Fighting Lassa fever through Community-based Disease Surveillance in Nigeria.

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Disease surveillance is primary and indispensable towards effective prevention and control of infectious diseases. It provides needed information for prompt detection of outbreaks and the initiation of response actions. An effective disease surveillance system must be able to produce valid, representative data in a timely manner; and these would be promptly analyzed for early detection of outbreaks. The International Health Regulations (IHR 2005 or the Regulations) came into force on 15th June, 2007 and mandates all Member States to develop, strengthen, and maintain core capacity for disease surveillance and response at most by June 2016. With no specific provision for funding, it is a challenge for low-resourced African countries (including Nigeria) to meet this deadline. It is equally a global concern because infectious diseases know no boundaries and can spread to other nations and continents in a matter of hours and days. Therefore, developing an effective surveillance system for African countries is an imperative.

Traditional surveillance that relies on exact diagnosis and laboratory confirmation is usually very slow. This is because data collection and reporting take a long winding route from the time the patient gets to the hospital and the doctor orders the laboratory test to the time the test result comes back and is reported if reportable. This journey could take days or even weeks especially in Africa where the bulk of the population lives in rural areas with few hospitals and inefficient transportation systems. Time is usually of the essence in infectious disease detection and control and a day or two could mean a life time in controlling the spread of such diseases. Additionally, even where a laboratory test was ordered and the results come back indicating a reportable disease, the doctor may fail to log in the report either because he is not aware of any obligation to do so or because the infrastructure to enable such reporting is not in existence.

Syndromic surveillance is a surveillance technique that monitors and analyses routinely collected automated disease-indicator data for early signs of outbreak of diseases. These data sources may include for instance, pharmacy records of sales of medications, ambulance

dispatch records, outpatient records, records of hospital emergency departments, requests for laboratory tests in public and private hospitals and health centers, etc., captured electronically, and capable of real-time analysis for early signs of disease outbreaks in a community. Syndromic surveillance could also be done through the use of appropriate internet applications to mine the web, gather, and sort through disease indictor data and outbreak information in real-time, in order to detect possible outbreaks of disease before the actual identification of the pathogenic organism. Under this category are the use of initiatives like the Global Public Health Intelligence Network (GPHIN), HealthMap, and EpiSPIDER, etc. However, due to the diverse nature, sources, and huge volumes of information collected through these techniques, it is difficult to classify and analyze the data without the possibility of losing vital materials. Therefore, improved algorithm for data classification and analysis is needed. Alternatively, a more targeted and well-structured form of data collection needs to be adopted so as to simplify, quicken and possibly standardize the analytical process. This could be achieved by the use of modern technologies like mobile phones and mobile devices equipped with appropriate applications (apps), and standard forms for gathering and reporting health events and outbreaks in a community. A good demonstration of such mobile phone app was the Open Data Kit (ODK) Collect application used for data collection and reporting for contact tracing in Nigeria during the Ebola outbreak response in 2014. So, rather than wait for laboratory confirmation of diseases before reporting them or collect desperate information via the web, members of the community will gather and supply outbreak information in a pre-determined format with their mobile phones and devices.

A new community-based syndromic surveillance system called the "Call-in system of syndromic surveillance" is built on the above idea. Under this system, data collection is outsourced to a distributed group in the community and the data collected are reported to a center which could be a hospital, health center or a designated section of the ministry of health. These data are tallied and analyzed for early detection of outbreaks like Lassa fever Cholera, Zika virus etc. This system is event-based and as such is supported by the World Health Organization (WHO), and the International Health Regulations (2005). The Regulations embraced a comprehensive syndrome oriented approach that would take care of both known and unknown infectious diseas**es.** It defined 'surveillance' as the systematic ongoing collection, collation and analysis of data for public health purposes and the timely dissemination of public health information for assessment and public health response. This operational definition can be actualized where there is a system set up for continuous

collection and collation of data, and analysis of the same in real time; where the result of such data analysis is promptly disseminated to relevant agencies and institutions for rapid response and control actions.

For well over a decade now and mostly in developed countries, logs and records of automated disease-indicators like records of hospital emergency departments, nurse advice lines, data from poison control centers, school/personnel absenteeism, ambulance dispatch records, pharmacy records of sales of medications, etc., have been used for syndromic surveillance. For instance, an unusual or unseasonal spike in sale of certain medications at the pharmacy will be an indication of an outbreak of the disease the medication is meant to cure or control. In 2003 following the severe acute respiratory syndrome (SARS) epidemic, it was discovered that two months before the outbreak, there was a spike in the sale of an anti-viral herbal medication used in treating flu-like symptoms in the Guangdong province of China from where SARS originated. If this pharmacy sale had been tracked for purposes of syndromic surveillance, perhaps, SARS would have been detected earlier and the epidemic prevented. In the same vein, spikes in school/personnel absenteeism, records of hospital emergency room on certain diseases, or an unusually large influx of calls on nurse advise lines on the same or similar symptom/syndrome have been used as outbreak indicators. Unfortunately, in developing countries like Nigeria, most of these data sources are either not available, or not usually in electronic forms. They are commonly kept manually in notebooks with attendant laxity and inconsistencies due to human error. Besides, such manual information can neither be transmitted automatically nor aggregated in real-time for outbreak detection. This is a handicap for most developing countries which may want to join the trend in using automated data sources for syndromic surveillance.

However, today, there is extensive use of mobile phones and applications even in developing countries. There is equally a broad agreement in literature and practice that these mobile devices could be used to report incidents of disease outbreaks, collect health related data for surveillance purposes, and reach patients in remote locations in order to offer medical advice and diagnosis. This practice is becoming increasingly popular in Africa especially because of its advantage of taking healthcare services to the hard-to-reach areas and getting health related information from there, for surveillance and planning purposes. For instance, the government of Kenya has introduced and piloted a number of mobile devices for health services and disease surveillance. Also, in Rwanda, in 2013, an electronic integrated disease

surveillance and response (eIDSR) system was built and launched in all district hospitals and health centers in the country. This system is used to report potential outbreaks of diseases like Cholera, Ebola, Lassa fever, etc., as well as help health workers contain the spread of diseases. With this eIDSR, the users can collect timely information from the field via the web and mobile phones and electronically transmit them to all health facilities at the same time. This has reportedly helped to improve timeliness, accuracy and completeness of reporting, and helped officials detect outbreaks rapidly, investigate them and mount a quick response within the country.

Also, some African countries have used select members of the community for delivering basic health services. For instance, in Rwanda, community health workers (CHWs) are simply select members of the community assigned to designated geographic area for basic health services delivery. There is also the "Nyateros of Gambia" (Friends of the eye) who because of the prevalence of eye disease, Trachoma (or *Ocular Chlamydia trachomatis* infection), are employed to deliver basic eye care services in their community. In the Call-in system of syndromic surveillance, select members of the community are trained for surveillance purposes and early detection of infectious diseases. Implementation of this in Nigeria could lead to early detection, prompt reporting, as well as early investigation, and rapid response to outbreaks like Lassa fever.

During the 2014 Ebola outbreak in West Africa (mostly in Liberia, Sierra Leone, Guinea and Nigeria), a text message was sent on 17th August 2014, by the Federal Ministry of Health, Nigeria, through MTN to all subscribers, asking them to help prevent the spread of Ebola by reporting any suspected case. The message gave the phone number and the government email address to which these messages would be sent. Though such reporting is clearly unscientific, one must agree that when many of such reports flow in from a particular area or village, the Ministry is bound to investigate further to determine whether an outbreak is actually occurring.

The Call-in system of syndromic surveillance presents a more structured arrangement in the sense that each select member of the public is assigned specific geographic area in their community to cover and will be instructed to collect and send outbreak information to a designated health centre or hospital. They would be taught what to look for and a standardized way of reporting it. The advantages of engaging the community in this way is that they would help to quickly point out where outbreak is likely occurring for prompt

investigation and urgent laboratory confirmations. It is therefore a good supplement to traditional surveillance for early detection of outbreaks; faster control and containment of infectious diseases.

Like all syndromic surveillance, the Call-in system is intended to alert public health officials of possible outbreaks leading to further investigation. Generally, if incoming reports show an increase/unseasonal spike in a particular syndromic group; a manifestation of an unknown syndrome/disease; or an event that is either hazardous to health or could create a potential for disease; then a response is triggered. This response, depending on the kind of disease or event could vary from mere preliminary investigation, to emergency control measures if the disease is highly infectious.

Under the Call-in system, preliminary investigation starts with call-backs to participants, health centers/hospitals from where the reports were originally submitted. This is a way to also cross-validate the information and ensure that it is not a fluke. Depending on the outcome of this preliminary investigation (e.g., if the suspicion of outbreak is sustained), detailed reporting including location of the victims/source population, age, gender, occupation, date and time of the onset of symptom, and its severity etc., may be required so that the sick could easily be tracked for control and treatment protocols.

Some of the challenges to this system include: Poor understanding of how to operate the apps; difficulties in actual disease detection through a syndromic approach and understanding case definitions; also training the participants may not always produce the assurance that they will know how to use the disease surveillance applications or correctly recognize reportable disease syndromes; there may be problems of how to appropriately fashion incentives to participants in order to improve the willingness to participate and sustain enthusiasm in reporting; analysis of the data may pose a problem at the implementation level due to a dearth of equipment for instant analysis, qualified manpower and enabling environment like steady power supply and other ancillary and supporting technology.

The challenges anticipated to arise in the operation of the Call-in system much like any other smart phone-based system of data collection and analysis could be cured with intensive training and retraining of the participants. This systematic training will improve the quality and accuracy of the system with respect to outbreak detection and reporting. To improve the willingness to participate and sustain enthusiasm in reporting, some incentives in form of

bonus airtime minutes, free medical screening and some monetary stipends should be given to the participants. However, full time CHWs have to be paid. In Rwanda, performance-based financing (PBF) is used for this purpose, and may be adopted by Nigeria with necessary modifications. Availability of funding both for equipment purchase and maintenance, training of the workforce and payment of remuneration, etc., is a big issue. This may be improved by intense advocacy in support of the system so that the government would increase funds allocation for healthcare and disease surveillance. Appeal for funds should also be made to international organizations, and corporations.

In conclusion, syndromic surveillance for infectious diseases outbreak alert and response must be taken serious if we must remain a step ahead of any pandemic. Nigeria should invest in the training of CHWs and health professionals to act as health vigilant eyes and ears for reportable diseases/syndromes and health events in their communities. Also, Nigeria needs sustained capacity building in health personnel and services in order to make healthcare accessible to the vast majority of the people, and supply the workforce for surveillance activities.

The Call-in system's community-sourcing paradigm will help to energize community participation, improve public vigilance and situational awareness leading to early detection of outbreaks like Lassa fever in the community. It will also be an effective way for Nigeria and other low-resourced African countries to meet the IHR's deadline for the development and maintenance of core surveillance systems. The adoption of this system or at least a variant of it is therefore, recommended for Nigeria.