

## Essay



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## Guinea worm eradication: the need for sustained surveillance using One Health approach amidst COVID-19 pandemic and worsening armed conflicts in Nigeria

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## Abstract

*Pockets of cases of guinea worm disease exist globally, despite several deadlines set for eradication. Previously, Nigeria was known to be endemic for guinea worm disease, until 2008 when it recorded zero case. In the past, guinea worm was thought to be an exclusive human disease. However, recent evidences have implicated animals. Hence, there is need for the use of novel methods of surveillance that integrates human, animal and environmental health as one. Guinea worm may find its way back into our midst as Nigeria faced numerous security challenges in addition to COVID-19 pandemic capable of negatively impacting surveillance efforts. Hence, multidisciplinary approach using one health should be employed to sustain the gains made in guinea worm eradication efforts.*

## Essay

Globally, information from the center for disease control and prevention (CDC) revealed the failure to eradicate guinea worm despite three deadlines set within the last thirty years [1]. Even though significant achievement has been made by reduction of cases from over three million cases in the 1980s to about 50 human cases in 2019. Only six countries have reported guinea worm disease worldwide for the past six years. The countries are Chad, Angola, Cameroun, Mali, South Sudan and Ethiopia [2]. There is still the need to do more in terms of surveillance and public health interventions to achieve success of this eradication efforts [3,4]. After the certification of 197 countries (Nigeria inclusive) around the world free of guinea worm transmission as far back as 2014 and a fall in the incidence of the disease in the endemic area, the International commission for the certification of dracunculiasis eradication (ICCDE) considered that the guinea worm eradication program (GWEP) was entering an “endgame”; situation [5]. However, the global initiative to eradicate guinea worm disease has pushed its target date to 2030 and the re-emergence of the disease in an area it was previously eradicated will be a great set back to the world, more so from the most populous nation in Africa Nigeria. Consequently, efforts must be intensified to sustain surveillance at all levels and regardless of the risk involved.

**The Nigerian situation:** the eradication campaign for guinea worms started at center for disease control (CDC) in 1980, with guinea worm eradication program (GWEP) also called DEP (dracunculiasis eradication program) put in place [6]. Nigeria was formerly known to be having high cases of dracunculiasis but was able to bring this trend to zero as far back as 2008 upon which the international commission for the certification of dracunculiasis eradication (ICCDE) endorsed the country for certification in 2013 and subsequently certified free of guinea worm the same year [7]. It achieved this feat in 2009 as a result of concerted

efforts by the former Nigerian head of state (Yakubu Gowon), the carter center and other major health organization and group across the globe. It came as a great relief for a country known to be endemic for the disease for a very long time; Nigeria was reported to be having two-thirds to three-fourths of the world's burden of dracunculiasis as at 1986 to 1989 [6]. Cases of guinea worm diminished greatly and virtually disappeared from the country from 1986 to 2008. Not a single case was reported from Nigeria even though countries not far from Nigeria like Chad, Cameroun, Mali, South Sudan, and far away Angola are still reporting cases from 2008 up to date [6]. Having adopted the GWEP/DEP programs, Nigeria with a fairly stable political and communal clashes was able to eradicate guinea worm infection despite several challenges leaving countries like South Sudan, Chad, Mali, Cameroun, Ethiopia and Angola in the struggle [6,7]. However, the geographical/sociocultural link between Nigeria and some of the neighbouring countries (like Chad and Cameroun) with the worsening trans-border armed conflicts is a major threat for Nigeria and presents a potential danger of renewed guinea worm transmission in the country.

**Microbiology of guinea worm infection:** guinea worm a name bequeathed to the worm by the Swiss traveller during their sojourn through the Gulf of Guinea around 1611 is a tissue nematode of species *Dracunculus medinensis*; it is the biblical fiery serpent that tormented the Israelites during their sojourn in the wilderness [6,8]. The intermediate host of the worm is a water flea by the name copepods or cyclops. It therefore requires that the larva of the worm is passed into the freshwater where it is taken up by copepods within three days of larva existence in the freshwater, otherwise the larva dies off. It then develops into infective larva in the tiny crustacean. The larva gets into mammalian host by drinking water infested with these crustaceans, when the insect dies and digested in the intestine, the worm emerges and burrows through the abdominal wall

into the abdominal cavity and retroperitoneal space where it matured into full adults. Male and female worms copulate, the male dies while the gravid female migrate into the subcutaneous tissue and around a year causes a blister on the skin through which it emerges slowly over days or weeks. As they emerge and become extruded from body the larvae are passed out which when get in contact with freshwater are ingested by copepods to develop into the infective larvae [6,9]. There is neither an effective prophylactic drug nor a vaccine for guinea worm unlike small pox and there are pets that can serve as reservoir of the infection [9,10]. The interplay between this pathogen, its intermediate host/reservoir pets and infected water bodies with the human victims makes the one health approach to controlling it very imperative. This is more important in low resource settings like Nigeria due to weak and relatively poorly coordinated health systems.

**The One Health approach in tackling guinea worm infection:** the one health approach has been recognized as a holistic system that integrates human, animal and environment health in disease control and prevention [2]. This is because it has been shown that no one specialist or expert is enough to solve emerging and re-emerging health challenges that transverse different species in our ecosystem [11]. Formerly, one of the major reasons proposed for targeting guinea worm for eradication after the success of smallpox eradication was the assumption that the guinea worm is primarily a human disease. However, recent evidences have proven this as not factual [2]. Dogs were noted as the reservoirs for resurgent cases of guinea worm in Chad by the year 2011. In Ethiopia, guinea worm parasite has also been detected from dogs, cats and baboons, raising a new surveillance challenge from a previously neglected area [1]. There was insinuation that fish could as well played a role in the transmission, as a ferret fed with fish that has eaten copepods develops dracunculiasis [12]. This underscores the importance of proper cooking of

fish or any other seafoods before eating. There were also report that amphibians like frog also act as paratenic host [9,12,13]. It was later established that frogs and small fish are an integral component of the guinea worm lifecycle [1]. Guinea worm disease also affect domesticated animals, especially cats and dogs, probably from consumption of fish or frog. Guinea worm has also been reported from donkeys, baboons and leopards, even though the leopard case was not taken as an official case as the worm did not emerge from the leopard but was retrieved from its corpse [2]. The species of guinea worm that was isolated from dog in Chad shares a common genome with the species affecting human [6] which means these domesticated animals could serve as a reservoir of the infection. Another paradoxical relationship that needs to reawaken our curiosity and interest in one health is that fact from 2012 till present the number of reported human cases assumes a decline, the number of animal case assumes a steady rise when looking at the global picture. However, when looking at the local data from specific countries like the Chad republic, there appear to be a direct relationship between rising incidence in animals and risen cases among humans [2]. The implication of this finding is that without concerted targeted approach we may end up having an increase in human cases due to the interplay between human and animals in their environment. All these evidences lead to an undisputable fact that without approaching surveillance taken into cognizance the role of animal health, behaviors and migration within the context of the environment in the transmission dynamics of Guinea worm eradication will lead to a futile attempt at any effective eradication effort [2]. Since the year 2015, the number of countries reported re-emergence have increased and this may be attributable to inadequate surveillance and the role of unidentified animal reservoirs among others leading credence to use of novel methods of surveillance that integrates human, animal and environmental health as one. Figure 1 shows this relationship. Therefore, Nigeria ought

to harness and adopt the one health approach to sustain the guinea worm free status.

**Challenges, rising armed banditry, kidnapping, “Boko Haram”, indigenous people of the Biafra, unknown gunmen and political agitations:** mass conflicts, mass migration and refuges crises are proven factors that facilitate the dissemination of the guinea worm parasite and dampen surveillance efforts [1]. Nigeria is currently battling with Boko haram/Islamic State of West Africa Province (ISWAP) in the north-east region of the country, armed banditry and kidnapping/ISWAP in the north-west region, farmers/herders’ clashes in the north-central region, rising tide of unknown gunmen, ritual killings, Indigenous People of the Biafra (IPOB)/separatist movements in the south-east region and to a lesser extent the south-south region of the country and cult killings in the southwest region of the country [14,15]. The country has never had it this bad and there is the real fear that these may negatively impact on surveillance efforts and make active case search and management difficult in case of reemerging guinea worm infections. Evidence has shown that armed conflicts trigger ecosystem changes in the affected area. In addition, dispensaries, clinics and hospitals have been majorly destroyed in areas worse hit by these violent conflicts [14]. This may further negatively impact on surveillance efforts. Furthermore, it is a well-known fact that instability in politics with non-maintenances of old structures, social unrest, kidnapping, political agitation and the crisis of banditry makes accessibility to villages and rural hard to reach population difficult. These are among secondary factors that may be responsible for Guinea worm re-emergence in other regions of the world that have been certified free of guinea worm. It is primarily due to inability of surveillance team to reach and detect these underserved populations, making truth the speculation that we are not yet there in terms of eradication effort [2,16]. Nigeria needs to devise an urgent means to end these conflicts or to improve access to healthcare needs at all the affected regions. This is because one of

the major strategies for guinea-worm eradication in Nigeria has been the active case search, whereby thousands of local volunteers are utilized to conduct house-to-house search for the disease [17,18]. Lack of surveillance therefore portends danger for maintenance and sustenance of eradication efforts.

**Challenges; COVID-19 pandemic:** the COVID-19 pandemic affected Nigeria similar to other parts of the world in the early 2020s worsening the global health security of the country in terms of prolonged impact of lock-downs, worsening social stability, inadequacy of supplies, consumables and thereafter the migration of trained personnel to developed world [15]. Studies have revealed that the COVID-19 pandemic further worsens an already stunted economic growth in the country and also humanitarian efforts in these crises' prone areas [15]. Nigeria has registered 258, 874 confirmed COVID-19 cases as at 12<sup>th</sup> of July, 2022 with 3144 deaths recorded [19]. However, Nigeria has administered 50, 619, 238 doses of vaccines with 24.56% total doses administered per 100 population which still inadequate to curb against COVID-19 and its variants [20]. Consequent upon this COVID-19 situation and if Guinea eradication efforts must be sustained, there should be efforts to intensify the equitable vaccine distribution in addition to other non-pharmacological measures to curtail the pandemic whilst.

**Final note:** as Nigeria celebrate the end of a disease era in the country, the scourge may find its way back to previously endemic communities that were declared as having eradicated the disease due to the double challenges of insecurity, COVID-19. There should be deliberate attempt to protect the most vulnerable; women, children, refugees, displaced persons, the farmers, fishermen, the villagers and people living in rural hard to reach and underserved population need to be put in place to prevent the spread. This should be done through the integration of animal health and environmental sampling by emphasizing the role of veterinarians, environment health specialists

with human doctors, laboratorians and epidemiologist to sustain this eradication drive. Surveys needed to be conducted in all the previously recognized endemic areas for the disease. This surveillance should extend to other remote parts of the country that may not be opportune to have access to safe water. Human, animal and environmental surveillance for more cases should be mounted for early detection and proper treatment [21]. Other measures that need to be emphasize are health education on boiling and filtrations of water in villages that are still drinking water from ponds, streams and shallow wells and also the proper disposal wastes so as not to contaminate the available source of water in the community [9]. It is hoped that with the support of the government and other non-governmental agencies in providing material, technical and financial support, the ugly trend of guinea worm infection maybe halted from Nigeria forever.

## Conclusion

Even though, Nigeria has successfully eradicated guinea worm and has remained free of the disease for the last 15 years. Guinea worm infection may find its way back into our midst, especially during this time that the country is facing multiple armed conflicts in almost all its geopolitical zones with a health system that is just recovering from the COVID-19 pandemic. A multidisciplinary approach using one health concept should be employed in the country to sustain the gains made in guinea worm eradication efforts.

## Competing interests

The authors declare no competing interests.

## Authors' contributions

Yahaya Mohammed: conceptualization, drafting the article, approval of final version; Sabitu Muhammad Zainu: conceptualization, drafting the article, approval of final version; Mohammed

Mohammed Manga: design, drafting the article, approval of final version; Ahmed Kolawole Jimoh: literature search, drafting the article, approval of final Version; Emmanuel Oloche Egbe: literature search, drafting the article, approval of Final Version; Jibril Abubakar: literature search, drafting the article, approval of final version; Yahaya Saminu: literature search, drafting the article, approval of final version; Salma Muhammad Galalain: literature search, intellectual input to article draft, approval of final version; Surayya Umar Lawal: literature search, intellectual input to article draft, approval of final version; Kabir Mohammed: modification of article draft, intellectual input, approval of final version; Daniel Zanyu Egah: modification of article draft, intellectual input, approval of final version. All the authors have read and agreed to the final manuscript.

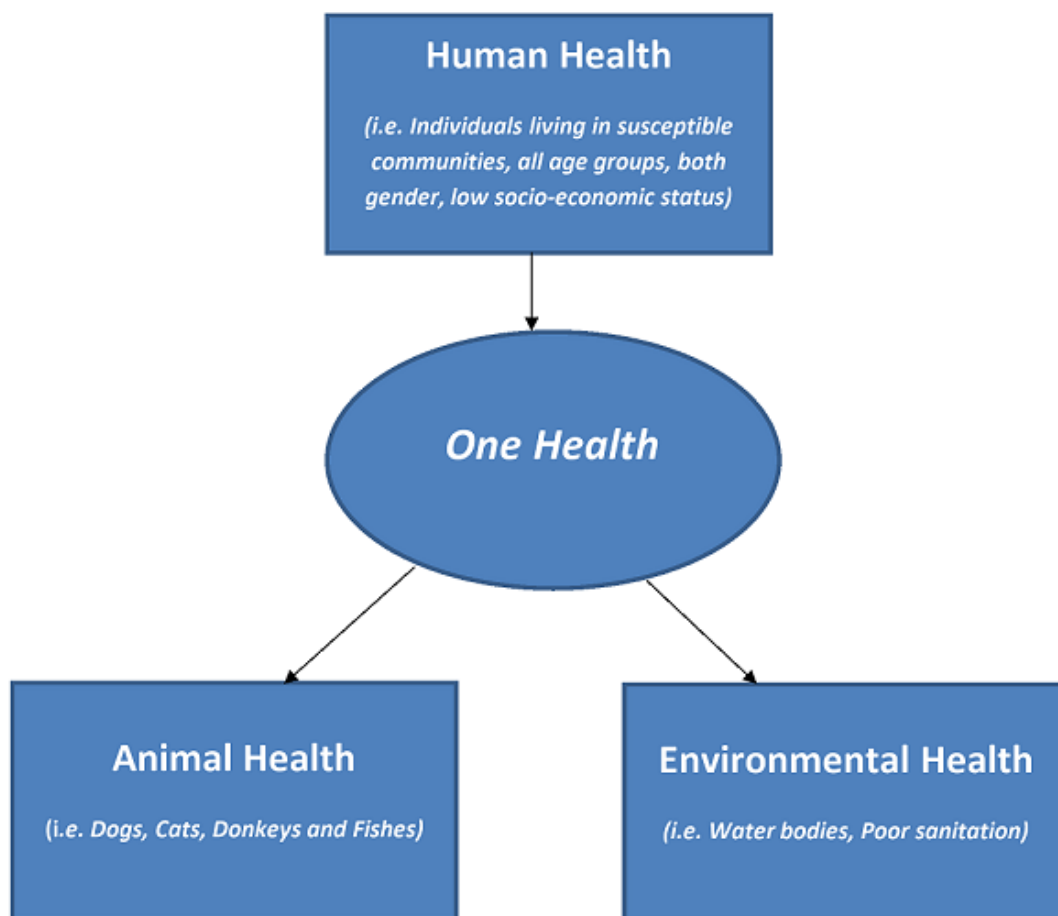
## Figure

**Figure 1:** an interplay between the role of human, animals and environment in response to the guinea worm eradication efforts and the central role of one health in strategic control efforts

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**Figure 1:** an interplay between the role of human, animals and environment in response to the guinea worm eradication efforts and the central role of one health in strategic control efforts