

Mobile health approaches to disease surveillance in Africa; Wellvis COVID triage tool

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Abstract

COVID-19 has rapidly spread across the globe and was declared a pandemic by the World Health Organization (WHO). The COVID-19 infection continues to spread across Africa. In Africa, mobile phone applications have been used for the surveillance and reporting of infectious diseases such as malaria, measles, polio, and other notifiable diseases as mandated by the WHO. A good example is the early warning alert and response system. We developed an eight-question triage tool using the Nigerian Centre for Disease Control surveillance case definitions for new coronavirus disease. Based on the assessed risk level we offered advice and guidance on the next steps. A user-administered tool such as this is vital to COVID19 control. It is also significant in relieving the burden on health systems, providing information on national health guidelines for prevention and control, fostering the participation of citizens, and giving them the next steps, pandemic control efforts become more effective.

Keywords

Africa, covid-19, mHealth < Psychology, surveillance, disease, epidemiology < medicine

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Introduction

The novel outbreak, now known as COVID-19 was reported in Wuhan City, Hubei Province, China in December 2019. Scientists worldwide are still learning new things about this SARS-CoV-2 (which is the causative organism for the disease). The transmission of this disease occurs through human-to-human contact. The symptoms are mainly flu-like (fever, sore throat, cough) and in severe cases, metabolic acidosis, septic shock, respiratory failure, and coagulopathy have been reported.¹ A loss of taste or smell, diarrhea, fatigue, and body pain have also been reported. It is especially critical to identify the presence of fever, cough, respiratory difficulties, and myalgia as being more of a pointer to COVID19 than when they occur singly, as seen in common conditions like colds and malaria.²

COVID-19 has rapidly spread across the globe and was declared a pandemic by the World Health Organization (WHO) on the 11th of March 2020.³ The first case in Africa was detected and confirmed in Egypt on the 14th of February 2020 in a 33-year-old man of

foreign origin. Nigeria recorded her first case on 28th February 2020. The COVID-19 infection continues to spread across Africa; the number of COVID-19 cases and mortality recorded as of November 12th, 2020 are 1,935,382 and 46,569 respectively.⁴ To respond to the pandemic, the Nigeria Centre for Disease Control (NCDC) initially opened phone lines for the public to conduct assessments and make reports remotely. However, these soon became overwhelmed and could

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not handle the surge of calls from the members of the public who had no alternative from the available phone lines. There was no known mobile application available to the public in Nigeria and across Africa at that time that could ease this process of symptom assessment and reporting to the NCDC.

Mobile phone applications have been used in Nigeria and across Africa by health workers for the surveillance and reporting of infectious diseases such as malaria, measles, polio, and other notifiable diseases; this includes E-Surve, which is a mobile-based tool that health workers can use to file reports of notifiable diseases and other epidemic-prone diseases.⁵ The early warning alert and response system (known as EWARS-in-a-Box) was used in Mozambique to detect priority epidemic-prone diseases and allow a quick response rapidly, and the Digicomms Ebola contact tracing app was used in Sierra Leone.⁶⁻⁸

Nigeria has one of the fastest-growing rates of mobile phone ownership in the world, while feature phones constitute the largest percentage of phones used in Nigeria (and Africa), smartphone ownership is growing and presently up to 50 Million Nigerians own smartphones.⁹ This has created opportunities to deliver health services to bridge gaps in health manpower and facility shortage which was worsened by the COVID-19 pandemic.¹⁰ We decided to build a public-facing tool (Wellvis) that can be deployed through mobile devices for the surveillance of COVID-19 in Africa and possibly other continents. It will be useful in the process of risk assessment and establishing direct self-reporting to the disease control bodies. We also believe that it will be an excellent way to provide tailored information based on the level of risk detected and offer guidance on what individuals need to do.

Methods

We used the Nigeria Centre for Disease Control (NCDC) surveillance case definitions for new coronavirus disease (version 1) to create a series of questions on symptoms and exposure to COVID-19.¹¹ The tool had eight questions. The responses allowed were ‘yes’ or ‘no’ to the various questions. The “no” responses were coded as “0,” and “yes” responses were scaled 1,3,5 to the questions based on how significant we believed they were likely to indicate exposure (Table 1). The choice of using 1, 3, and 5 as scores for “yes” answers to different questions were based on how we believed the questions were indicative of the likelihood of exposure. Therefore, the ones we determined to be of the highest exposure had a score of 5 for the Yes, and the lowest had 1. These scores were also selected to make it easy to

Table 1. COVID-19 triage questions and scoring algorithm.

Question	Scoring
Do you have fever?	Score 0 if No
Fever is body temperature above 38°C or 100.4°F	Score 1 if Yes
Do you have a cough?	Score 0 if No
	Score 1 if Yes
Do you have difficulty breathing?	Score 0 if No
	Score 3 if Yes
In the past 14 days have you or anyone you have come in contact with travelled to China, Iran, UK, Italy, Spain, USA, or any country with over 1000 cases?	Score 0 if No
	Score 3 if Yes
In the past 14 days, have you been to a gathering that later had a confirmed positive case?	Score 0 if No
	Score 3 if Yes
In the past 14 days have you or anyone you know had close contact with a confirmed case of COVID-19 (coronavirus) infection	Score 0 if No
	Score 5 if Yes
Have you been in the vicinity of a suspected COVID-19 (coronavirus) case?	Score 0 if No
	Score 1 if Yes
Have you been exposed to a healthcare facility in a country where hospital-associated COVID-19 (coronavirus) infections have been reported	Score 0 if No
	Score 2 if Yes

Notes: Total score: 19. Risk rating: Low risk: 2, Medium risk: 4 and High risk: 5 and above.

- Low risk – advised retaking the assessment after a few days, informed of safety precautions, and linked to a resource of health information on COVID-19.
- Medium risk - advised to retake the assessment after a few days, observe for indicative symptoms, and be told to report to self-isolate and report to NCDC as soon as symptoms are noticed.
- High risk - advised to self-isolate and immediately report to their respective local disease control agency of their states (for Nigerian users) or countries for other Africans to run a COVID-19 test for them.

balance the total score for categorization to the final risk levels, which we decided as low, medium, and high.

We developed the first version of the tool over a period of two weeks and deployed it for public use on the 19th of March. It was made available in 5 languages: English, French, and the three most spoken languages in Nigeria (Hausa, Yoruba, and Igbo). The tool was launched as a web app and hosted on the www.wellvis.org platform. Also, an Unstructured Supplementary Service Data (USSD) version was

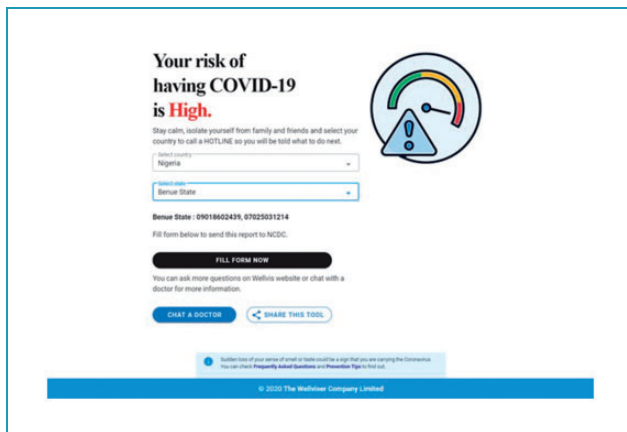


Image 1. Assessment result page with next steps and disease control contacts.

Source: www.wellvis.org

developed and launched in July to serve people without access to smartphones and the Internet, improving its access to over 180 million mobile subscribers in the country.¹² No personal information apart from geolocation (with users' permission) was collected as part of the features of the first version.

Discussion

While there is no known cure or vaccine for COVID-19 at this time, scientific evidence suggests that the disease can be stopped if contact tracing is sufficiently fast, efficient, and happens at scale.^{13,14} Web and mobile-based applications implementing algorithmic risk assessment have the potential to fast track contact tracing while providing information to plan behavioral changes of social distancing, quarantining, and self-isolation among others. The database of anonymized data collated from responses to the assessment can be queried to know the total number of users who reported to be at low, medium, or high-risk levels of COVID-19, where they are reporting from, and which cluster of the community is significantly at high risk through the integrated map. The tool has been used over 4,00,000 times. Most of the users are from Nigeria (70%), Ghana, United States, United Kingdom, Canada, and South Africa.

For those users outside Nigeria, the tool helps them identify symptoms, increases awareness of risk levels, and provides a fair idea of what to do for each. Many communities still have low testing capacity; however, a triage tool greatly reduces the burden of testing by assessing the need for tests and ensuring efficient use of what little resources are available. Also, it gives the user a sense of control when most people feel helpless in the face of information overload,

unverified news reports, numbers of infections, and deaths reported daily.

The Triage tool performs the following functions:

- Probes users for their travel and commuting history in the past 14 days
- Queries for symptomatic (tendency to have been directly exposed to or infected by individuals showing COVID-19 symptoms), pre-symptomatic (tendency to have been exposed to individuals who are carriers but have not tested positive or show clinical symptoms), and asymptomatic but clinically reported signs associated with the COVID-19 such as temporary anosmia (loss of sense of smell).
- Collects anonymized data, including geolocations, after seeking permission from users
- Presents data from the back end for analysis, reporting, and decision making.
- Language toggling option for English, French, Yoruba, Hausa, and Igbo.

The presence of the 'next steps' at the end provides confidence as it gives a sense of purpose to the questions answered before that stage. There is one for each outcome. This ranges from reassurance to the contact of the appropriate authorities. The recommendations for each risk level give them a sense of responsibility in helping to stem the virus spread and this is reverberated by the core message of the national campaign. Subtly, the tool educates the users, complementing the public health education efforts of the disease control agencies in their countries of residence. Therefore, an added use is the dispelling of rumors, quelling of panic, and equipping citizens with the proper guidelines based on their risk level. All of this fosters sense of ownership which improves the uptake of available services.

The tool was also officially adopted by the Nigeria Centre for Disease Control (NCDC) as one of the official self-assessment tools for nationwide usage. Iterations have been made to make it offer more utility for surveillance. These provide an option for self-reporting of address and contact information to enable the NCDC reach out to the users who get a 'high risk' categorization and might need to be evacuated to an isolation and treatment center. Users can also privately chat with doctors (remotely) to discuss their peculiar cases without leaving the tool environment. User-friendly technology such as this triage application is highly vital in navigating the difficulties of this pandemic. The geo-location data collected can potentially be used in understanding the spread of the disease and highlight high-risk locations.

The high rate of mobile phone use in the country coupled with the fact that information about the virus is shared on mobile platforms necessitate a solution being hosted on the same medium. This tackles the problem of

false reports and gives citizens an easy way to take preventive or treatment action from the comfort of their homes.

Conclusion

A user-administered tool such as this is useful for COVID19 control. In reporting their symptoms to assess risk, users are empowered to take decisions like retaking the test when new symptoms arise, maintaining safety guidelines, and notifying the public health body in preparation for self-isolation or treatment at an isolation center.

This increases the number of cases that will become officially recorded, obviating the incidence of cases under the radar, and improving national data quality and correctness. Thus, it is significant to relieve the burden on health systems, boost reporting, and provide information on national health guidelines for prevention and control. By fostering citizens' participation and giving them the next steps of action after assessment, pandemic control efforts become more effective.

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