Characteristics of COVID-19 cases and factors associated with their mortality in Katsina State, Nigeria, April-July 2020

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Abstract

Introduction: COVID-19 was first detected in Daura, Katsina State, Nigeria on 4 April 2020. We characterized the cases and outlined factors associated with mortality. **Methods:** We analysed the COVID-19 data downloaded from Surveillance Outbreak Response, Management and Analysis System between 4 April and 31 July 2020. We defined a case as any person with a positive SARS-CoV-2 test within that period. We described the cases in time, person, and place; calculated the crude and adjusted odds ratios and 95% confidence intervals for factors associated with mortality. **Results:** We analysed 744 confirmed cases (median age 35, range 1-90), 73% males and 24 deaths (Case fatality rate 3.2%, Attack rate 8.5/100,000). The outbreak affected 31 districts, started in week 14, peaked in week 26, and is ongoing. Highest proportion of cases in the age groups were 26.7% (184) in 30-39, 21.7% (153) in 20-29 years, and 18.3% (129) in 40-49 years. While the highest case fatality rates in the age groups were 35.7% in 70-79, 33.3% in 80-89 years, and 19.4% in 60-69 years. Factors associated with death were cough (AOR: 9.88, 95% CI: 1.29-75.79), age ≥60 years (AOR: 18.42, 95% CI: 7.48-45.38), and male sex (AOR: 4.4, 95% CI: 0.98-20.12). **Conclusion:** Male contacts below 40 years carried the burden of COVID-19. Also, persons 60 years and above, with cough have an increased risk of dying from COVID-19. Risk communication should advocate for use of preventive measures, protection of persons 60 years and above, and consideration of cough as a red-flag sign.

Introduction

The coronavirus disease 2019 (COVID-19) is a new disease caused by an emerging strain of coronavirus (SARS-CoV-2), an RNA virus of coronaviridae family [1-3]. It had not been previously identified in humans until 7 January 2020 in Wuhan, Hubei Province, China when the first case was reported [1-5]. Globally, there were 20,439,814 cases of COVID-19 with 744,385 deaths reported by the World Health Organization (WHO) as of 13 August 2020 [6]. In Nigeria, cases of COVID-19 peaked at 48,116 with 966 deaths, and Katsina State; one of the northern states of Nigeria, had 744 COVID-19 cases and 24 deaths as at 31 July 2020 [7]. COVID-19 outbreak started in Daura, Katsina State of Nigeria after the report of the index case on 4 April 2020. A post-mortem nasopharyngeal sample was collected from the index case by the state rapid response team and tested positive for SARS-CoV-2 on 7 April 2020.

COVID-19 is highly infectious and evidence of transmission between humans has been demonstrated between people who come in contact with a positive case [8-10]. Transmission can be direct when the hands come in contact with contaminated surfaces and fomites or indirectly through respiratory droplets generated via coughing, sneezing, or talking [9,11,12]. The most frequent symptoms of COVID-19 include fever, cough, fatigue, dyspnoea, myalgia, sputum production, and headache [4,8]. Less reported symptoms include chest pain, rhinorrhoea, sore throat, and haemoptysis [4,13,14].

Fewer deaths from COVID-19 were reported in Nigeria compared to other parts of the world [6,7]. Certain conditions compromise the immunity and are known to increase the risk of death in COVID-19 cases. Older patients with medical illnesses like diabetes and heart diseases are known to have increased risk of severe disease and death from COVID-19 [13-15].

The characteristics of COVID-19 cases and factors associated with their mortality have been described by several research, but little is known about the presentation and factors associated with mortality in the Northern Nigerian setting [12-23]. We aim to describe the characteristics of COVID-19 cases and outline the factors associated with their mortality in Katsina State of Nigeria from April to July 2020.

Methods

Study Design

We performed a cross-sectional study, reviewing secondary data.

Study Setting

Katsina State Ministry of Health, Katsina State Primary Healthcare Agency, Nigerian Centre for Disease Control (NCDC), World Health Organization, and other partners set up rapid response teams that have been responding to the outbreak since its onset. SORMAS is a mobile and web-based platform and database created from the experiences of 2014 Ebola outbreak in Nigeria. It is an electronic medium for implementing the Integrated Disease Surveillance and Response (IDSR) system [19,24]. It was jointly developed by NCDC, and Helmholtz Centre for Infection Research based in Germany. NCDC deployed SORMAS in 2015 after the 2014 Ebola outbreak. SORMAS is now used in all the Nigerian states. COVID-19 module was developed following the pandemic and is used by some countries in Africa, Asia, and Europe [19]. Immediate case-based surveillance data is entered at the health facilities, the laboratories, and by surveillance officers in the field. The State Epidemiologist, the NCDC Surveillance Support Officer, and Data Clerk ensured good data quality, timeliness and completeness. About 80% to 90% of the data on all confirmed cases are uploaded to SORMAS and updated within the first four days of case detection.

Study Area

Katsina State has 34 Local Government Areas (LGAs) and Katsina is the capital [25]. It covers a landmass of 24,192km2, a population of 8,761,794 (2020 Projection) [26]. In the last census conducted in Nigeria, the population of Katsina State comprised 50.8% males, 49.2% females.[26] Also, children (0-14 years), adults (15-64) years, and the elderly (65 years and above) made up 48.5%, 48.7%, and 2.8% of the population, respectively [26].

Study Subjects

The study subjects were all the confirmed cases of COVID -19 in Katsina State from 4 April to 31 July 2020 living within 31 Local Government Areas between 1 and 90 years.

Methods

Case Definitions

The NCDC case definition was used to define cases; a suspected case of COVID-19 is any person with acute respiratory illness (fever and either cough, difficulty breathing or shortness of breath) or new respiratory symptoms without fever (cough, difficulty breathing or shortness of breath) and no other explanation, and a history of travel to or residence in a country reporting COVID-19 within 14 days before symptom onset [19]. A confirmed case, however, is any person with laboratory confirmation of SARS-CoV-2 infection with or without signs and symptoms [19]. While a probable case is any suspected case whom testing for COVID-19 is indeterminate or who testing was positive on a pan-coronavirus assay or where samples were not collected before the demise of a suspect case [19].

Data collection

The primary data was collected using paper-based case investigation forms that were filled by interviewing case-patients or their caregivers (in the case of deceased case-patients) and consultation of their hospital records in some instances of incomplete information before uploading to SORMAS.

Variables

The case investigation forms captured the socio-demographic data such as name, age, sex, LGA, address, education, and occupation. Also, important dates such as date of symptom onset, date of report, and date of first sample collection. Information on history of contact with a confirmed case or probable case, travel history within or outside Nigeria within the last 14 days was also collected. It also captured the history of possible sources of exposure, symptoms, management at the health facility, laboratory data, and the outcome of cases. Our main outcome variable was death.

Data Analysis

Data on COVID-19 cases from 4 April to 31 July 2020 was downloaded from SORMAS on 10 August 2020. It was cleaned with Microsoft Excel 2016 and an epidemiological curve for date of onset of symptoms of cases was created. The data was analysed with Epi Info version 7; frequencies and proportions were calculated. Crude odd ratios (cOR) and 95% confidence intervals were calculated to determine the association between our main outcome variable (death) against other variables. Adjusted odd ratios (aOR) and 95% confidence intervals were calculated using the logistic regression model. Tables were generated with Microsoft Excel, and maps were created with QGIS version 3.10.

Ethical Considerations

Ethical approval was obtained from the ethics committee of Katsina State Ministry of Health (SMOH). Primary data was collected during the COVID-19 outbreak which is still ongoing. Identifying information was removed to mask the identity of the cases. Data was password protected and securely stored on the SORMAS platform, and only authorized personnel have access to it.

Results

Frequencies and Proportions

A total of 3,638 cases had their samples tested for SARS COV-2 and 744 were positive. There were 24 deaths with an overall CFR of 3.2%. There were 2,217 contacts listed for the 744 cases and a history of direct contact with a confirmed or a probable case was recorded among 84.8% (631). The attack rate was 8.5/100,000. Out of the 744 confirmed cases, 94.8% (705) had their ages analysed while 5.2% (39) had missing values. Among the confirmed cases 73% (515) were males while 27% (190) were females. The median age was 35 years with a range of 1-90. The remaining 5.2% (39) confirmed cases that had missing age values were excluded from the calculation for median and range. Figure 1 shows an epidemiological curve of COVID-19 cases in Katsina State from April to July 2020. The chart shows the number of COVID-19 cases

by the epidemiological week of first sample collection which started on the 14th week as shown. There were two peaks in week 19 and 26. There was a sharp decrease in the number of cases between week 22 and 25. Figure 2 shows the spatial distribution of cases and deaths; attack rate and deaths per 100,000 population. Katsina LGA had the highest attack and mortality rate.

Sociodemographic Characteristics

In Table 1, out of 744 confirmed cases, 26.7% (184) were within the age group of 30-39, 21.7% (153) were between 20-29 years, and 18.3% (129) were between 40-49 years. However, the highest case fatality rates were 35.7% in the age group of 70-79, 33.3% in those between 80-89 years, and 19.4% in those 60-69 years. Males made up 73% (540) of confirmed cases while 27% (204) were females. Among the confirmed cases, 84.8% (631) had close or direct contact with another confirmed or a probable case while 15.2% (113) had no history of contact. Only 1.5% (11) confirmed cases had a history of travel to other states while 722 (97%) had no history of travel outside Katsina State.

Symptoms

Among the confirmed cases, the symptoms were as follows: 65.7% (489) had cough, 61.6% (458) had fever, 48% (375) had headache, 35.2% (262) had runny nose, 9.4% (70) had pharyngitis, 5.1% (38) had chest pain, 2.3% (19) had fatigue, 13 (1.8%) had arthritis, 13 (1.8%) had dyspnoea, 0.9% (7) had chills or sweats,0.9% (7) had diarrhoea, 0.8% (6) had muscle pain, and 0.5% (4) had vomiting, and 0.4% (3) had abdominal pain.

Factors Associated with Death

On bivariate analysis in Table 2, 91.7% (22) of deaths occurred among males (OR:4.29, 95% CI: 1.04- 37.92, P=.035) whereas 58.3% (14) deaths occurred among persons 60 years and above (OR: 20.30, 95% CI: 8.53-48.32, P<0.0001). Among those who died, 75.0% (18) had fever (OR: 1.91, 95% CI: 0.75- 4.87, P=0.169). Also, 95.8% (23) of those who died had a cough (OR: 12.54, 95% CI: 1.68- 93.38, P<0.001). On multivariate analysis, factors associated with death were cough (AOR: 9.88, 95% CI: 1.29-75.79), age ≥60 years (AOR: 18.42, 95% CI: 7.48-45.38), and male sex (AOR: 4.44, 95% CI: 0.98-20.12).

Discussion

The characteristics of COVID-19 cases in our study were like findings from other publications [13-17,19-23]. Like in our study, the burden of COVID-19 infection was carried by the young population in other Nigerian studies, showing a high transmission in the younger age groups in Nigeria. The young population are more active and more likely to engage in risk behaviour like violating the guidelines to wear mask or physical distancing.

Our finding that males were more likely to be infected with COVID-19 than females was in accord with findings from other studies [15,17,19,21]. Majority of the workers in Katsina State are males, who may be more likely to spread COVID-19 infection than females, the minority of the workforce in a typical Northern Nigerian setting where most females are housewives.

Like prior studies, contact with COVID-19 cases played a major role in the transmission of COVID-19 as most of the cases in Katsina State had a history of contact while only a small fraction of them travelled out of Katsina State. By the time of our study, the outbreak was already in community transmission phase. This shows the big role having contact with a confirmed or probable case plays, and the importance of contact prevention measures in stopping the COVID-19 outbreak. This also presents an opportunity to break transmission by strengthening the use of non-pharmacological preventive interventions to curb the spread of COVID-19. Those measures include social distancing, hand hygiene, and use of face mask or covering to prevent infection through inhalation of droplets [10].

The most common symptoms of the confirmed cases were cough, fever, headache, and rhinorrhoea. While the least reported symptoms were pharyngitis, chest pain, fatigue, dyspnoea, arthritis, chills, diarrhoea, muscle pain, vomiting, and abdominal pain. These findings are like the ones found in various studies [4,13-15,17,19]. In our study, all our confirmed cases were symptomatic, which makes it worrisome, because in some studies, as high as almost 80% of cases were asymptomatic [27]. The surveillance system of Katsina State could have been detecting only the symptomatic cases. With over 90% of the population in Katsina State being less than 60 years, many cases could have existed with unhindered and undetectable community transmission [26]. Even though ,herd immunity,is a term used to describe immunity achieved in a

population through vaccination, there is a possibility that ,herd immunity, could be achieved through natural infection in Katsina State as COVID-19 is highly infectious.

Most cases survived with just a small number of deaths reported. This is the trend across Nigeria and Africa. However, these figures may be misleading, as death is poorly registered in Nigeria [6,7]. Secondly, most deaths were recorded in the older population in our study. This is like most studies we reviewed. But what makes our finding alarming is the fact that, even though the population of older people above 60 years in Katsina State is approximately 3% of the total population, most deaths occurred among them. [26]. What makes this worse is the anecdotal report of unusual unexplained deaths in Katsina State among the elderly population. Similar reports of ,mysterious death, among the elderly emerged in Kano State, a neighbouring state, as well as other neighbouring states in the North-Western Region of Nigeria [28-31]. These deaths occurred between April and May 2020 among the older population during the Ramadan fasting period. Verbal autopsies were done in Kano State, and it was estimated that more than 50% of the deaths could have been caused by COVID-19 or related to COVID-19 [28-31]. Investigations commenced in Katsina State but there is no word yet on the possible cause of the deaths.

The factors found to be significantly associated with mortality from COVID-19 at the bivariate level included the male sex, age greater than or equal to 60 years, and having a cough. Almost three-quarters of the confirmed COVID-19 deaths were males though this finding was not statistically significant at multivariate level. The finding that males are much more likely to die from COVID-19 than females is similar to a Nigerian study where the males were found to be more likely to die from COVID-19 infection as compared to females [19]. The finding in this study that more than half of the deaths occurred in older cases who were found to be several times more likely to die from COVID-19 than those below 60 years is similar to the findings from another Nigerian study where the older population were more likely to die than the younger population [19].

More than half of the confirmed cases that died from COVID-19 in Katsina State had a cough. Cough happens to be a symptom of COVID-19 itself used as part of a case definition to identify symptomatic cases. Cough may not be a symptom of early disease, as in our study, cases with cough were several times more likely to die from COVID-19 than those that did not. Cough in COVID-19 cases could be a more ominous late symptom than earlier anticipated. Findings from our study suggest that cough could be a sign of imminent fatality especially in the older cases. Also, the current case definition for COVID-19 used worldwide could be identifying the late stage of the disease and may not be the best to identify cases. No significant association was found between mortality from COVID-19 and having a fever and headache. The risk factors we found strongly associated with death in our study are not necessarily the cause.

Our major limitation was missing data on some important variables which we excluded from our analysis. We did not have complete information on comorbidities in most of the cases that died. As such, we could not analyse for other possible factors that may be associated with mortality among confirmed cases of COVID-19. Other variables that had a significant number of unknown values were excluded from the analysis. These include education, occupation, and other symptoms including the newly added loss of taste and smell. One of the reasons for the missing data was that the paper-based case investigation form was not updated to capture some new variables updated on SORMAS, the main electronic reporting platform. Katsina State Ministry of Health, Primary Healthcare Agency, and NCDC made effort to ensure the data on SORMAS was updated. Another major limitation was the fact that only 24 deaths were recorded in Katsina State- a number too small to represent the deaths from COVID-19 in the state.

Conclusion

Persons aged 60 years and above, having a cough were more likely to die from COVID-19 in Katsina State. Based on our findings, we recommend that clinicians should do a chest radiograph in COVID-19 patients aged 60 years and above presenting with cough. This will enable clinicians to properly assess for the occurrence and severity of pneumonia in the older COVID-19 patients to guide further management of cases. NCDC and Katsina SMOH should ensure risk communication messages highlight that most COVID-19 infections occur among male adults 20 to 39 years of age, and that these individuals should adhere strictly to preventive measure to reduce the spread of COVID-19. Katsina State government should advocate for

measures that reduce contact with confirmed or probable cases at the state, LGA, and community levels by reinforcing the adherence to NCDC's guidelines. More research should be considered in determining a more sensitive case definition and screening tests for COVID-19.

What is known about this topic

- COVID-19 is a viral respiratory disease caused SARS-CoV-2
- The first known human infection was reported in Wuhan, China
- Older COVID-19 cases with background medical illnesses like diabetes and heart diseases have increased risk of severe disease and death from COVID-19

What this study adds

- Younger males below 40 years carry the burden of COVID-19 infection
- COVID-19 cases above 60 years have an increased risk death
- COVID-19 cases with cough have an increased risk of death

Competing interests

Authors declare no competing interest.

Authors' contributions

ASI conceptualized the Study, design, implemented data acquisition, drafted the initial manuscript and data analysis. ADD, AOD, and SSB implemented data acquisition and made substantial additions to initial manuscript. SK, BUI, IMK, KM, and SSY supervised the study and made substantial revision of initial manuscript. SBA, AAO, CU, and ATA carried out data analysis and interpretation, made substantial revision of initial manuscript. ASH, ATG, and LAK made substantial revision of draft manuscript. AU and CA made substantial revision of draft manuscript. MSB made substantial revision of draft manuscript. DT made substantial revision of initial manuscript. AM made substantial revision of initial manuscript. KS supervised the overall study and made substantial revision of initial manuscript.

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Tables and figures

Table 1: Characteristics of COVID-19 Cases in Katsina State, April-July 2020

Table 2: Factors Associated with Death from COVID-19 in Katsina State, April-July 2020

Figure 1: An Epidemiological curve showing confirmed COVID-19 Cases by date of first sample collection in Katsina State April-July 2020

Figure 2: Cases and Deaths from COVID-19 in Katsina State April-July 2020

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Table 1: Socio-demographic Characteristics of Confirmed COVID-19 Cases in Katsina State April-July 2020

Characteristics	All Cases (%) n=744	All Deaths n=24	CFR (%)
Age Group			
<10	24 (3.4)	0	0.0
10-19	67 (9.5)	0	0.0
20-29	153 (21.7)	1	0.7
30-39	184 (26.1)	3	1.6
40-49	129 (18.3)	2	1.5
50-59	90 (12.8)	4	4.4
60-69	36 (5.1)	7	19.4
70-79	14 (2.0)	5	35.7
80-89	6 (0.9)	2	33.3
>=90	2 (0.3)	0	0.0
Missing Data	39 (5.2)	0	0.0
Sex			
Male	540 (72.6)	22	4.1
Female	204 (27.4)	2	1.0
History of Contact			
Yes	631 (84.8)	16	2.5
No	113 (15.2)	8	6.0
History of Travel			
Yes	11 (1.5)	2	18.2
No	722 (97.0)	22	3.1
Missing Data	11 (1.5)	0	0.0

Table 2: Factors Associated with Death from COVID-19 in Katsina State, April-July, 2020							
Characteristics	**Alive (%)**	**Dead (%)**	**CFR (%)**	**cOR (95% CI)**	***P* Value**	**aOR (95% CI)**	***P* Value**
Sex n=744							
Male	518 (71.9)	22 (91.7)	4.1	4.29 (1.04-37.92)	0.035	4.44 (0.98-20.12)	0.053
Female	202	2	1				
Age group n=705							
≥ 60 years	44 (6.5)	14 (58.3)	24.1	20.30 (8.53-48.32)	<0.0001	18.42 (7.48-45.38)	<0.0001
< 60 years	638	10	1.5				
Symptoms n=744							
Fever	440 (61.6)	18 (75.0)	3.9	1.91 (0.75-4.87)	0.169	1.06 (0.38-2.96)	0.916
No Fever	280	6	2.1				
Cough	466 (64.7)	23 (95.8)	4.7	12.54 (1.68-93.38)	<0.001	9.88 (1.29-75.79)	0.028
No Cough	254	1	0.4				

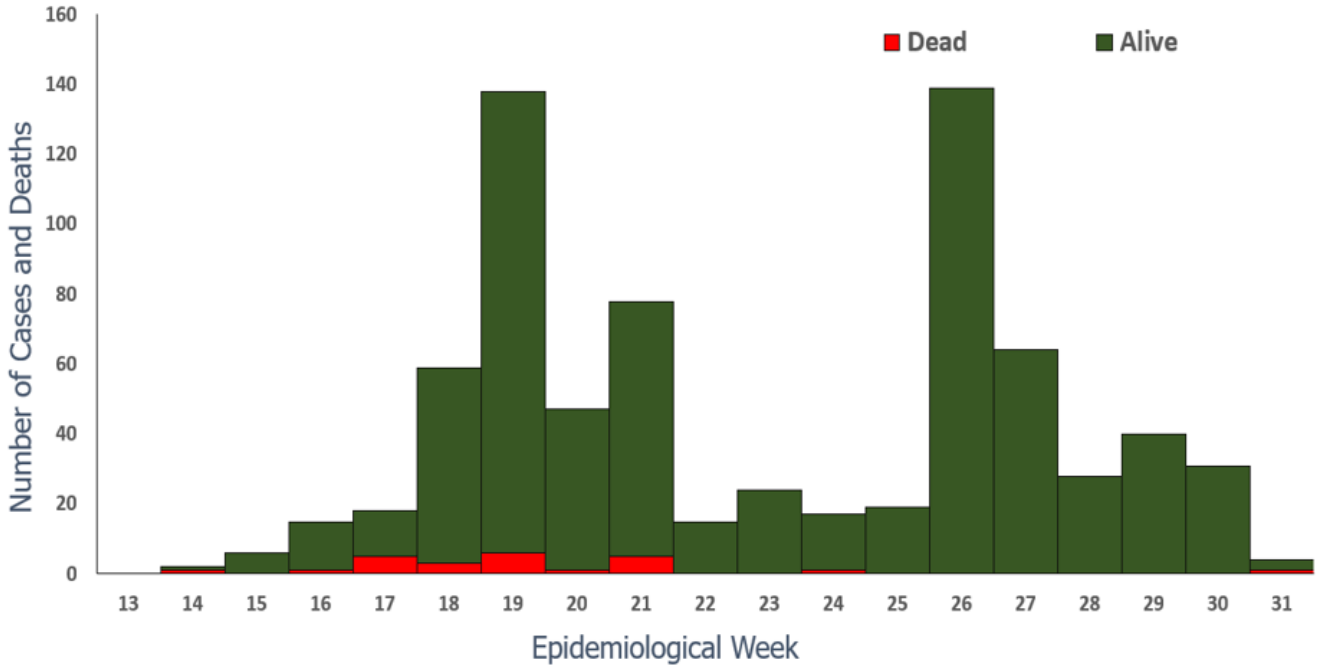

Figure 1: An Epidemiological curve showing confirmed COVID-19 Cases by date of first sample collection in Katsina State April-July 2020

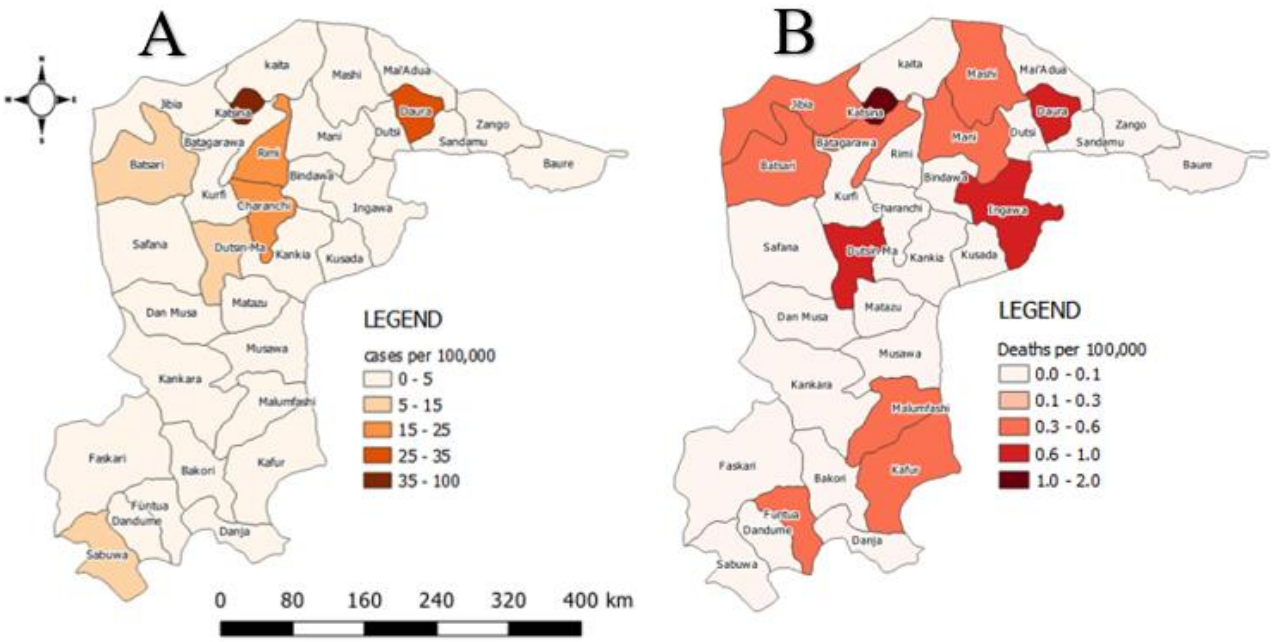

Figure 2: Cases and Deaths from COVID-19 in Katsina State April-July 2020