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RESEARCH ARTICLE OPEN ACCESS

Clinical characteristics and survival analysis of hospitalised COVID-19 patients in Ogun State, Nigeria

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Abstract

Objective: Despite the end of the pandemic, COVID-19 remains a disease of global concern. This study aimed to describe the clinical characteristics, outcomes, and survival analysis of hospitalised COVID-19 patients in Ogun State, Nigeria, with a view to providing evidence on the survival of hospitalised COVID-19 patients.

Methods: The study examined the medical records of COVID-19 patients at the Olabisi Onabanjo University Teaching Hospital COVID-19 Isolation Centre in Sagamu, Ogun State, between March and December 2020. Data was analysed using SPSS version 22, with chi-square tests for association and logistic regression for mortality predictors. Kaplan-Meier curves and Log-rank tests were used for survival analysis.

Results: The study involved 273 patients, with a mean age of 45.33±16.9 years. The majority were males, had symptoms (51.6%), and had SPO2 ≥ 94% (82.4%) at presentation. Most were discharged home (94.1%), while 5.1% died. Over half presented with fever (55.3%) and cough (51.8%), and one-third had comorbidities. Most of those with comorbidities had hypertension (73.3%). The presence of two or more comorbid conditions (AOR 9.5, 95% CI 1.8 – 50.6; p = 0.008) and oxygen saturation less than 94% at admission (AOR 19.5, 95%CI 3.0 – 128.0; p = 0.002) were predictors of mortality. A significant difference was observed in the Kaplan-Meier curve regarding age group, symptom presence, comorbid conditions, and oxygen saturation at admission.

Conclusion: The study found higher mortality rates due to co-morbidities and low oxygen saturation at admission, emphasising the need for early diagnosis, prompt referral, and management of patients with co-morbidities.

Keywords: COVID-19, Clinical characteristics, Outcome, Survival analysis, Predictors

Plain English Summary

Even though COVID-19 is no longer a cause of global crisis, it is still a source of concern because of the emergence of new strains. In order to give information regarding the survival of hospitalised COVID-19 patients, this study set out to characterise the clinical features, outcome, and survival analysis of COVID-19 patients in Ogun state, Nigeria. The study involved getting information from the records of patients hospitalised at the Olabisi Onabanjo University Teaching Hospital COVID-19 Isolation Centre, Sagamu, Ogun State, between March and December 2020. A total of 273 patients with an average age of 45.3±16.9 years were included in the study. Over half of them were males, had symptoms, and the majority had good oxygen saturation at the time they were first seen. Almost all went home after receiving treatment, while 5.1% died. More than half had fever, cough, and a third had other illnesses

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apart from COVID-19, such as hypertension and diabetes. Patients with two or more other illnesses and those with poor oxygen saturation were more likely to die.

Background

Although the World Health Organisation has declared an end to COVID-19 as a public health emergency, it remains a disease of global concern. The disease persists and continues to evolve with the risk of new variants emerging and causing increasing morbidity and mortality (1). Since December 2019, there have been over 775 million confirmed cases and over 7 million deaths worldwide due to COVID-19, with over 5.4 billion vaccine doses administered as of June 2024 (2). The Americas, Europe, and the Western Pacific were the worst-hit regions with the virus accounting for over 80% of the overall cases globally (2). Africa was the least affected region with less than 3% of the globally reported confirmed cases (2). In Nigeria, there were about 266,675 confirmed cases of the disease and 3155 deaths as of August 2023. Lagos State in Southwestern Nigeria had the highest number of reported cases and deaths (103,931 and 771, respectively), while Ogun State, which shares borders with it, has reported 5810 confirmed cases and 82 deaths (3). COVID-19 is a viral disease caused by the coronavirus, and the major mode of transmission is via droplet spread during the process of coughing and sneezing by an infected person. The mode of presentation in persons affected by the virus ranges from asymptomatic presentation with no signs or symptoms to those with mild/moderate symptoms such as fever, dry cough, fatigue, aches and pains, abdominal pain, sore throat, difficulty in breathing, diarrhoea, headache, conjunctivitis, loss of taste or smell, and so on. Severe presentations could occur with symptoms such as acute respiratory distress syndrome, multiple organ failure or even death (4, 5, 6, 7). The study of the clinical characteristics, outcome and survival analysis of hospitalised patients is an important activity to understand the epidemiological characteristics of the disease further, as this may vary from one region to another. Early studies in China and Italy found that individuals hospitalised with severe COVID-19 disease were more likely to be adults 65 years and older, and people with chronic conditions like diabetes and cardiovascular disease (7). In Nigeria, few studies have been done which looked at the characteristics of hospitalised patients with confirmed COVID-19 disease (8, 9, 10). Hence, this study was done to add to the body of knowledge on the epidemiology and survival of COVID-19 in Nigeria.

Methods

Study Location

Ogun state is in the South-Western region of Nigeria and shares a close boundary with Lagos and the Atlantic Ocean on the South, and Oyo and Osun states in the North. It has 20 local governments and three senatorial districts. The estimated population for the state is at least 5.2 million people, as projected by the 2006 National Population Census (11). The State has 426 primary health care facilities, 26 secondary health care facilities, four tertiary health care institutions, 904 registered private health facilities and state-owned COVID-19 isolation centres located in Olabisi Onabanjo University Teaching Hospital (OOUTH), Sagamu and Ikenne.

Study Design and Participants

The study was a retrospective study of all hospitalised COVID-19 patients admitted in the state isolation centre between March and December 2020. All patients had both nasal and oropharyngeal specimens that were tested for SARS-CoV-2 virus and were confirmed to be COVID-19 positive using real-time reverse-transcription-polymerase-chain-reaction (RT-PCR) assay for SARS-CoV-2 under the COVID-19 protocol published by WHO (12). At the outset of the epidemic, both symptomatic and asymptomatic COVID-19 confirmed patients were admitted into the isolation centres. Some of the patients admitted were contacts of confirmed COVID-19 positive patients who were screened and found to be positive. Others were referred to the isolation centre following a diagnosis of COVID-19 after presenting with symptoms at health facilities or were referred by the epidemiology team following positive field testing of high-risk groups. They were discharged after having two consecutive negative results. As the epidemic progressed, the national guideline was revised such that only symptomatic patients were admitted to the isolation centre, and they were discharged after 10-14 days or when their symptoms had completely resolved.

Treatment

The treatment of COVID-19 patients was based on a state protocol created under the NCDC and WHO standards for COVID-19. The protocol evolved throughout the study period to reflect current available evidence at each step and to align with NCDC and WHO guidelines (13, 14). In the early stages, all patients received Vitamin C and Zinc, with Vitamin D added as the pandemic progressed, as well as low molecular

weight heparin and dexamethasone. The state protocol suggested the administration of chloroquine or hydroxychloroquine in the early phase if there were no contraindications. Azithromycin and/or ceftriaxone were used as needed based on the clinician's assessment of the disease's severity and the existence or suspicion of a secondary bacterial infection.

Data Collection and Statistical Analysis

The baseline clinical data and other relevant information, such as demographics, signs and symptoms, presence of comorbidities and treatment outcome, were collected by trained Junior residents from the patients' health records retrospectively, and the information was entered into a predesigned proforma. Data was cleaned and entered into SPSS for analysis. Data was summarised and associations between categorical variables were determined using inferential statistics. The multivariable Cox proportional hazards regression model was used to determine predictors of mortality. Kaplan Meier curves were used to estimate the probability of survival, and the log-rank test was employed to assess the survival trend among COVID-19 patients who died or survived by the end of the study period. A p-value of < 0.05 was considered statistically significant.

Results

A total of 273 patients were included in this study, and the mean age was 45.33±16.9.

Table 1 shows baseline characteristics of the patients. Males made up more than half of the patients (58.2%), and the majority were Nigerians (94.57%). Over half (51.6%) had symptoms, and more than two-thirds (82.4%) had SPO2 ≥ 94% at the time of presentation. Almost all (94.1%) were discharged home after treatment, while 5.1% of the patients died.

Table 1: Baseline Characteristics of COVID-19 patients

Variable N =273	Frequency	Percentage
Age (Years)		
≤ 45	147	53.8
>45	126	46.2
Sex		
Male	159	58.2
Female	114	41.8
Nationality		
Nigerian	259	94.5
Indian	10	3.9
Egyptian	1	0.4
Guinea Conakry	1	0.4
Pakistan	1	0.4
Chinese	1	0.4
Symptoms on admission		
Yes	141	51.6
No	132	48.4
SPO2 status on admission		
≥ 94%	225	82.4
Less than 94%	48	17.6
Outcome		
Discharged	257	94.1
Died	14	5.1
Referred	2	0.7

Table 2 shows the pattern of clinical presentation. Over half of the patients (55.3% and 51.8%) presented with fever and cough, respectively. Less than a third (28.4%) had difficulty breathing, while almost a fifth (17.7%) had weakness.

Table 2: Pattern of clinical symptoms among COVID-19 patients

Variable N=141	Frequency	Percentage
Fever	78	55.3
Cough	73	51.8
Difficulty in breathing	40	28.4
Weakness	25	17.7
Sore throat	17	12.1

Headaches	15	10.6
Nasal discharge	14	9.9
Loss of smell	12	8.5
Body aches/pains	9	6.4
Leg swelling	6	4.3
Loss of appetite	6	4.3
Vomiting	5	3.5
Loss of taste	4	2.8
Diarrhoea	3	2.1
Loss of consciousness	3	2.1
Nausea	2	1.4
Abdominal pain	2	1.4
Insomnia	2	1.4
Dizziness	2	1.4
Dysuria	2	1.4
Chest pain	2	1.4
Others	9	6.4

Table 3 shows the comorbidity pattern among the patients. One third (33.0%) had comorbidities. Almost three-quarters (73.3%) had hypertension, and 31.1% had diabetes. Less than 10% had cardiac failures or asthma. Of those with comorbidities, almost two-fifths (35.6%) had two or more comorbid conditions.

Table 3: Comorbidity pattern in COVID-19 patients

Variable	Frequency	Percentage
Comorbidity present N=273		
Yes	90	33.0
No	183	67.0
Type of comorbidity N=90		
Hypertension	66	73.3
Diabetes	28	31.1
Cardiac failure	8	8.9
Asthma	5	5.6
Cancer	4	4.4
PUD	2	2.2
CKD	3	3.3
Liver Cirrhosis	1	1.1
CVA	2	2.2
Bronchiectasis	1	1.1
Obesity	1	1.1
Post Renal Transplant	1	1.1
Previous Gastric bypass surgery	1	1.1
Paraplegia	1	1.1
Tuberculosis	2	2.2
Sickle cell disease	1	1.1
Two or more comorbidities	32	35.71
Yes	32	35.6
No	58	64.4

Table 4 shows the relationship between baseline characteristics and the outcome of the patient. Age, symptoms on admission, presence of comorbidities, having two or more comorbid conditions and SPO2 status on admission were significantly associated with mortality among the patients (0.002; <0.001; <0.001; 0.002; and <0.001, respectively).

Table 4: Factors associated with mortality in COVID-19 patients

Variable N=271	Alive	Dead	Chi square	P value
Age				
≤ 45	144(56.0)	2(14.3)		
>45	113(44.0)	12(85.7)	9.311	0.002
Sex				
Male	149(58.0)	8(57.1)		
Female	108(41.7)	6(42.9)	0.004	0.951
Nationality				
Nigerian	246 (95.7)	13 (92.9)		
Others	11 (4.3)	1 (7.1)	0.257	+0.612
Symptoms on admission				
Yes	125 (48.6)	14 (100.0)		
No	132 (51.4)	0 (0.0)	14.019	<0.001
Comorbidity present				
Yes	75 (29.2)	14 (100.0)		
No	182 (70.8)	0 (0.0)	+30.189	<0.001
Two or more comorbid conditions				
Yes	22 (28.9)	10 (71.4)		
No	54 (71.1)	4 (28.6)	+9.311	0.002
SPO2 status on admission				
≥ 94%	221(86.0)	2(14.3)		
Less than 94%	36(13.0)	12(85.7)	+46.838	<0.001

Table 5 shows predictors of mortality among the patients. Those who had two or more comorbid conditions were 9 times more likely to die compared to those who did not (p = 0.008). Also, patients who had oxygen saturation less than 94% on admission were 19 times more likely to die compared to those whose oxygen saturation was ≥ 94% (p = 0.002).

Table 5: Predictors of mortality in COVID-19 patients

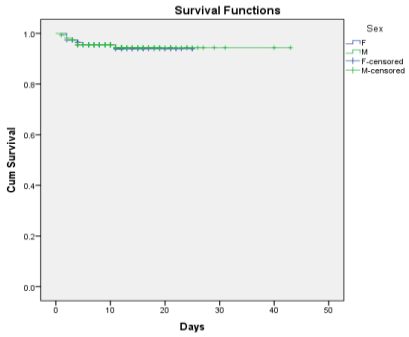
Variable	Adjusted odds ratio	95% Confidence interval	P value
Age			
≤ 45	1		
>45	1.3	0.2 – 9.7	0.815
Sex			
Male	1		
Female	0.9	0.2 – 6.0	0.885
Nationality			
Nigerian	1		
Others	0.1	0.0 – 1.8	0.116
Symptoms on admission			
Yes	1		
No	38189517.6	0.0	0.995
Comorbidity present			
Yes	1		
No	34037877.7	0.0	0.995
Two or more comorbid conditions			
No	1		
Yes	9.5	1.8 – 50.6	0.008
SPO2 status on admission			
≥ 94%	1		
Less than 94%	19.5	3.0 – 128.0	0.002

Survival analysis

Data on outcome were available for 271 patients (99%), and these were included in the survival analysis. The Mean recovery/discharge time for COVID-19 patients was 11.83 ± 6.31 days, approximately 12 days. The Kaplan-Meier curve and the log-rank test showed no significant difference in the probability of survival from the

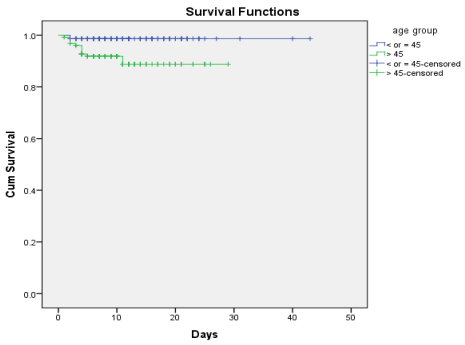
COVID-19 infection between the different sexes. However, a significant difference was observed in the Kaplan-Meier curve regarding the age, the presence of symptoms at admission, the existence of comorbid conditions and oxygen saturation <94% at admission. These factors were associated with a lower probability of survival.

Figure 1: Kaplan-Meier survival curve of hospitalised COVID-19 patients in Ogun State. (A) Survival function according to sex of hospitalised COVID-19 patients in Ogun State. (B) Survival function according to age group of hospitalised COVID-19 patients in Ogun State. (C) Survival function according to the presence of comorbidity of hospitalised COVID-19 patients in Ogun State. (D) Survival function according to the presence of symptoms of hospitalised COVID-19 patients in Ogun State. (E) Survival function according to the need for oxygen therapy on admission to hospitalised COVID-19 patients in Ogun State.



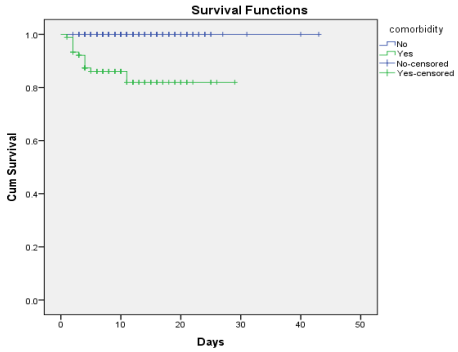
A: Survival function according to sex of hospitalised COVID-19 patients in Ogun State

Log Rank (Mantel-Cox) was not statistically significant (χ2= 0.0, df =1, p 0.940)



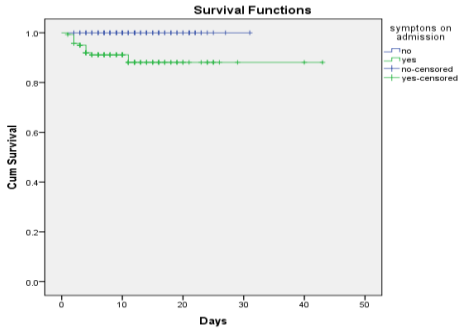
B: Survival function according to age group of hospitalised COVID-19 patients in Ogun State

Log Rank (Mantel-Cox) was statistically significant (χ2= 9.4, df =1, p 0.002)



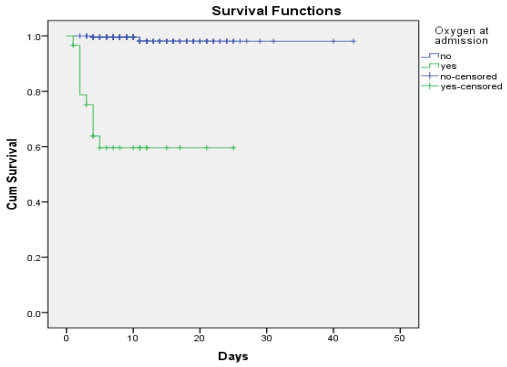
C: Survival function according to the presence of comorbidity of hospitalised COVID-19 patients in Ogun State

Log Rank (Mantel-Cox) was statistically significant (χ2= 31.6, df =1, p < 0.001)



D: function according to the presence of symptoms of hospitalised COVID-19 patients in Ogun State

Log Rank (Mantel-Cox) was statistically significant (χ2= 14.8, df =1, p < 0.001)



E: Survival function according to need for oxygen therapy on admission to hospitalised COVID-19 patients in Ogun State

Log Rank (Mantel-Cox) was statistically significant (χ2= 89.631, df =1, p < 0.001)

Discussion

This study provides important insights into the clinical characteristics and outcomes of patients hospitalised with COVID-19 in Ogun State. Fever emerged as the most reported symptom among participants. Approximately one-third of the admitted patients had at least one comorbid condition, with hypertension being the most prevalent. The overall mortality rate was 5%, and analysis revealed that the presence of two or more comorbidities and oxygen saturation below normal levels were significant predictors of mortality. The average hospital stay was 12 days, and survival analysis demonstrated that patients older than 45 years, those with comorbidities, presenting symptoms at admission, and low oxygen saturation faced a higher risk of poor outcomes.

The COVID-19 isolation centres in Ogun state saw a total of 273 patients within the study period. Most of them were males with an average age of 45 years. This is similar to other Nigerian studies, which reported mean ages ranging from 43 – 47 years, and male preponderance ranging from 51% - 75% (9, 10, 15). The finding from this study is slightly lower than what was reported in China and Brazil, where the mean age of the patients was 51 years and 58 years, respectively (16, 17). The lower mean age observed in this study could be attributed to the fact that Nigeria has a predominantly youthful population (11). Almost half of the patients (48.4%) did not have any observable symptoms. This is because this study examined the characteristics of patients hospitalised during the first and second waves of the COVID-19 pandemic in Nigeria. The first COVID wave was stated as occurring between February and October 2020, while the second wave happened between November 2020 to April 2021 (18). During the first wave of the pandemic, patients were admitted even when they had no obvious symptoms in a bid to contain the spread of the COVID-19 infection in the early phase. This is evidenced in this study that several of the individuals did not present with symptoms. Concerning patients who presented with symptoms, fever (55.3%) was the most prevalent presenting symptom. This corroborates the findings of other research, which found that fever was the most common symptom in COVID-19 cases occurring in up to 85.6% of patients during the disease (10, 19). One potential reason is that COVID-19 infection, which is viral, causes an immunologic response in an attempt to contain the infection (20, 21). Fever is thus a crucial aspect of the body's defence against infection

and helps to eliminate the offending microorganisms from the host (22). Comorbid conditions were present in about a third of the study population (33%). Among those with comorbidities, 35.6% had two or more comorbidities. This is consistent with earlier studies (10, 16, 23, 24) that found comorbidities in COVID-19 patients ranging from 13% - 42%. This finding is also consistent with findings from Chinese studies, in which 33% of cases had at least one concurrent condition (16). Hypertension was the most common comorbidity in this study (73.3%). This is similar to the findings of a study conducted in southwest Nigeria, which discovered that 74.2% of COVID-19 patients with comorbidity had hypertension (24). Other studies in Nigeria and Mexico found that 44%, 34%, and 22% of individuals had hypertension (9, 20, 25). This finding contradicts some earlier research that found diabetes to be the most prevalent comorbidity among COVID-19 patients (17). The mortality rate within our cohort was 5%. This was higher than the national average (1.2%) (3) and in Lagos, Nigeria, as seen in studies by Otuonye et al and Osibogun et al (3.3%, 2.6%) (9, 24). This may be attributed to the fact that this study was among hospitalised COVID-19 patients who had more severe disease compared with the general population. However, a study of hospitalised patients at a federal isolation centre in Ogun state, Nigeria (26.9%) and a National tertiary referral centre in Ghana (34.4%) (10, 26), reported a higher mortality rate than this study. The higher mortality rate reported in the Abeokuta study may have been overestimated due to the very small sample size reported in the study, and the study population in Ghana was relatively older patients compared to our study.

Regarding factors that predicted mortality, our study confirms prior findings that the presence of two or more comorbidities is a risk factor for mortality in COVID-19 patients (24, 27). Those with two or more comorbid conditions were 9 times more likely to die than those without. co-morbid conditions such as hypertension and diabetes. These conditions continue to be prevalent in Nigeria (national prevalence 28.9% and 5.77% respectively) (28, 29) and in many instances go undiagnosed, potentially due to poor health-seeking behaviours or lack of awareness among the general populace (29). As a result, affected persons often present with poorly controlled diseases or sequelae (30), which increases their risk of poor prognosis if infected with COVID-19 (27).

Additional findings in our study showed that patients with less than 94% oxygen saturation at presentation were 19 times more likely to die than those with higher oxygen saturation at presentation. Previous studies in China, the United States and Peru have highlighted hypoxaemia on admission as a predictor of mortality (31, 32, 33). These findings suggest that patients possibly presented to the hospital with late-stage disease (33) or had visited other hospitals that were not fully equipped to detect hypoxemia and/or offer the essential oxygen support before arriving at the state isolation centre. This emphasises the significance of a high index of suspicion among healthcare personnel, as well as early referral to appropriately equipped facilities for the management of patients requiring hospitalisation.

The mean length of stay in the isolation ward was 12 days. This is slightly higher than what was reported in the United States, Asia and other European studies (34, 35, 36, 37). Regarding survival analysis using the Kaplan-Meier method, those who were older than 45 years, had comorbidities, symptoms on admission and low oxygen saturation had a higher risk of dying from COVID-19. Studies have reported that age greater than 50 years increases the risk of fatal complications in people with COVID-19 (38, 39).

This study has certain limitations. This study was retrospective and used only hospitalised patients. Hence, it may have overestimated the mortality rates and the study may not be generalizable to the general population.

Conclusion

In conclusion, this study describes the clinical characteristics of hospitalised COVID-19 cases in Ogun state. Fever was the most common presenting feature, and a quarter of the patients had comorbidities. Mortality rate was 5% with the presence of two or more comorbid conditions, less than normal oxygen saturation at presentation, shown as a predictor of mortality. Early diagnosis, timely referral to appropriate facilities, especially in patients with comorbidities, remains an important aspect in achieving a positive outcome for patients with COVID-19.

List Of Abbreviations

NCDC: Nigeria Centre for Disease Control
WHO: World Health Organisation

Declarations

Ethical consideration

Approval for this study was obtained from the Health Research Ethics Committee of the Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria (NHREC/28/11/2017). Confidentiality of patients' records was also

maintained, and all data was kept in secure locations with electronic data coded to preserve confidentiality

Consent for publication
The authors hereby give consent for the publication of our work under the Creative Commons CC Attribution-Non-commercial 4.0 license.

Competing Interests
There is no competing interest.

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None.

Authors' Contributions
DOJ, BJO, ABO, FOM, JEO, CMO, SFO, and AAD contributed to the conceptualisation and study design. BJO, AO, EBO, AVA, OAA, ATD, GAA, and OAO collected the data. DOJ, BJO, JEO, AAD analysed the data. DOJ, FOM, ABO, and CMO supervised the study. DOJ, BJO, GAA, and OAO wrote the manuscript. DOJ, BJO, AO, EBO, AVA, OAA, ATD, GAA, OAO, ABO, FOM, JEO, CMO, SFO and AAD revised the manuscript for intellectual content.

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