

Role of Infrared Thermometer in Management of Covid-19 Pandemic in Nigeria

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ABSTRACT: With the advent of the Corona virus Disease (SARS-CoV-2) affected the world's economy in no small measure. The aim of the study was to describe the current situation of the outbreak in Nigeria and argued the need for effective engagement of appropriate tools, health personnel and deliberate implementation of wider screening and testing practices. A review of published articles on COVID-19 and daily epidemiological reports from the website of the Nigeria Centre for Disease Control (NCDC) from 27 February 2020 until October 9, 2020 was carried out to describe the outbreak as well as ongoing responses by Nigerian government. Findings revealed overdependence on infrared thermometers for screening of people and inadequate testing capacity as was seen in the testing of only Five Hundred and Fifty Five Thousand, Three Hundred and Sixty Two (551,362) Persons (as at 11/10/2020), out of a population of over Two Hundred Million Persons. It is therefore recommended that the government should enforce adherence preventive measures such as social distancing and hand washing practices. It should also step up COVID-19 testing centres capacities and make it easy for people to access. Health personnel should be trained on remote Psychological First Aid, and its adaptation to COVID-19 context.

Key words: Role, Infrared Thermometer, Curbing, Covid-19

I. INTRODUCTION

Human survival has often been threatened by diverse plagues since existence. One of such recent threats is an infectious disease, the pandemic of SARS-CoV-2 also known as the Corona Virus Disease 2019 (COVID-19). The first case of the novel strain of the Corona virus was reported in Wuhan, Hubei province in China on November 17, 2019 according to the South Morning China Post and ever since, there has been a world-wide exponential increase in the number of infections and casualties. The first confirmed incident of the COVID-19 in Nigeria was announced on February 27, 2020, when an Italian citizen arriving Nigeria

through the Lagos Airport tested positive for the virus [1]. Sahu, Mishra, and Lal, [2] asserts that with each passing day, more cases of corona virus disease (COVID-2019) are being detected and unfortunately the fear of novel corona virus 2019 (2019-nCoV) becoming a pandemic disease has come true.

Briggs and Numbere [3] added that while the reports of new cases and death toll (epidemic curve) appears to be flattening and decreasing in other countries of the world, this cannot be said among the countries in Africa especially sub-Saharan Africa, where testing for COVID-19 is still a major challenge and healthcare facilities are in deplorable states.

Review of Relevant Literature

COVID-19 outbreak preparedness in Nigeria

Prior to the importation of COVID-19 into Nigeria, the government established a "Coronavirus preparedness group" through its nation's leading public health agency, the Nigeria Centre for Disease Control (NCDC), which commenced point of entry screening for travellers. Based on lessons learnt from the Ebola Virus Disease (EVD) outbreak, the NCDC strengthened the National Reference Laboratory with diagnostic capacity for epidemic-prone pathogens. Through this process, the NCDC supported 22 of the 32 states to establish emergency operation centres (EOC), and trained rapid response teams in all the 36 states [4].

Furthermore, the agency provided relevant public health advisory to the Nigerians; shared the case-definition and preventive information with networks of national and subnational public health workers; built capacity for contact tracing and case management; and strengthened five laboratories for diagnostic capacities [5].

Curbing the Spread of Covid-19

Agusi et al [1] mentioned that Covid-19 is an infectious disease that causes respiratory illness with symptoms of cough, fever, and in more severe cases, difficulty in breathing. This disease spreads

primarily through contact when an infected person either coughs or sneezes openly, when a person touches a surface or object and then touches the eyes, nose, or mouth. The commonly reported symptoms as per the earlier studies were predominantly related to the respiratory system like fever, dry cough, fatigue, and myalgia [6].

The severity of novel 2019 Corona virus leaves much trepidation, anxiety and desperate measures are taken to curb the pandemic. There is currently no standard vaccine or cure for COVID-19, hence, its prevention is strongly recommended. Preventive measures against this virus include frequent hand-washing for at least 20 seconds with soap and running water or use of alcohol based hand sanitizers, covering the nose and mouth with disposable tissue or flexed elbow when coughing or sneezing, avoid touching the eyes, nose and mouth if hands are not clean and the practice of social distancing. People who are sick are encouraged to self-isolate to avoid infecting others (if shedding coronavirus) or being infected as the immunity of a sick person is usually compromised [1].

The Polio infrastructure was vital to the success of the 2014 Ebola Virus Disease (EVD) outbreak response. Currently, it provides technical support to government agencies including NCDC with an on-ground network of human resources including traditional and religious leaders, community mobilizers and health workers to support the COVID-19 response. In addition, the Polio infrastructure had SMS-based application, auto-visual AFP detection and reporting (AVADAR) that support disease surveillance through networks of community volunteers and healthcare workers. This app has been useful for the current pandemic as COVID-19 surveillance questions have been added to this app [8].

Measurement of Body Temperature with Thermometer

The Coronavirus (COVID-19) has spread globally and temperature measurement is used to rapidly screen people. Most of the early methods of measuring body temperature used contact mercury thermometers. Advances in electrical technology mean that contact-type electronic thermometers have become widely used [9].

A thermometer is an instrument that estimates and displays core temperature. Thermometers are ubiquitous and are used in homes, physician clinics, and hospitals [10]. According to El-Radhi [11], currently available thermometers include:

1. Mercury-in-glass and liquid-in-glass
2. Electronic with digital display
3. Infrared or tympanic

4. Contact or non-contact temporal artery thermometer

5. Disposable-chemical thermometers

Traditionally, body temperatures have been measured with mercury-in-glass thermometers. But because of their health and safety risks, such as glass breakage and the potential for mercury poisoning, they are no longer used in clinical settings.

Infrared Thermometer

Today's lower cost infrared thermometers operate more precisely and reliably than those previously available. The instruments are rugged and stable, and they generally need be calibrated only once for an application. Both handheld and on-line, or fixed, infrared thermometers are now widely used in industry. The primary elements of an infrared thermometer are an optical system, infrared detector, and electronic signal-processing circuitry. They operate on the principle that all objects at a temperature greater than absolute zero emit energy, a large portion of which is radiated in the infrared segment of the electromagnetic spectrum [12].

The Workings of Infrared Thermometer

Infrared Thermography (IRT) is a science dedicated to the acquisition and processing of thermal information from non-contact measurement devices. It is based on infrared radiation, a form of electromagnetic radiation with longer wavelengths than those of visible light. Any object at a temperature above absolute zero (i.e., $T > 0$ K) emits infrared radiation. The human eye cannot see this type of radiation. Thus, infrared measuring devices are required to acquire and process this information. Infrared measuring devices acquire infrared radiation emitted by an object and transform it into an electronic signal [13].

Thermometry is used to diagnose high-temperature conditions such as fever and heat stroke, and low-temperature exposure. A digital thermometer uses thermistor resistance that varies with temperature. An infrared uses a pyroelectric, composed of pyroelectric film and circuitry within a housing, filled with dry air or nitrogen, to generate an electrical charge in response to a change in its temperature. Common infrared thermometers sense radiation from the tympanic membrane in the ear or forehead. Core temperature is regulated for homeostasis. Under typical conditions, an approximate interthreshold zone of core temperature, 36.0° – 37.5° C (or 96.8° – 99.5° F) is preserved. When a change in ambient temperature occurs, the hypothalamus seeks to

maintain core temperature in the interthreshold zone through a vasomotor response. In warm temperatures, blood vessels vasodilate to increase heat loss. In cold temperatures, blood vessels vasoconstrict to decrease heat loss. If the vasomotor response is unable to maintain stable core temperature, the hypothalamus induces an appropriate autonomic response of sweating or shivering. Different temperatures trigger sweating for evaporative heat loss and shivering for heat production. Key thermometer features include electronic thermometer accuracy, ear IR thermometer accuracy; skin IR thermometer accuracy, clinical accuracy, and probe cover physical integrity [10].

In a research work to determine the effectiveness and accuracy of non-contact thermometers for the detection of febrile individuals, traditionally, body temperature has been measured using contact thermometers that are placed on the forehead or in the mouth, ear, armpit or rectum. For children, rectal temperature measurement is the gold standard. Non-contact thermometers allow a person's temperature to be taken with minimal (tympanic) or no (Non-Contact Infrared Thermometer [NCIT], thermal scanner) contact with the person. This means temperature can be measured without the discomfort of having to sit still with a thermometer in the mouth, armpit, or rectum long enough to obtain a correct temperature reading. The lack of contact also means the disinfection process between patients for the thermometers is minimal or unnecessary, allowing for easier and faster use when screening large numbers of people in settings like airports or border crossings [14].

Some issues of concern however have been the fact that the device was not intended for individual testing and that it tests skin temperature rather than core temperature which can be affected by cosmetics, spectacles, antipyretics and has an uncertain relationship with core body temperature [15]. Chen et al [9] also argue that the difference between core and infrared temperature measurements can be as high as 1.5 degrees Celsius which is clinically significant and that the machines themselves are not reliable enough to exclude fever.

It is also worth noting that persons infected with the corona virus disease that are themselves infectious may not be detected using the temperature check since the virus can be

detected in infected persons 1-3 days before symptoms show [16]. In some instance, as high as 43% asymptomatic persons tested positive for corona virus, and these have an unquantifiable risk of transmitting same infection to others [17].

Historically it appears safe to say that temperature screening has not been effective at preventing infectious diseases such as SARS. During the 2009 H1N1-2009 pandemic, several Airports began screening arrivals for fever. Nine million people were screened in Japan; 930 people with potential infection were detected and none was diagnosed with H1N1. In the same year four out of 300,000 passengers screened through Airport travel in Sierra Leone, Guinea and Liberia were later found to have Ebola. None was detected with temperature measurement [18].

II. METODOLOGY

Materials and Methods

Databases of Pubmed and African Journals OnLine were searched for published articles on COVID-19 and daily epidemiological reports from the website of the Nigeria Centre for Disease Control (NCDC) from 27 February 2020 until October 9, 2020 to describe the outbreak. Ongoing responses by the government and other relevant agencies were reviewed. Other relevant literatures were sought for using the following keywords: Infrared Thermometer, management of COVID-19 pandemic in Nigeria. Additional keywords used in the search were as follows: Screening for Covid-19, Temperature checks, COVID-19 Asymptomatic persons. Internet searches were based on Google and Search Nigeria.

III. RESULTS AND DISCUSSION

A total of Fifty Nine Thousand Nine Hundred and Ninety Two (59,992) confirmed corona virus cases were recorded in the country across 36 states and the Federal Capital Territory (FCT) as of October 9 2020, (Table 1). Of these numbers, 38, 154 (64 %) were males and 21,838 (36%) were females. The age group that was most affected by this infection was 31- 40 years (27%), 1013 (2%) of the affected population had international travel history; records showed that 51,614 (9.36%) cases were discharged, while 1,113 deaths were recorded, bringing the case fatality rate (CFR) of confirmed cases to 1.9%.

TABLE 1: STATES WITH REPORTED LABORATORY-CONFIRMED COVID-19 CASES, RECOVERIES, DEATHS AND DAYS SINCE LAST REPORTED CASE

CASE	CONFIRMED CASES		DISCHARGED CASES		DEATHS		TOTAL	
	DAYS SINCE		DAYS SINCE		DAYS SINCE		DAYS SINCE	
	TOTAL	NEW	TOTAL	NEW	TOTAL (%)	NEW	CASES	ACTIVE
Lagos	19,886	71	15,250	0	204 (1.03)	0	4,432	0
FCT	5,790	6	5,223	2	79 (1.36)	0	488	0
Plateau	3,504	5	2,931	27	33 (0.94)	0	540	0
Oyo	3,293	8	2,553	0	40 (1.67)	0	700	0
Rivers	2,659	6	2,471	24	59 (2.22)	0	129	0
Edo	2,635	0	2,503	0	107 (4.06)	0	25	1
Kaduna	2,484	17	2,381	3	40 (1.61)	0	63	0
Ogun	1,927	26	1,735	2	28 (1.45)	0	164	0
Delta	1,803	0	1,737	0	49 (2.72)	0	17	4
Kano	1,740	0	1,675	0	54 (3.10)	0	11	1
Ondo	1,638	0	1,545	0	36 (2.20)	0	57	3
Enugu	1,289	0	1,166	0	21 (1.63)	0	102	14
Kwara	1,050	0	982	0	25 (2.38)	0	43	2
Ebonyi	1,042	0	1,008	0	30 (2.88)	0	4	8
Abia	898	0	872	0	8 (0.89)	0	18	6
Katsina	894	0	868	0	24 (2.69)	0	2	3
Osun	884	10	813	5	17 (1.92)	0	54	0
Gombe	883	0	747	0	25 (2.83)	0	111	10
Borno	745	0	705	0	36 (4.83)	0	4	10
Bauchi	707	0	687	0	14 (1.98)	0	6	1
Imo	579	0	551	0	12 (2.07)	0	16	1
Benue	482	0	413	0	10 (2.08)	0	59	1
Nasarawa	469	0	325	0	13 (2.77)	0	131	1
Bayelsa	401	0	376	0	21 (5.25)	0	4	7
Jigawa	325	0	308	0	11 (3.39)	0	6	14
Ekiti	323	1	312	0	6 (1.86)	0	5	0
Akwa Ibom	295	1	278	0	8 (2.71)	0	9	0
Niger	261	0	242	0	12 (4.60)	0	7	3
Anambra	250	0	219	0	19 (7.60)	0	12	3
Adamawa	248	0	208	0	17 (6.95)	0	23	9
Sokoto	162	0	145	0	17 (10.49)	0	0	14
Taraba	106	0	89	0	16 (15.09)	0	11	4
Kebbi	93	0	84	0	8 (8.60)	0	1	42
Cross River	87	0	74	0	9 (10.35)	0	4	15
Zamfara	79	0	73	0	5 (6.33)	0	1	7
Yobe	76	0	62	0	8 (10.53)	0	6	13
Kogi	5	0	63	0	2 (40.00)	0	0	98
TOTAL	59,992	151	51,614	63	1,113 (1.86)	0	7,265	

Source: [19]

Following the detection of the index case, a multi-sectoral NCDC-led national emergency operation centre at Level 3, the country's highest level of public health emergency, was activated. This was followed by deployment of Rapid Response Teams with states leading contact tracing and other response activities. The confirmed case was also evacuated to a

health facility designated for the treatment of COVID-19 [19].

Similar capacity for early diagnosis, swift quarantine of cases and prompt contact tracing lead by the NCDC were strong points of the country's ability to promptly control the 2014 Ebola Viral Disease (EVD) outbreak as well as prepare the country for the COVID-19 response [20]. However, more is required

to respond to the current COVID-19 pandemic, considering its mode of transmission and the possibility of asymptomatic and pre-symptomatic individuals transmitting the infection [21]. While transmission of COVID-19 is majorly through respiratory droplets and contact routes, there is a potential of airborne transmission [22], [23].

The total number of confirmed COVID-19 cases in Nigeria as at 11/10/2020 stood at 59,992 persons with 151 new cases. It is however worth noting that the overall number of persons tested for corona virus in Nigeria stood at Five Hundred and Fifty One Thousand, Three Hundred and Sixty Two (551,362) Persons out of a population of over Two Hundred Million Persons (NCDC, 2020). The number of samples tested was grossly inadequate and this may give an insight into why Nigeria and most African countries have maintained low records of corona virus infections. Studies show that home quarantine of suspected cases will reduce the overall expected number of cases by 62 %. COVID-19 pandemic has had devastating impact on all economies worldwide, prevention has been key in curbing further damage, and this is in fact easier and better than cure [1].

IV. CONCLUSION

Because there is currently neither a proven curative treatment nor vaccine for COVID-19 and protocols have already been established, persons who show signs and symptoms similar to this infection are advised to immediately seek medical attention. This is because ignoring these signs and symptoms do lead to complications in some instances. The most important public health measures that have proven to be effective in control and spread of corona virus infection are quarantine of persons suspected to have the infection, social distancing and use of facemask and face shield. While the use of infrared thermometer has some benefits in terms of screening, it is worthy of note that additional tests such as polymerase chain reaction (PCR) are inevitable for the diagnosis of COVID-19 infections since these have the capacity to detect both symptomatic and asymptomatic infections. In addition, as people deliberately make themselves available for testing, incidences of corona virus infection become easier to control.

V. RECOMMENDATION

1. Government should enforce adherence to social distancing, use of facemask and shield, and hand washing practices especially at entrances to public places through coordinated monitoring.

2. While using the infrared thermometer, Government should be more transparent in making it easy for people to access COVID-19 testing centers.
3. Government should construct, manage and maintain Self-Quarantine Shelters (SQS) to quarantine internally Displaced Persons (IDPs) and host community members with travel and contact history as well as new arrivals from other towns. Quarantine shelters are non-medical facilities, with living areas segregated by gender and with integrated WASH facilities.
4. Strict adherence to single entrances and exits to public places such as schools and worship should be ensured in other to maintain proper coordination of movements in other to minimize contact between people.
5. There is need for government and relevant stakeholders to identify and train primary healthcare workers, physicians and Laboratory scientists on remote Psychological First Aid, and its adaptation to COVID-19 context, and on remote counseling services.

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