Results of Statistical Analyses

Predictors of mortality of hospitalized patients with laboratory-confirmed severe acute respiratory syndrome coronavirus 2 in Nigeria: A retrospective analysis of high burden states

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Front Matter

Background

The current COVID 19 pandemic has resulted in a high number of deaths and associated disruption of public health and socioeconomic activities of countries and populations. As at 9th of April 2021, Nigeria had recorded 163,581 confirmed cases, with 150,005 cases discharged, 7,518 cases on admission and 2,058 deaths with a significant increase in the number of confirmed cases and concurrent deaths since the beginning of the second wave of infections. Most of these deaths have been in-hospital. Little is known about the deaths in the community due largely to poor community records of deaths and other vital statistics. The weak Nigerian health system is thought to have led to a considerably high in-hospital mortality especially in settings where critical care services and resources are scarce. Underlying morbidities such as malnutrition, anemia, HIV/AIDs, and chronic respiratory conditions, diabetes and heart failure have been shown to be important contributors to high global mortality in the current COVID 19 pandemic. Even though several global reports have been written about the impact of the COVID 19 pandemic on clinical outcomes especially the attendant morbidity and mortality, little is known about the situation in Nigeria. Understanding the relative contributions and probable mechanism through which sociodemographic, clinical and laboratory factors relate to the high in-hospital mortality in Nigeria could help us identify weak points within the health system that can be improved upon for current and future responses. In addition, such review will also help us plan and prioritize health infrastructure and resource allocation for better health outcomes in our public health system. The aim of this study was to describe clinical characteristics and factors associated with mortality and time to mortality for patients hospitalized with laboratory-confirmed severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection in Nigeria

Data Analysis Plan

Study Setting

Nigeria is Africa's most populous country. We studied patients with laboratory-confirmed SARS-CoV-2 infection from 28 COVID-19 treatment centers across 15 states in Nigeria including the Federal Capital Territory (see Figure1).

Study Design

This study was a retrospective cross-sectional study.

Data Collection

We extracted data from the World Health Organization (WHO) nCOV database platform (OpenClinica Electronic Data Capture [EDC] System) for 28 sites across 15 states in Nigeria (see Figure1). We retrieved data on date of admission, enrollment date, demographic data (patients' sex, age, health worker), data on pre-existing morbidity (chronic cardiac disease, hypertension, chronic pulmonary disease, asthma, chronic kidney disease, chronic neurological disorder, HIV, diabetes, current smoking, tuberculosis, asplenia, malignant neoplasm), pre-admission and chronic medication (ACE inhibitors, angiotensin II receptor blockers, non-steroidal anti-inflammatory drugs in the 14 days prior to admission), medications received on day of admission or following (antiviral, corticosteroid, chloroquine/hydroxychloroquine), admitted to ICU or HDU, supplemental oxygen given, use of non-invasive ventilation, use of invasive ventilation, outcome (discharged alive, hospitalized, transfer to other facility, death, palliative discharge), and outcome date.

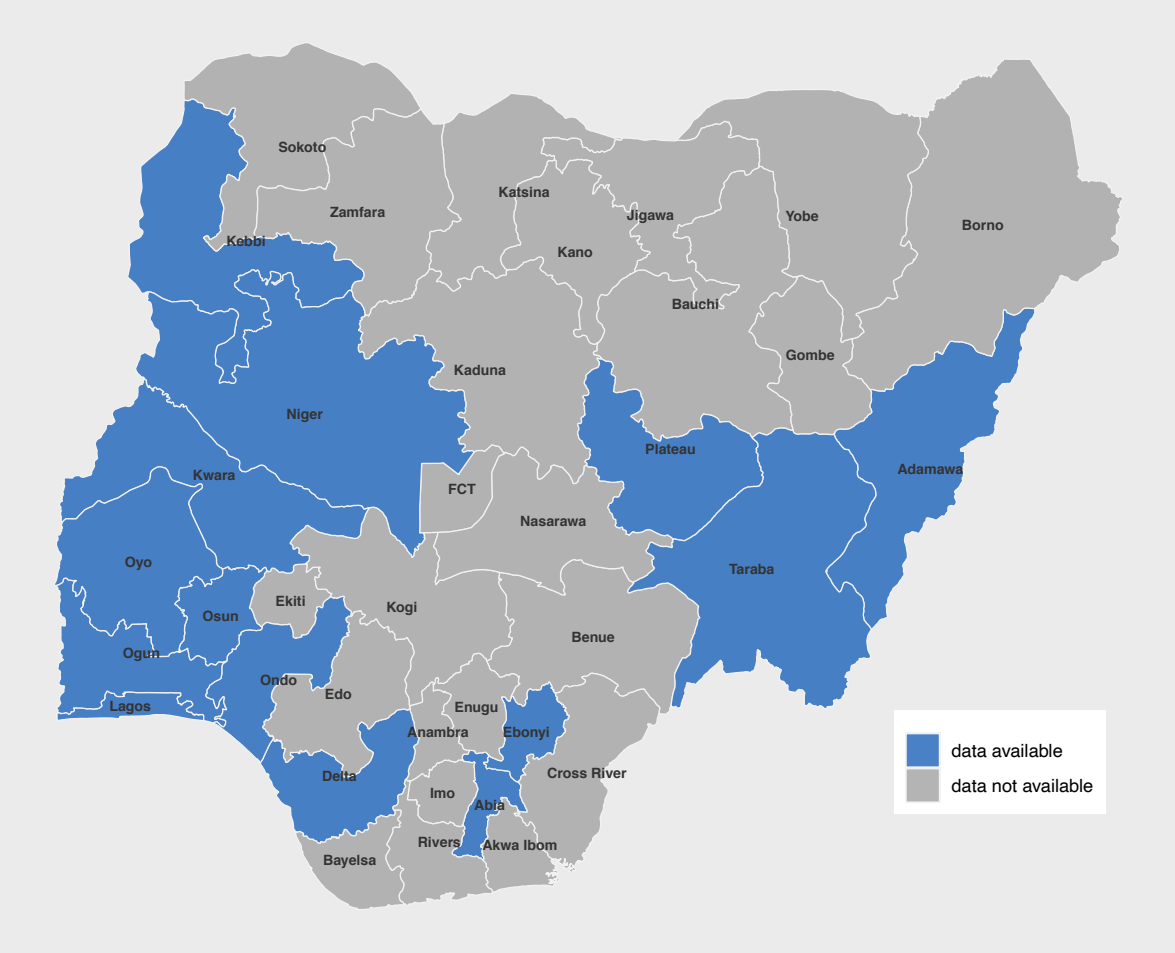

Figure 1: States with available data

Following data cleaning, data recoding and removal of missing observations we were left with 3,462 records for data analysis. Two states (Delta and Taraba) were excluded because the states each had less than 10 records: Delta (6), Taraba (1).

Study Variables

The primary study outcome was death for a PCR confirmed infection with SARS-CoV-2 virus. The secondary study outcome was time from enrollment to death. We coded the primary study outcome as 1 if the patient died or 0 if outcome was censored. Time following admission was right censored at 84 days post-enrollment. The main explanatory variable was severity of disease. We defined severity of disease as a composite score derived from any or all of:

1. Received supplemental oxygen therapy on any day during hospitalization,
2. Admitted to the ICU or HDU at any point during hospital stay,
3. Received non-invasive ventilation (CPAP/BIPAP) on any day during hospitalization, and
4. Received invasive ventilation (mechanical ventilator) on any day during hospitalization.

These variables were assigned a score of 1 if reported in the database or 0, otherwise. The severity score was calculated as the sum of these individual scores with a range of 0 to 4. The other explanatory variables were demographic (age, sex, healthcare worker), pre-existing morbidity, malaria, HIV infection, pre-admission and chronic medications, and medications received on admission or following admission. These explanatory variables were coded as 1 if reported or 0 if not reported or missing.

Statistical Analysis

Power calculation1-

The relationship between the log odds of the mortality and *k* explanatory variables may be modeled thus:

$$log\left(\frac{\mathrm{p}}{1-\mathrm{p}}\right) = \beta_1 \mathrm{x}_1 + \beta_2 \mathrm{x}_1 + \cdots + \beta_\mathrm{k} \mathrm{x}_\mathrm{k}$$

The main explanatory covariate was severity score assumed to be normally distributed based on the central limit theorem. Given two-sided testing of H_0: $\beta_i = 0$ on the log scale versus H_1: $\beta_i \neq 0$, then the minimum sample size is according to Hsieh et al.,[i] given by:

$$n = \frac{\left(z_{1-\alpha/2} + z_\gamma\right)^2}{p(1-p)\left(1-\rho_i^2\right)\hat{\beta}^2}$$

[i] Hsieh FY, Bloch DA, Larsen MD.A simple method of sample size calculation for linear and logistic regression. Statistics in Medicine. 1998;17(14):1623–34.