Positivity Rate as a Performance Indicator for COVID-19 Response in Edo State, Nigeria

Andrew Ifeanyichukwu Obi¹,²,³, Pius Ononigwe⁴, Faith Irye⁵, Patrick Okundia⁶,⁷, Osamuyi Irowa⁶,⁷, Helen Eboreime⁶,⁷, Ekaete Tobin⁸, Lauretta Iruobe⁶,⁷, Bruce Osa⁶,⁷, Uwa Okhuarobo⁶,⁷ and Kester Okoduwa⁷

¹Department of Public Health and Community Medicine, University of Benin, Benin City, PMB 1154, Edo State, Nigeria.
²Department of Public Health and Community Medicine, University of Benin Teaching Hospital, Benin City, PMB1111, Edo State, Nigeria.
³Centre of Excellence for Reproductive Health Innovation (CERHI), University of Benin, Benin City, Edo State, Nigeria.
⁴Africa Centres for Disease Control and Prevention, Addis Ababa, Ethiopia.
⁵World Health Organization, Nigeria.
⁶Edo State Ministry of Health, Nigeria.
⁷Public Health Emergency Operation Centre, Nigeria.
⁸Lassa Fever Training Institute, Irrua Specialist Teaching Hospital, Nigeria.

Authors’ contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Positivity rate is a very reliable indicator in determining the effectiveness of public health interventions of infectious disease magnitude.

Aim: To use positivity rate as performance indicator of effectiveness of COVID-19 Control measures in Edo State, Southern Nigeria.

*Corresponding author: E-mail: andrew.obi@cerhi.uniben.edu;
**Materials and Methods:** Laboratory based record review of 20,220 Polymerase Chain Reaction (PCR) based laboratory results from COVID-19 line-list analysed from the four (4) NCDC accredited molecular laboratory within Edo State. The weekly COVID-19 test positivity was computed in relation to the total samples tested between 23rd March to 30th November, 2020. Data collected were analysed using IBM SPSS version 20.0 software with statistical significance set at \( p < 0.050 \) and 95% Confidence Interval.

**Results:** A total of 20,220 PCR results reviewed with 2696 (13.3%) COVID-19 cases identified while 17,524 (86.7%) were negative. The average weekly sample collection and testing was 552.28 \( \pm 369.98 \), with average weekly COVID-19 case yield and positivity rate (\%) of 77.89 \( \pm \)106.23 and 12.20\%13.75% respectively. A statistically significant positive correlation was identified between sample tested and COVID-19 case yield (\( R = 0.569; < 0.01 \)). The first wave of the COVID-19 in Edo State witnessed a consistent and progressive decline in test positivity rate till it deepened at 0.6% by the end of November, 2020.

**Conclusion:** Increasing sample testing has significant positive correlation with COVID-19 case detection in Edo State. Positivity rate was a good indicator to monitor COVID-19 outbreak response in Edo State.

Targeted surveillance and sample collection for testing can significantly help improve the quality and case yield during epidemic outbreak response. Bridging the gap in sample collection for testing can greatly influence how quickly an epidemic outbreak response and control is achieved.

**Keywords:** COVID-19; disease outbreak; indicator; performance; test positivity.

### 1. INTRODUCTION

The 2019 novel coronavirus, which is called severe acute respiratory syndrome coronavirus-2 (SARS-COV-2) has been identified as the causative agent of coronavirus disease 2019 (COVID-19) [1].

The World Health Organization declared COVID-19 a Public Health Emergency of International Concern (PHEIC) on 30th January 2020, since then, over 71 million cases and 1,618,374 deaths had been reported globally [2,3]. In Africa, a total of 1,646,189 COVID-19 cases and 24,464 deaths had been reported as at 30th November, 2020 [3]. Nigeria had recorded a total of 803,621 suspected cases, 67,557 confirmed cases of COVID-19 with 1173 deaths and rated as the third country in Africa reporting COVID-19 cases as at the end of November 2020 [3]. The low cases of COVID-19 in Nigeria may be due to under-reporting attributable to low testing and possibly low testing capacity [4]. The average COVID-19 test positivity rate of 8.4% in Edo State was reported between March and November 2020 with varying rates reported across the States of Nigeria.

COVID-19 positivity rate is the percentage of all coronavirus tests performed that are actually positive. Test positivity rate is a critical measure in infectious disease outbreak response monitoring, as an indicator on the extent of disease spread in the area of test and whether levels of testing are keeping up with levels of disease transmission. Furthermore, low test positivity rate simply means that the level of coronavirus transmission, relative to the amount of testing is low at a particular point in time [3,5]. According to criteria published by the World Health Organization in May 2020, test positivity rate of less than 5% is one indicator that an epidemic is under control in a country [5]. Because limited testing makes it likely that many cases could be missed, the positivity rate can therefore help our understanding of the extent and behavior of spread of the virus [5]. In countries with a low-test positivity rate, the number of confirmed cases is likely to represent only a small fraction of the true number of infections, and where the positive rate is rising in a country, this can suggest the virus is actually spreading faster than the growth seen in confirmed cases [5]. This also means that the level of coronavirus transmission is still likely to be high, this is a very strong indication for more testing and enforcement of compliance to non-pharmacological interventions such as compulsory, consistent use and appropriately wearing of facemasks, frequent hand washing or use of hand rub sanitizers, maintaining at least a meter physical distancing spacing while avoiding situations that put one at risk of getting infected or infecting others [4].

Currently, Nigeria is experiencing an ongoing community transmission of SARS-COV-2 from
asymptomatic individuals across the various states of the country, with increasing number of daily reported cases of COVID-19 [6]. Edo State Nigeria is presently being reported as the State with the seventh highest number of COVID-19 cases and also the second highest number of COVID-19 deaths in Nigeria with an average test positivity rate of 13 percent [6].

Risk assessment to determine specific public health measures to be put in place at every point in the response should be based on epidemiological factors like incidence of confirmed COVID-19 cases, rate of hospitalizations and ICU admissions, number of deaths, test positivity rate and results of serological testing (i.e., providing reliable assays) [7].

Studies in Washington observed that early and aggressive mitigation measures employed in COVID-19 response influenced the course of COVID-19 pandemic with downward trend in test positivity rate [8]. Some mitigation measures like massive screening, scaling up of testing and introduction of home based care to facilitate compliance with isolation protocol are known to improve the outcome of the COVID-19 response especially where the other indicators like test per million populations, excess mortality rate etc are not readily available as in most developing countries like Nigeria.

Positivity rate can be used as a reliable indicator in determining the effect of the public health measures being instituted in the course of the outbreak response. Since testing rates are generally low and below one percent of the total population in most African countries such as Nigeria there is need to ramp up sample collection and testing. Improving sample collection to at least one percent of the total population as recommended by the Africa Centre for Disease Control and Prevention is a crucial step in the right direction to helping assess the true state of things with regards to the numbers and spread of COVID-19, thus aiding the understudying of the behavior of the outbreak for necessary mitigatory action [3].

This study utilized available secondary data based on monthly and weekly trends in test positivity rates for SARS-CoV-2 derived from laboratory data of all confirmed cases in Edo State which were analyzed to identify temporal trends that may reflect the local dynamics of the pandemic and the effect of mitigation strategies such as massive screening, scaling up of testing and introduction of home-based care to improve compliance with COVID-19 preventive measures among confirmed cases.

2. MATERIALS AND METHODS

Laboratory based record review of 20,220 PCR based laboratory results of COVID-19 line - list analysed from the four (4) NCDC accredited molecular laboratory within Edo State (viz. Irrua Specialist Teaching Hospital, University of Benin Teaching Hospital, Edo Specialist Teaching Hospital and Lily Hospital Ltd Laboratories). The laboratory data from the line - list was sorted for completeness in relation to weekly and monthly sample collected.

The weekly laboratory record review entailed a weekly update of total sample collected and the total weekly positive case update from which the test positivity rate was computed, this test positivity rate was computed on a weekly and monthly bases to help monitor trend across the epi-week of the outbreak over an eight-month period from March to 30th November 2020.

Test positivity rate is the percentage of all coronavirus tests performed that are actually positive and is calculated as; (positive tests)/(total tests) x 100%. Test positivity yield was assessed using secondary data over an eight-month period (i.e., 23rd March to 30th November, 2020). The findings enabled us to assess pattern and trends which provided basis for comparison and interpretation of data. Data collected were analysed using SPSS version 20.0 statistical software with statistical significance set at p<0.050 and 95% Confidence Interval.

3. RESULTS

A total of 20,220 PCR test-results were analyzed for positive case yield with a total of 2,696 confirmed cases was identified subsequently. The results were sorted into epi-week and month of outbreak with their respective case positivity rate analyzed and presented as charts (See Fig., 1, 2 and 3).

Fig. 1 Shows that with rise and a fall in sample collection, positive case detection followed a similar pattern up till the last five weeks of first wave of COVID-19 outbreak (i.e. 43, 44, 45, 46, 47 respectively) where rise in sample collection did not reveal a commensurate rise in case detection, this pattern continued till week 47 with the lowest recorded weekly average in sample
case positive yield of 2 and test positivity of 0.6%. This pattern was also in tandem with monthly test positivity rate 0.1% for November 2020 (See Fig. 2). Furthermore, over the period under review the average weekly sample collection for testing was 552.28±369.98 with average weekly positive case yield and positivity rate of 77.89 ±106.23 and 12.20±13.75% respectively (See Fig. 1). A statistically significant positive correlation (See Fig. 1) was identified between sample tested and positive case yield for COVID-19 (R = 0.569; < 0.01) in Edo State.

In relation to the pattern and trend of test positivity rate (See Fig. 3), the pattern of the test positivity curve was in tandem with a standard epicurve. The epicurve showed a consistent decline in test positivity throughout the first wave of COVID-19 transmission from onset, peak and final deep. This pattern and behavior were clearly reflective by the test positivity rate of the outbreak as shown in Figure 3.

4. DISCUSSION

This study identified that sample collection for testing modulates positive case detection to a large extent. The study showed that as sample testing increased following identification of the index case on the 23rd of March 2020, there was a commensurate increase in yield of positive cases identified, having more cases identified with increasing sample testing and vice versa. This was evident in the test positivity rate and also positive case yield in the analysis of laboratory data from Edo State. This finding is in keeping with existing literature that revealed high cases detection yield when targeted surveillance activities are carried out during outbreak response. This approach for targeted surveillance activities through active case search at facility and community levels and highly coordinated surveillance activities were conducted across the 18 Local Government Areas (LGAs) of Edo State over the eight-month period of the 1st wave of COVID-19 outbreak in Edo State. In addition to wide scale community based mobile screening activities conducted at selected hot spot location across the municipal LGAs in Edo South senatorial zones, Edo Central and Edo North zones of the State. These activities aided ramping up of sample collection for testing between April and June 2020, in addition to improved testing capacity supported by the four reference molecular laboratories across the State helped aid speedy analysis of collected laboratory samples and improved turnaround time of 48-96 hours on the average.

![RELATIONSHIP BETWEEN SAMPLE TESTING AND POSITIVE CASE YIELD](image)

**Fig. 1. Relationship between weekly sample testing and positive covid-19 case yield**
Fig. 2. Relationship between monthly sample tested and positive case yield for Covid-19

Fig. 3. Pattern and trend of case positivity rate by epi-week of outbreak response
The pattern and trend in test positivity as shown in Figs. 1 and 3 is suggestive of the characteristic of a standard epidemic curve and in keeping with the weekly pattern in positive case detection and as such a strong indicator of the pattern and behavior of the first wave response. The test positivity rate rose from 14.3% at the onset of the outbreak in Edo State to 51.8% when it peaked then progressively when it began to plateau in August-September, 2020 till when it was successfully contained with test positivity of 0.6% in November, 2020.

The progressive decrease in the test positivity rate in Edo State observed till the month of November 2020 may not be unconnected with the fact that many individuals had gained high awareness and knowledge of COVID-19 through the risk communication interventions across the State, improved capacity for case management for COVID-19 due to facility and home based care treatment interventions of the State due to prophylactic medication and therapeutic use of selected medications as reported in existing literature [9-11].

The test positivity rate of COVID-19 outbreak has provided useful insight as a good indicator in monitoring the quality of outbreak response in Edo State in relation to all pillars of response from surveillance, case detection (laboratory), case management, risk communication among others. This equally holds true in line with existing literature that test positivity rate is a useful tool and indicator for monitoring performance of COVID-19 outbreak response in addition to any infectious disease locally, nationally, regionally and globally.

5. CONCLUSION

Increasing sample testing is significantly correlated with increase in positive case detection for COVID-19 in Edo State. Positivity rate was a good indicator to monitor COVID-19 outbreak response in Edo State.

Targeted sample collection for testing from surveillance activities can significantly help improve the quality and yield from testing during epidemic outbreak response. This can help monitor successfully the containment of infectious disease outbreak through highly organized case identification, testing and treatment interventions. Bridging the gap in sample collection for testing can greatly influence how quickly an epidemic outbreak response and control is achieved.

CONSENT

It is not applicable.

ETHICAL APPROVAL

Institutional Approval was obtained from Edo State Ministry of Health before the commencement of the Study.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Zhu H, Wei L, Niu P. The novel coronavirus outbreak in Wuhan, China. Glob Heal Res Policy [Internet]. 2020; 5(1):6. [Cited 2020 Dec 6]. Accessed on 5th May, 2021. Available: https://ghrp.biomedcentral.com/articles/10.1186/s41256-020-00135-6

2. World Health Organization. WHO Director-General’s opening remarks at the media briefing on COVID-19 - 11 March 2020. World Health Organization; 2020.

3. COVID-19 Resources – Africa CDC [Internet]. [Cited 2020 Dec 4]. Accessed on 5th May, 2021. Available: https://africacdc.org/covid-19/resources/?wpv_aux_current_post_id=3648&wpv_view_count=3646&wpv_paged=2

4. COVID-19 Testing: Understanding the Percent Positive - COVID-19 - Johns Hopkins Bloomberg School of Public Health.
