

Evaluation of Excess Deaths in a Tertiary Hospital in Urban Northern Nigeria during the COVID-19 Pandemic (EDiK-2020 Study)

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Abstract

Context: The morbidity and mortality arising from the COVID-19 pandemic in low- and middle-income countries were further worsened by the disruption in health systems and diversion of strained health resources for emergency response. **Aim:** This study ascertained whether there was an increase in the number of deaths recorded in Kano, Nigeria, during the pandemic, compared to the preceding 3 years and identified the potential causes of these deaths. **Materials and Methods:** Using a retrospective design, data were collected from a tertiary hospital in Kano from January to June 2020. Data on number and date of deaths, as well as clinical information of the deceased, were retrieved from hospital records. Comparison data were collected on all deaths and admissions in the hospital within a similar period (January–June) of 2017–2019. **Results:** The age of the deceased ranged from one day to 115 years, with the majority being males ($n = 414$; 63.2%) and adults ($n = 491$; 75.0%). The majority did not have history of recent travel ($n = 570$; 87.0%), contact with COVID-19 suspected cases ($n = 622$; 95.0%), or confirmed COVID-19 ($n = 625$; 95.4%). Slightly less than half ($n = 262$; 46.2%) died within 24h of admission. The majority ($n = 452$; 79.7%) died within 7 days of admission. The most common cause of death recorded on admission was sepsis ($n = 66$; 10.1%), while 53 (8.1%) were brought in dead. SARS-CoV-2 infection was the documented cause of death in twelve patients (1.8%). More than half ($n = 378$; 57.7%) had underlying medical conditions, of which hypertension ($n = 172$; 45.5%) was the most common. The highest annual average deaths (178) and admissions (2179) were recorded in 2019, while 135 deaths and 1532 admissions were recorded in 2020. Most deaths occurred in April 2020 (208), while the highest number of admissions was recorded in March 2020. Mortality was higher in April of 2020 (14.1%, 95% CI: 12.4%–16.0%) compared to the same month in 2017 (7.6%, 95% CI: 5.9%–9.7%), 2018 (8.4%, 95% CI 7.0%–10.2%), and 2019 (8.5%, 95% CI 7.3–9.8%). **Conclusion:** In summary, we found excess mortality rates during the COVID-19 pandemic in Kano, Nigeria, consistent with prior studies.

Keywords: COVID-19, Kano, mortality, Nigeria, pandemic

INTRODUCTION

The coronavirus disease 2019 (COVID-19) pandemic has been associated with substantial morbidity and mortality, with significant disruption of economies, social structure, and health service delivery.^[1] The impact of this pandemic has been higher in older age groups, those with co-morbidities, vulnerable groups, and poorer countries.^[2] Due to the overwhelming nature of already weak health systems in low-resource settings, strained resources were diverted to emergency response efforts, thus

compromising the provision of both routine and specialized health services. The additional burden of managing patients

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Submitted: 15-Mar-2023

Revised: 15-May-2023

Accepted: 02-Jun-2023

Published: 29-Nov-2023

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How to cite this article: Galadanci HS, Abubakar IS, Musa BM, Adamu A, Gadanya MA, Tsiga-Ahmed F, *et al.* Evaluation of excess deaths in a tertiary hospital in urban Northern Nigeria during the COVID-19 pandemic (EDiK-2020 study). *Niger J Basic Clin Sci* 2023;20:109-13.

Access this article online

Quick Response Code:



Website:
www.njbcsc.net

DOI:
10.4103/njbcsc.njbcsc_12_23

with COVID-19 created a reduction in access to quality health services for persons with existing medical conditions. Further, caregivers were faced with burnout, and some healthcare workers had to be quarantined or isolated due to exposure or infection, respectively. As was reported during the 2014 Ebola epidemic, COVID-19 resulted in near-collapse of health systems, especially in resource-constrained countries like Nigeria.^[3]

From the beginning of the pandemic on December 31, 2019, to May 8, 2020, there were nearly 4 million confirmed cases, with over 270,000 deaths attributed to COVID-19 globally.^[4] At that time, Nigeria reported over 3,500 confirmed cases and 107 deaths, with more than half of the cases in Lagos and Kano states.^[5] Assessing the exact burden of this pandemic in low-resource settings was hampered by limited testing capacity within the context of weak health systems unprepared to deal with emergency health crises.^[6-9] Lay reports speculated an increase in the number of deaths from unexplained illnesses of sudden onset in Kano that coincided with the beginning of the pandemic.^[10,11] The absence of a complete vital registration system in Kano and cultural rites that mandate the immediate burial of deceased persons further complicate the ability to reliably document vital events. The objective and formal documentation of causes of deaths are largely only recorded in health facilities. We, therefore, sought to quantify the number of deaths that occurred in a tertiary hospital in Kano over 6 months (January to June 2020) and compare findings with those from similar months in the last 4 years, in addition to describing the causes of death during the pandemic. We hypothesize that a substantial proportion of these deaths were likely to have been due to COVID-19 and occurred early in the post-admission period.

METHODS

Study setting

Kano state is located in North-west Nigeria and is the most populous state in the country, with a population density of 550.8 p/km². Health services are provided via three hierarchies (primary, secondary, and tertiary care). Private health facilities provide a blend of healthcare services of varying complexity. Aminu Kano Teaching Hospital is a 750-bed referral center for other hospitals within and outside Kano.

Study design

Using a cross-sectional design, we retrospectively retrieved data on number and date of deaths from January to June 2020; as well as on clinical information of the deceased from the hospital records department. In addition, a number of deaths and admissions in similar periods (January to June) for the previous 3 years (2017–2019) were retrieved.

Data collection

Data were collected on all patients who died on admission, as well as those who died at point of presentation, as well

Table 1: Socio-demographic characteristics of the deceased

Variable (number of missing observation)	n (%) n=655
Sex (0)	
Male	414 (63.2)
Female	241 (36.8)
Age in years (0)	
Children (<18)	164 (25.0)
Adults (≥18)	491 (75.0)
Religion (0)	
Islam	591 (90.2)
Christianity	64 (9.8)
Ethnic group (0)	
Hausa/Fulani	561 (84.1)
Igbo	31 (4.7)
Yoruba	17 (2.6)
Others	56 (8.5)
Geo-political zone (3)	
North Central	1 (0.3)
North East	30 (4.7)
North West	617 (94.3)
South South	2 (0.4)
South West	2 (0.4)
History of travel (570)	
Yes	12 (14.1)
No	73 (85.9)
Contact with SARS-CoV-2 suspect (622)	
Yes	2 (6.1)
No	31 (93.9)
Contact with confirmed SARS-CoV-2 patient (625)	
Yes	1 (3.3)
No	29 (96.7)
Sample taken for SARS-CoV-2 (83)	
Yes	12 (2.1)
No	560 (97.9)
SARS-CoV-2 Result (n=7)	
Positive	2 (28.6)
Negative	5 (71.4)
Time to death (88)	
≤24 h	262 (46.2)
Days	190 (33.5)
>7 days	115 (20.3)

as on total admissions in the hospital for the period of study. Sources of mortality data within the hospital were identified as hospital mortality registers, accident and emergency (A and E) registers, ward registers, nurses' records, and physician notes. The tool obtained information on the number of deaths as well as admissions. Data were collected on individual deaths stratified by week from January 1, 2020, and included dates of admission/presentation and death, demographic, epidemiological, clinical, and laboratory test results for COVID-19. In addition, we obtained information on the number of deaths and admissions in similar periods (January to June) for the previous 3 years (2017–2019).

Analysis

The overall number of deaths was obtained as counts and used to calculate the proportion of deaths out of total admissions. Continuous variables were expressed as mean (\pm SD) or median with range. Categorical variables were presented as frequencies and percentages. Analysis was performed using STATA software.^[12]

Ethical consideration

Ethical approval was obtained from Aminu Kano Teaching Hospital Ethical Committee with approval number: NHREC/28/01/2020/AKTH/EC/2828 and dated January 28, 2020. The study conformed to the provisions of the Declaration of Helsinki (as revised in Edinburgh 2000).

RESULTS

A total of 753 deaths were recorded between January 1, 2020, and June 30, 2020. Of these, 655 (87.0%) files were retrieved and data extracted. The mean age (\pm standard deviation, SD) at death was 49 ± 25 years. The majority of deceased persons were men ($n = 414$; 63.2%), adults ($n = 491$; 75.0%), of the Islamic faith ($n = 591$; 90.2%), Hausa/Fulani ethnic group ($n = 551$; 84.1%), and from Kano state ($n = 534$; 81.5%). History was not elicited in the majority for recent travel ($n = 570$; 87.0%), contact with SARS-CoV-2 suspect ($n = 622$; 95.0%), and contact with confirmed SARS-CoV-2 patient ($n = 625$; 95.4%). Positive history of contact with SARS-CoV-2 suspects ($n = 31$) and SARS-CoV-2 patients ($n = 29$) was elicited in very few: (2/31; 6.1%) and (1/29; 3.3%), respectively. Slightly less than half ($n = 262$; 46.2%) died within 1 h of admission and the majority ($n = 452$; 79.7%) died within 7 days of being admitted. Of those who had a history elicited, there was contact with very few SARS-CoV-2 suspects (2/31; 6.1%) and patient (1/29; 3.3%) [Table 1].

Causes of death

More than 50 causes of death were documented. The top five were sepsis ($n = 66$; 10.1%), head injury ($n = 63$; 9.6%), cerebrovascular accident ($n = 54$; 8.2%), cancer ($n = 54$; 8.2%), trauma ($n = 30$; 4.6%), and chronic renal failure ($n = 26$; 4.0%). Fifty-three (8.1%) were brought in dead. SARS-CoV-2 was the documented cause of death in twelve (1.8%) [Table 2].

Signs and symptoms at presentation

The most common signs and symptoms at presentation to the hospital were fever ($n = 240$; 36.6%) and loss of consciousness ($n = 221$; 33.7%); followed by difficulty in breathing ($n = 178$; 27.2%), vomiting ($n = 161$; 24.6%), cough ($n = 122$; 18.6%), and myalgia/fatigue ($n = 97$; 14.8%) [Table 3]. For those who had two of the COVID-19 case definition symptoms, 75 (11.5%) had a loss of consciousness and fever; 76 (11.6%) had fever and cough, while 93 (14.2%) had cough and breathlessness at presentation. Sixty (9.1%) of them had three symptoms (fever, cough, and breathlessness) at presentation.

Table 2: Documented causes of death

Cause of death	Frequency (n=655)	Percentage
**Sepsis	66	10.1
Head injury	63	9.6
**Cerebrovascular accident	54	8.2
**Cancer	54	8.2
Brought in dead	53	8.1
Trauma	30	4.6
**Chronic renal failure	26	4.0
Chronic liver disease	25	3.8
Diabetes mellitus	23	3.5
Low birth weight	14	2.1
Tuberculosis	12	1.8
SARS COV-2	12	1.8
Malaria	11	1.7
**Cardiac failure	11	1.7
Community acquired pneumonia	10	1.5
Renal failure	9	1.3
**Hypertensive heart disease	8	1.2
Respiratory failure	8	1.2
**Others	155	27.7
Not documented	20	3.1

*Other causes: malnutrition, neural tube defects, intestinal obstruction, aspiration pneumonitis, shock, peptic ulcer disease, pulmonary embolism, coronary heart disease, eclampsia, viral hepatitis, meningitis, seizure disorder, brain abscess, viral hemorrhagic fever, neonatal jaundice, etc.
**Multiple responses

Table 3: Reported signs and symptoms of the deceased

Sign/Symptom	Frequency (n=655)	Percentage
Fever	240	36.6
Loss of consciousness	221	33.7
Difficulty breathing	178	27.2
Vomiting	161	24.6
Cough	122	18.6
Myalgia/fatigue	97	14.8
Headaches	89	13.6
Bleeding	82	12.5
Chills/rigors	50	7.6
Other flu like symptoms	27	4.1
Seizures	25	3.8
Abdominal swelling/distension	21	3.2
Sore throat	15	2.3
Diarrhea	14	2.1
Weight loss	13	2.0
Loss of taste or smell	8	1.2
Jaundice	7	1.1
*Other symptoms	116	17.7

All entries were multiple responses. * Other sign/symptoms: Abdominal wall defect, swelling in the back, bedsores, body swelling, dizziness, dysphagia, constipation, breast lesions, scrotal swelling, orbital swelling, orthopnea, dysuria, refusal to nurse/breastfeed, right-sided hemiparesis, palpitations, etc.

Associated medical conditions

More than half ($n = 378$; 57.7%) had underlying medical conditions; of which almost half had hypertension ($n = 172$;

45.5%). Some of the deceased persons had diabetes mellitus ($n = 71$; 18.8%), chronic liver disease ($n = 44$; 11.6%), and cancers ($n = 36$; 9.5%) [Table 4].

Trends in mortality over 4 years

A total of 2,904 deaths and 36,038 admissions were recorded within the first 6 months (January to June) from 2017 to 2020. Average mortality and admissions for 2017 were 122 and 1491, respectively. In 2018, an average of 150 deaths were recorded out of 1579 admissions. The highest average number of deaths (178) and admissions (2179) were recorded in 2019. One hundred and thirty-five deaths and 1532 admissions were recorded in 2020. The least deaths (60) and admissions (788) were recorded in April 2017 and the highest deaths in April 2020 (208). The highest number of admissions was recorded in March 2020. No admissions were recorded in March 2017 and May 2018 on account of a strike by healthcare workers. Over four years, mortality rates varied from 6.9% (95% CI: 5.8%–8.2%) to 14.1% (95% CI: 12.4%–16.0%). Mortality was significantly higher in April of 2020 (14.1%, 95% CI: 12.4%–16.0%) compared to the same month in 2017 (7.6%, 95% CI: 5.9%–9.7%), 2018 (8.4%, 95% CI 7.0%–10.2%) and 2019 (8.5%, 95% CI 7.3–9.8%) [Figure S1].

When different months were compared within the same year, there was no significant difference in mortality except in 2020, where deaths in April were higher than that of January (6.9%, 95% CI: 5.8%–8.2%), February (7.5%, 95% CI: 6.3%–8.2%), March (8.4%, 95% CI: 7.3%–9.7%), May (7.7%, 95% CI: 6.1%–9.5%), and June (8.9%, 95% CI: 7.3%–10.6%) [Figure S2].

DISCUSSION

We found the mortality rate during the 2020 COVID-19 pandemic to be comparable to previous years (2017–2020) except in the month of April 2020 when there was significant increase in the proportionate occurrence of death compared to the preceding three years. The average length of hospitalization before death was short for most patients, and the leading causes

of death were from infections and non-communicable diseases. Many of the deceased had underlying medical conditions and presented at the hospital with acute symptoms that were consistent with SAR-CoV-2 case definitions.

Although the impact of COVID-19 on the health system and delivery of services was global, low-income countries like Nigeria were more affected.^[2,13] Major interruptions in routine health care, decreased access, and uncoordinated responses to the pandemic all caused major disruptions that impeded the delivery of health services, particularly for non-communicable diseases.^[13,14] Our study noted poor testing capacity in the hospital as only a few of the deceased were tested for SARS-CoV-2, and it was not established if the symptoms were suggestive or confirmatory for COVID-19 infection. Many of the deceased had non-communicable diseases that may not have resulted in death in the absence of COVID-19 pandemic but presented in serious condition due to delayed intervention at presentation. The underlying medical conditions may also have put patients in a doubly disadvantaged position, as persons with non-communicable diseases are at higher risk of severe COVID-19-related illness and death.^[13] Also suggestive was the large proportion of patients (46.2%) that died within 24 h of presentation at the hospital. This is in contrast to a similar study in the same setting that noted the majority (83.9%) of deaths to have occurred after 24 h of presentation.^[15]

The month of April 2020 which was the peak period of deaths in Kano state coincided with peak mortality rates recorded not only for the state,^[16] but also for places like Massachusetts in the United States.^[17] The observed mortality rate (14.1%) during the COVID-19 pandemic is not divergent to what had been described previously in Kano (7.8% and 25.3%),^[15,18] with the leading causes of death being a mix of communicable and non-communicable diseases. It was difficult to establish the contributions of COVID-19 to the deaths. Several non-COVID-19 conditions may have contributed to the recorded deaths in Kano during this period. It is also possible that observation bias occurred because of increased community-wide anxiety during the lockdowns, with people noticing deaths more, although death rates may have been unchanged and comparable to similar periods of previous years.

This study had its limitations. Firstly, our study utilized secondary data, which was not complete and therefore could introduce some bias to our findings. The fact that the majority of the deceased were not tested for COVID-19 also prevented definitive conclusions on the impact of COVID-19 on mortality patterns. Further, post-mortem may have contributed to definitive diagnoses, but the practice is very limited in northern Nigeria.^[19] None of the deceased patients in this study underwent a post-mortem exam. However, the study provided data for comparison of causes of death and mortality rates for the state that could inform future institutional responses to similar pandemics.

Table 4: Associated medical conditions

Medical condition	Frequency ($n=378$)	Percentage
Hypertension	172	45.5
Diabetics mellitus	71	18.8
Chronic kidney disease	44	11.6
Cancers	36	9.5
Chronic obstructive public disease	10	2.6
Sickle cell disease	9	2.4
Obesity	9	2.4
HIV/AIDS	8	2.1
Asthma	8	2.1
Pregnancy	6	1.6
*Others	5	1.3

*Others: dementia, schizophrenia, rheumatic heart disease, peptic ulcer disease, hypertensive heart disease, arthritis

CONCLUSION

We found that except for mortality rates in the month of April 2020, the mortality rates and documented causes of deaths observed during the peak months of the COVID-19 pandemic in Kano were similar to what had been reported from previous studies. The double burden of communicable and non-communicable diseases was a major contributor to mortality in our environment. It was difficult to establish what role COVID-19 played in the deaths recorded, as most of the deceased were not tested before their death. Findings from this study can inform future pandemic responses in our settings, including the sustained provision of essential services and good surveillance systems that will help early detection of outbreaks.

Availability of data and materials

The datasets analyzed in this study can be obtained from the corresponding author on request.

Acknowledgements

We would like to thank all the members of the research teams who made data collection and analysis possible.

Financial support and sponsorship

Funding for this study was provided by the Africa Center of Excellence for Population Health and Policy, Bayero University Kano, Kano, Nigeria.

Conflicts of interest

There are no conflicts of interest.

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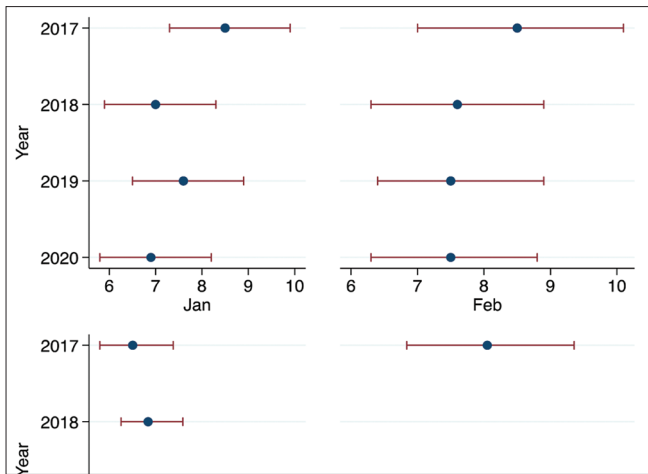


Figure S1: Proportion of deaths out of monthly admissions in AKTH

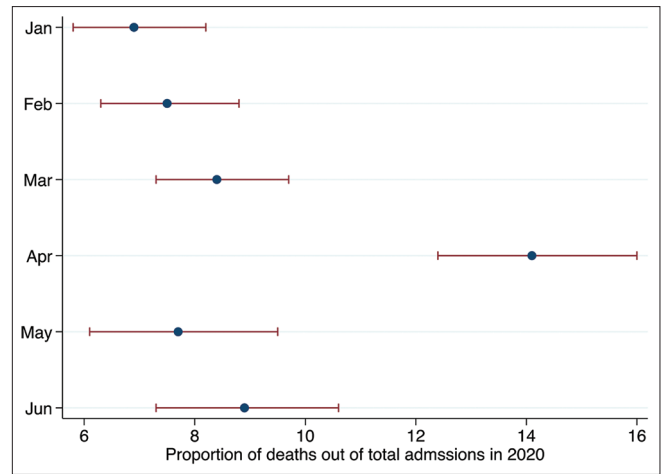


Figure S2: Proportion of deaths by month in 2020