

# The spread of Yellow fever amidst the COVID-19 pandemic in Africa and the ongoing efforts to mitigate it

To the Editor,

Yellow fever (YF), a viral illness transmitted by *Aedes* and *Haemagogus* mosquitoes, is a severe public health concern in countries of Sub-Saharan Africa. It can manifest itself in several ways, from a self-limited, mild febrile illness to serious hemorrhage and liver disease.<sup>1</sup> Large epidemics of YF occur when infected individuals spread the virus to densely populated areas with high mosquito densities and where the majority of people lack immunity due to a lack of vaccination. In these situations, infected mosquitos spread the virus from person to person.

In Africa, 27 countries are at the greatest risk of yellow fever epidemics. YF is thought to affect 84,000–170,000 people in Africa each year, with 29,000–60,000 deaths. In 2016, 965 cases of YF were confirmed, and about 400 people died in two related urban YF outbreaks in Angola and the Democratic Republic of the Congo. The outbreak necessitated the manufacture of more than 28 million doses of YF vaccine, depleting the global vaccine supply. It also diverted public health officials' focus away from other problems impacting health systems.<sup>2</sup>

Since YF virus infects a multitude of primates by a plethora of vectors, parallel pools of transmission take place. The preventive strategies against YF are based on the vaccines, which fortunately exist for decades, and on the elimination of mosquito breeding grounds. Despite the tons of efforts put into by the local authorities and the WHO efforts to eliminate the disease by launching ambitious vaccination programs, vaccination against YF is still not at the expected levels. A study done in Nigeria stated that low vaccine uptake has caused an outbreak in 2019. The study suggests that low vaccination rates were due to not seeking medical attention priorly.<sup>3</sup>

As in other countries in the world, such as Brazil,<sup>4–6</sup> India,<sup>7</sup> and Pakistan,<sup>8</sup> the coronavirus disease 2019 (COVID-19) outbreak also had a negative impact on preventive measures against vector-borne infectious diseases on the African continent, causing serious delays and postponements. Nigeria already faces the consequences of lagging into YF vaccine distribution which is close to setting off an epidemic in the middle of the COVID-19 outbreak.<sup>9</sup> In analogous fate are Ghana, Ethiopia, Congo, Guinea, and so forth due to the constant movement of people and native fauna populations.<sup>10,11</sup> A disentanglement to the allocation problems may arise from a recently published clinical trial, reporting that fractionalizing vaccine doses up to one-fifth can induce the seroconversion in eligible populations.<sup>12</sup> Despite the efforts, routine immunization has dropped significantly.<sup>9</sup>

COVID-19 continues to cause significant medical unattendance. Despite the fact that Africa consists of relatively young populations, with active community health structures educated in pandemics and favorable climate, the COVID-19 outbreak brought a notable growth of hospital workload affecting patient management.<sup>13</sup> Despite the reduction of patient visits, the increased demands for critically ill patients in understaffed intensive care units result in significantly less time dedicated to non-COVID-19 patient care,<sup>14</sup> while the landscape of public restrictions for the deterioration of the COVID-19 pandemic is rapidly evolving with disproportional effects among rural and urban areas. The collateral political damages from incidents of police enforcement abuse and brutality in South Africa with regard to racial discrimination, the assignment of police authorities from the government to people in Ghana, in conjunction with economic recession might cause a new exacerbation of YF in African regions.<sup>15</sup>

Therefore, YF has been increasing its incidence in Africa for the last years and it is considered a re-emerging disease. For this reason, not only African authorities but also international institutions are taking action for its control and prevention by mobilizing resources, forming global collaborations, and strategies implementing the principle of prevention while there's no treatment for YF.<sup>16</sup>

Since effective vaccination for YF is developed, efforts begin from immunization. Mass immunization is implemented in high-risk areas for the control and prevention of outbreaks and regional transmission. These strategies include routine infant immunization, vaccination of travelers in YF endemic areas. In addition, the fact that International Health Regulations established the legally binding framework for countries to have the right to require the provision of YF vaccination certificates by the traveler assists in decreasing transmission chances.<sup>17</sup>

Moreover, efforts for the control and prevention of YF include mosquito control programs since mosquitoes constitute vectors of YF. This is achieved by the elimination of mosquito breeding sites using larvicides in places collecting standing water. Furthermore, the number of mosquitoes is reduced by insecticide spraying during urban epidemics.<sup>17</sup>

In addition to that, emergency vaccination campaigns are being performed as a form of preparedness and response. WHO recommended that each country of high risk attains at least one national laboratory where YF blood tests can be done. At the same time, one laboratory-confirmed case in an unvaccinated population is considered an outbreak.<sup>17</sup>

For that reason, WHO provides technical support to the African government, guidance on integrating YF, trains teams to conduct large-scale campaigns, and assists in increasing national laboratory capacities. Also, to ensure rapid response to outbreaks in high-risk countries, the International Coordinating group maintains an emergency stockpile of YF vaccines.


Finally, international initiatives such as the Eliminate Yellow Fever Epidemics Strategy bring countries together to tackle the increased risk of YF in a coordinated manner, and it is an opportunity for demonstrating new ways of managing re-emerging infectious diseases.

## CONFLICT OF INTERESTS

All the authors declare that there are no conflict of interests.

## AUTHOR CONTRIBUTIONS

Mohammad Yasir Essar, Shoaib Ahmad, and Abdullahi T. Aborode conceptualized the concept for this letter. Sude Çavdaroglu, Mohammad Mehedi Hasan, Anmol Mohan, and Eleni Xenophontos wrote the first draft. Ana Carla dos Santos Costa, Christos Tsagkaris and Oumaima Outani edited the second draft. Shoaib Ahmad, Aborode and Yasir Essar made the critical comments and revision. All authors revised and approved the final draft.

Sude Çavdaroglu<sup>1</sup> 

Mohammad Mehedi Hasan<sup>2,3</sup> 

Anmol Mohan<sup>4</sup> 

Eleni Xenophontos<sup>5</sup> 

Ana Carla dos Santos Costa<sup>6</sup> 

Abdullahi T. Aborode<sup>7</sup> 

Christos Tsagkaris<sup>8</sup> 

Oumaima Outani<sup>9</sup>

Shoaib Ahmad<sup>10</sup> 

Mohammad Yasir Essar<sup>11</sup> 

<sup>1</sup>Faculty of Medicine,

Maltepe University, Istanbul, Turkey

<sup>2</sup>Department of Biochemistry and Molecular Biology, Faculty of Life Science,

Mawlana Bhashani Science and Technology University, Tangail, Bangladesh

<sup>3</sup>Division of Infectious Diseases,

The Red-Green Research Centre, BICCB, Dhaka, Bangladesh

<sup>4</sup>Department of medicine,

Karachi Medical and Dental College, Karachi, Pakistan

<sup>5</sup>Medical School,

University of Cyprus, Nicosia, Cyprus

<sup>6</sup>Department of Internal Medicine,

Federal University of Bahia, Salvador, Bahia, Brazil

<sup>7</sup>Department of Chemistry,

University of Ilorin, Nigeria

<sup>8</sup>Faculty of Medicine,

University of Crete, Heraklion, Greece

<sup>9</sup>Department of Medicine, Faculty of Medicine and Pharmacy of Rabat, Mohammed 5 University, Morocco

<sup>10</sup>Department of Medicine and General Surgery, Punjab Medical College, Faisalabad, Pakistan

<sup>11</sup>Department of Medical Research Center, Kateb University, Kabul, Afghanistan

## Correspondence

Mohammad Yasir Essar, Medical Research Center, Kateb University, 1001 Kabul, Afghanistan.

Email: m.yasir.essar@kateb.edu.af

## ORCID

Sude Çavdaroglu  <http://orcid.org/0000-0003-1752-003X>

Mohammad Mehedi Hasan  <https://orcid.org/0000-0002-3871-889X>

Anmol Mohan  <http://orcid.org/0000-0002-8312-2884>

Eleni Xenophontos  <http://orcid.org/0000-0001-8124-3677>

Ana Carla dos Santos Costa  <https://orcid.org/0000-0001-8486-7899>

Abdullahi T. Aborode  <https://orcid.org/0000-0003-2516-5920>

Christos Tsagkaris  <http://orcid.org/0000-0002-4250-574X>

Shoaib Ahmad  <http://orcid.org/0000-0002-7241-7724>

Mohammad Yasir Essar  <https://orcid.org/0000-0002-6554-7619>

## REFERENCES

1. Moghe PV, Berthiaume F, Ezzell RM, Toner M, Tompkins RG, Yarmush ML. Culture matrix configuration and composition in the maintenance of hepatocyte polarity and function. *Biomaterials*. 1996; 17(3):373-385. [https://doi.org/10.1016/0142-9612\(96\)85576-1](https://doi.org/10.1016/0142-9612(96)85576-1)
2. WHO. Yellow Fever | WHO | Regional Office for Africa. Published 2015. <https://www.afro.who.int/health-topics/yellow-fever>. Accessed April 9, 2021.
3. Umoke PCI, Umoke M, Eyo N, et al. Delay in health-seeking behaviour: Implication to yellow fever outcome in the 2019 outbreak in Nigeria. *Heal Soc Care Community*. 2021. <https://doi.org/10.1111/hsc.13329>
4. Jain S, Rocha ICN, Maheshwari C, et al. Chikungunya and COVID-19 in Brazil: the danger of an overlapping crises [published online ahead of print April 22, 2020]. *J Med Virol*. 2021:jmv.26952. <https://doi.org/10.1002/jmv.26952>
5. Rabiou AT, Mohan A, Çavdaroglu S, et al. Dengue and COVID-19: a double burden to Brazil [published online ahead of print April 03, 2021]. *J Med Virol*. 2021. <https://doi.org/10.1002/jmv.26955>
6. Costa ACS, Hasan MM, Xenophontos E, et al. COVID-19 and Zika: an emerging dilemma for Brazil [published online ahead of print April 10, 2021]. *J Med Virol*. 2021. <https://doi.org/10.1002/jmv.27006>
7. Phadke R, Mohan A, Çavdaroglu S, et al. Dengue amidst COVID-19 in India: the mystery of plummeting cases [published online ahead of print April 06, 2021]. *J Med Virol*. 2021. <https://doi.org/10.1002/jmv.26987>
8. Ahmad S, Tsagkaris C, Aborode AT, et al. A skeleton in the closet: the implications of COVID-19 on XDR strain of typhoid in Pakistan. *Public Heal Pract*. 2021;2:100084. <https://doi.org/10.1016/j.puhp.2021.100084>
9. MSF. Yellow fever in depth | MSF. <https://www.msf.org/yellow-fever-depth>. Accessed April 9, 2021.
10. UNDP. UNDP: In Ethiopia, pandemic struck amid slowing growth, locust invasion, and disease outbreaks | Africa Renewal. Published

- June 23, 2020. <https://www.un.org/africarenewal/news/coronavirus/undp-ethiopia-pandemic-struck-amid-slowng-growth-locust-invasion-and-disease-outbreaks>. Accessed April 9, 2021.
11. UN. Ghana's community nurses deliver child health care amid COVID-19 | Africa Renewal. Published July 16, 2020. <https://www.un.org/africarenewal/news/ghana%27s-community-nurses-deliver-child-health-care-amid-covid-19>. Accessed April 9, 2021.
  12. Juan-Giner A, Kimathi D, Grantz KH, et al. Immunogenicity and safety of fractional doses of yellow fever vaccines: a randomised. *Double-Blind, Non-Inferiority Trial*. 2021;397:119-127. [https://doi.org/10.1016/S0140-6736\(20\)32520-4](https://doi.org/10.1016/S0140-6736(20)32520-4)
  13. Soy A Coronavirus in Africa: Five reasons why Covid-19 has been less deadly than elsewhere - BBC News. Published October 8, 2020. <https://www.bbc.com/news/world-africa-54418613>. Accessed April 9, 2021.
  14. Mash RJ, Presence-Vollenhoven M, Adeniji A, et al. Evaluation of patient characteristics, management and outcomes for COVID-19 at district hospitals in the Western Cape, South Africa: descriptive observational study. *BMJ Open*. 2021;11(1):e047016. <https://doi.org/10.1136/bmjopen-2020-047016>
  15. Haider N, Osman AY, Gadzekpo A, et al. Lockdown measures in response to COVID-19 in nine sub-Saharan African countries. *BMJ Glob Heal*. 2020;5(10):21. <https://doi.org/10.1136/bmjgh-2020-003319>
  16. CDC. Yellow Fever. <https://www.cdc.gov/yellowfever/index.html>. Accessed April 9, 2021.
  17. WHO. Yellow fever. Published May 7, 2019. <https://www.who.int/news-room/fact-sheets/detail/yellow-fever>. Accessed April 9, 2021.