



Time to Negative Test Result among Patients with COVID-19: A Retrospective Study

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Authors' contributions

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

Article Information

DOI: 10.9734/IJTDH/2021/v42i2230558

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/83103>

Original Research Article

Received 23 November 2021
Accepted 25 December 2021
Published 26 December 2021

ABSTRACT

Background: Coronavirus disease 2019 (COVID-19) is a public health emergency, however, there is still limited data on the length of infectiveness of the disease especially in Nigeria. The aim of this study was to ascertain the duration of viral shedding in patients testing positive for COVID-19 to deduce the appropriate time to discharge SARS-CoV2 Positive patients from follow-up by the healthcare team in our setting.

Methods: In this retrospective study, time to a negative test result in patients with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) RNA was evaluated in a cohort of 490 patients who tested positive at the Satellite Molecular Laboratory of the Rivers State University Teaching Hospital, Port Harcourt.

Results: The mean age of the 490 patients was 39.8 ± 13.9 . There were 379 (77.3%) males and 111 (22.7%) females. The mean duration of SARS-CoV-2 RNA detection was approximately 15 ± 2 days. When comparing patients who were tested twice with those who were tested more than two times, a significant difference between mean time to a negative result and the number of tests done was identified ($t = P\text{-Value} = <0.001$).

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Conclusions: Findings from this study show that the average time of transition from a positive to negative PCR test result was approximately 15 days, regardless of the gender. This can provide an estimated duration of hospital stay among COVID-19 patients to prevent unnecessary healthcare costs and minimize re-infection.

Keywords: SARS-COV-2; polymerase chain reaction; viral shedding; positive; negative; Port Harcourt.

1. INTRODUCTION

The coronavirus disease 2019 (COVID-19) resulting from infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), was declared a pandemic by the World Health Organisation on the 11th of March 2020 and has since been a major source of concern for worldwide human health [1]. As of October 2021, there have been 240 million cases worldwide, with million deaths, of which 6 million cases and 149,041 fatalities were reported in Africa [2]. There were 212,713 cases and 2,906 deaths in Nigeria, with Rivers State accounting for 12751 (6%) of the total cases [3]. The clinical and epidemiological characteristics of individuals with coronavirus disease 2019 (COVID-19) have been reported in several publications [4]. During treatment, the pattern of SARS-CoV-2 RNA shedding has not been extensively defined. Only 25% of patients show negative oral swabs after 5 days of therapy, according to Zhang et al. [5]. Although, the actual test for infectivity would be the presence of viable cell cultures of which are rarely the case 10 days post-symptom-onset or after first positive test [6]. The US CDC recommendations on de-isolation were based on the lack of culturable virus >9 days post symptom onset, suggesting a lack of infectivity 9 days post symptom onset [7]. (According to a recent study, the median length of SARS-CoV-2 RNA was 17 (13–22) days from the commencement of illness to the end of therapy [8]. Prolonged SARS-CoV-2 viral presence has been linked to the male sex, old age, concurrent hypertension, delayed admission to hospital after illness onset, and severe illness at admission when comparing patients with early (within 15 days) and late (15 days after illness onset) viral RNA clearance [8].

COVID-19 patients have a wide range of clinical symptoms that affect different body systems, including the respiratory and digestive systems. Mild self-limited disease to severe pneumonia, acute respiratory distress syndrome, septic shock, and systemic multiple organ failure syndromes are examples of these symptoms [9]. COVID-19 patients are typically admitted to a

hospital for routine therapy, and if their condition improves, they are discharged according to local health authorities' protocols and guidelines.

Although no official guidance is available in Nigeria for time to de-isolation, symptomatic individuals were usually discharged 14 days after a positive test, according to the Nigerian Centre for Disease Control [10], and a negative laboratory test is no longer required. However, local evidence supporting this is unavailable yet. The goal of our research is to describe the time it takes for a patient in Nigeria to have a negative COVID-19 result, which may help to anticipate and manage self-isolation, hospital stay and treatment in our local setting.

2. METHODS

2.1 Study Design and Participants

A total of 490 patient records with confirmed SARS-CoV-2 infection at the COVID-19 laboratory of the Rivers State University Teaching Hospital, Port-Harcourt were retrospectively reviewed within a 12-month period from May 2020 to August 2021. Patients were enrolled in the study if they met the inclusion criterion of a positive Covid-19 result. SARS-CoV-2 infection was confirmed in all patients by testing respiratory specimens with a reverse transcription-polymerase chain reaction assay. Microsoft Excel 2016 and the Statistical Package for Social Sciences (SPSS) version 23 were used to analyze the data. Sex comparisons were made for the age of the study patients and the mean time-to-negative results were analyzed for the number of COVID-19 RNA tests done. To determine the characteristics of the participants, descriptive statistics were employed, and inferentially chi-square, T-Test, and ANOVA were used to determine statistical significance set at $p < 0.05$ for categorical and continuous variables as appropriate.

3. RESULTS

A total of 490 patient files were eligible for the study. Table 1 shows the distribution of the

participants' age and sex. A major proportion of 379 (77.3%) of the patients were males. The overall mean age of study participants was 39.8 ± 13.9 years. A majority of the study patients 153(31.2%) were between 35-44 years and was closely followed by those between 18-34 years 103(21%). Table 2 shows a significant association between age and sex (P-Value = <0.001). No significant association was found between sex and mean time to negative result as

displayed in Table 3, and no significant association was identified between age and mean time to negative (Table 4). The mean time to transition from a positive test to a negative test was 14.8 days. The number of repeat tests done and time to a negative COVID – 19 result was significant between those who were tested two times versus those who were tested more than two times (P-Value = <0.001) as shown in Table 5.

Table 1. Age and sex distribution

Variable	Frequency (n = 490)	Percent
Age Group of Patients (years)		
<18 (minors)	30	6.1
18 – 24 (young people)	44	9.0
25 – 34	90	18.4
35 – 44	153	31.2
45 – 54	103	21.0
>54	70	14.3
Mean Age: 39.8 ± 13.9		
Sex		
Male	379	77.3
Female	111	22.7

Table 2. Age by sex distribution

Variable	Sex		Chi-square	P-Value
	Male	Female		
Age Group of Patients (years)				
<18 (minors)	16 (4.2)	14 (12.6)	42.149	<0.001*
18 – 24 (young people)	22 (5.8)	22 (19.8)		
25 – 34	66 (17.4)	24 (21.6)		
35 – 44	129 (34.0)	24 (21.6)		
45 – 54	92 (24.3)	11 (9.9)		
>54	54 (14.2)	16 (14.4)		

Table 3. Time to negative and sex relationship

t = Students' T-test

Variable	Sex		T-test	P - value
	Males	Females		
Mean Time to Negative (Log) ± SD	15.31 ± 2.24	13.06 ± 1.84	1.803	0.072

Table 4. Time to negative and age relationship

Variable	Frequency	Mean Time to Negative (Log)	Test Statistics (ANOVA)	
Age Group of Patients (years)			F	p-value
<18 (minors)	24	13.24 ± 2.39	0.531	0.753
18 – 24 (young people)	40	13.40 ± 2.20		
25 – 34	81	15.21 ± 1.95		
35 – 44	138	15.21 ± 2.33		
45 – 54	88	15.67 ± 2.09		
>54	60	13.55 ± 2.05		

F = ANOVA

Table 5. Time to negative and number of tests relationship

*(statistically significant), t = students' T-test

Variable	Number of tests done		T-test	P - value
	Two	More than Two		
Mean Time to Negative (Log) ± SD	14.09 ± 2.16	23.93 ± 1.77	-5.186	<0.001*

Mean Time to Negative:

The average number of days it took for patients to convert to negative was 14.760 ± 2.160 Days.

There was a statistically significant relationship between the number of tests done and the Time to Negative, having a p-value of <0.001, as shown by Student's T-test; where statistical significance is set at ≤ 0.05.

4. DISCUSSION

The majority of COVID-19 research has focused on describing the early clinical and epidemiological findings. There has been minimal research into the time-to- negative conversion among SARS-CoV-2 patients in Nigeria after a confirmed positive PCR test result. Male patients with COVID-19 were shown to be more infected by the SARS-CoV-2 RNA and to have a longer disease duration than female patients. This finding could indicate that COVID-19 affects males more severely than females [8,11]. From May 2020 to August 2021, the average time it took for a patient to get a negative result after testing positive was about 15 days, regardless of age or sex. This report appears to be comparable to one from a Chinese study, after the onset of a clinical symptoms, a patient's test result was negative after 17 days, according to the previous study [8]. However, another study experienced a 24-day duration as the mean time-to-negative transition [12]. The differences in this study can be attributable to the age differences in the participants and the study designs. There is evidence that a patient may remain RT-PCR positive but viral culture negative indicating that although Viral RNA are detectable, the patient is no longer infectious, even in the critically ill [7,13]. Findings from this research with a mean time-to-negative PT PCR test of 14 days, therefore suggest that COVID-19 patients are not likely infectious and can be discharged 14 days after receiving a confirmation of a positive PCR test result as stated by the Nigerian Centre for Disease Control. As a result, this information adds to the current de-isolation strategies for individuals with COVID-19 disease [14] and can indicate the estimated length of

hospital stay among patients admitted for the management of COVID-19, consequently limiting re-infection and catastrophic losses from healthcare expenses. Nonetheless, this study has a limitation as patients only performed a follow-up test at their own discretion or their doctor's recommendation. So, it is possible that they may have tested negative earlier as the United State's Centre for Disease Control has currently recommended a shortened time of 5 days for isolation for prevention [15].

5. CONCLUSION

In conclusion, management of COVID-19 patients, particularly male patients should be commenced promptly since they make up the bulk of admitted COVID-19 patients. Additionally, the average time of conversion from positive to negative of about 15 days can be considered for estimating length of hospital stay or time to resume work activities and other social interactions.

CONSENT

It is not applicable.

ETHICS APPROVAL

Ethics approval was obtained from the Institutional Review Board of the Rivers State University Teaching Hospital.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:

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