conditional lifting of most restrictions. Available: <https://www.africanews.com/2020/06/01/coronavirus-updates-from-ghana/>. Accessed 23 June 2020.

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