



Impact Assessment of Corona Virus Disease 2019 (COVID-19) on Health Services in Katsina State, Nigeria

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Summary

INTRODUCTION

In the wake of the novel COVID-19 pandemic the health service disruption with the resultant widespread health consequences associated with the virus has become abundantly clear to all. Our primary objective was to determine the impacts of the COVID-19 epidemic on primary health care performance indicators in Katsina state.

MATERIAL AND METHODS

Data was pulled and analyzed for trends and coverage of selected performance indicators from Quarter 1, 2019 to Quarter 2, 2020. Data sources were administrative data from District Health Information Software. An indicator each was analyzed from the following health thematic areas: Child health, Routine Immunization, Family planning, HIV/AIDS Care and Treatment, Labor and Delivery, Malaria and Antenatal Care (ANC). Descriptive and inferential statistical analyses were carried out using Statistical Package for Social Sciences version 20. Time series analysis with Auto-Regressive and Integrated Moving Average (ARIMA) modeling on indicators was used to study trends of performance over time. Simple Linear Regression (SLR) analysis was used to report coefficients of relationships at intercept and period points.

RESULTS

ANC 4th visit decreased abysmally from 65% to 46%, pentavalent vaccine 3 also declined consistently from 83% to 74% during the active lock down period. The study was also able to identify rising numbers of <5 mortality rate (from 2% to 19%) and a corresponding decrease in Pentavalent vaccine 3 coverage over time. These finding were significant ($P = 0.01$) across periodic quarters of 2019 and 2020.

CONCLUSION

The current study was able to demonstrate, using ARIMA and SLR modeling, the decline in ANC 4th visit and pentavalent vaccine coverage in Katsina state, Nigeria during the active lock down phases.

Keywords: COVID-19, Health-Impact, Katsina State, Time Series, Performance Indicators.

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Introduction

Coronavirus Disease 2019 also known as COVID-19 is a rapidly expanding pandemic caused by a novel human coronavirus called severe acute respiratory syndrome coronavirus 2 (SARS CoV 2) previously known as 2019-nCov (1,2). COVID-19 was first reported in December 2019 among patients with viral pneumonia symptoms in Wuhan, China (3, 4). They were found to be linked with Huanan seafood market in Wuhan, in the Hubei province of China, where other non-aquatic animals were also being sold before the outbreak (5).

As of 4th January 2021, over 85 million cases, 1,851,040 deaths and 60,492,708 recoveries had been reported globally (6). United States of America was the most affected with over 21 million cases and 360,078 deaths (6). Nigeria had confirmed 90,080 cases of COVID-19 as of 4th January, 2021 (7).

SARS-COV-2 is transmitted from person-to-person through inhalation of aerosols from an infected individual (3). Old age and patients with pre-existing illnesses (like hypertension, cardiac diseases, lung diseases, cancers, or diabetes) have been identified as potential risk factors for severe disease and mortality (8, 9).

Currently, information about its distribution, transmission, pathophysiology, treatment, and prevention are being studied. World Health Organization (WHO) recommends prevention of human-to-human transmission by ensuring social distancing, use of personal protective equipments (PPEs) and stopping infections from animal sources (8). Primary preventive measures include regular hand washing, social distancing, and respiratory hygiene (covering mouth and nose while coughing or sneezing) (10,11).

Frontline health workers providing

varying health services such as routine immunization, maternal and child health, infectious and non-infectious disease management are at high risks of contacting COVID-19 (12).

Poor understanding of the disease among Health Care Workers (HCWs) can result in delayed identification and treatment leading to rapid spread of infections. Over 100 health workers lost their lives to COVID-19, a tragedy to the world and a barrier to fight against the disease (13). Guidelines for HCWs and online refresher courses were been developed by WHO, CDC, and various governmental organizations in various countries to boost the knowledge and prevention strategies (14).

Due to fear and strict regulation of movements by the government of Katsina State in an attempt to contend the spread of the disease, uptake of health services and interventions had been affected drastically. There was a decline in performance indicators for most health services especially Child health, Routine Immunization, Family planning, HIV/AIDS Care and Treatment, Labor and Delivery, Malaria and Maternal health, following the imposition of lock down by the Federal Government of Nigeria (15).

District Health Information System (DHIS) is a web based electronic data capturing platform built on a framework of Health Management Information System (HMIS). In 2014, Nigeria adopted DHIS as the only government approved electronic reporting platform for all HMIS data (16). The aim of the study was to assess the impact of COVID-19 on Health Services in Katsina State, Nigeria.

Materials and Methods

Study area

The study was conducted in Katsina state, Nigeria. The state has three geopolitical



zones (North, Central and Southern geopolitical zones). There are 361 wards in Katsina State with 1618 health facilities offering Routine Immunization (RI) in the state. Katsina State is located in the Sahel Savannah in northwest Nigeria. It has a total population of nearly 6 million. Each ward has at least one functional primary health facility.

Key Performance indicators (Under 5 Mortality rate, Pentavalent vaccine 3 coverage, Contraceptive prevalence rate, HIV Test Positive rate, HIV Test Positive rate, Caesarian delivery rate, % Confirmed uncomplicated malaria given Artemisinin Combination Therapy (ACT), ANC coverage 4th Visit) were studied across identified Health Thematic Areas (HTAs)

Study period

Secondary administrative data domiciled at DHIS2 was pooled for a period of 12 months (July 2019 to June 2020) for the purpose of evaluation.

Study type

Retrospective study was adopted to review and analyze secondary data to identify trends and coverage of Key Performance Indicators (KPIs) over a period of 12 months.

Data source

Data used for this study was quarterly data from the Nigerian DHIS 2 database

domiciled and controlled by the Nigerian Federal Ministry of Health (FMOH). In this system, the data are entered from the health facilities' monthly health service reports at LGA health offices. Significant efforts have been launched by the Katsina state government to improve the quality of HMIS data, including continuous quality assessment activities to improve report submission and completion

Data variables

KPIs were the data variables used for this study. The study focused on the following health thematic areas: Child health, Routine Immunization, Family planning, HIV/AIDS Care and Treatment, Labor and Delivery, Malaria and Antenatal Care (ANC). Table 1.0 shows the KPIs that were used to analyze for trends and performance for each thematic area.

Data analysis

Secondary data from DHIS was analyzed using the pivot table tool contained in the DHIS application store which was later exported to SPSS for descriptive and inferential analysis.

Time series analysis with Auto Regressive and Integrated Moving Average (ARIMA) modeling on indicators were used to better understand trends of performance of indicators over time.

Table 1.0: Health Thematic Areas and Key Performance Indicators (KPIs) Considered

Health Thematic Area	Key Performance Indicators (KPIs)
Child Health	Under 5 Mortality rate
Routine Immunization	Pentavalent vaccine 3 coverage
Family Planning	Contraceptive prevalence rate
HIV and AIDS	HIV Test Positive rate
Labour and Delivery	Caesarian delivery rate
Malaria	% Confirmed uncomplicated malaria given Artemisinin Combination Therapy (ACT)
Antenatal (ANC)	ANC coverage 4 th Visit



Table 2.0: Time Series Analysis of Under 5years Mortality Rate

Period (t)	Quarter (Q)	Under 5 mortality rate	Moving Average (MA)	Centered Moving Average (CMA)	Seasonal & Irregular Components (S_t, I_t)	Seasonal Component (S_t)	De-seasonalized	Trend Component (T_t)
1	1	2	-	-	-	1.21	1.6	-2.31
2	2	2.4	2.2	2.2	1.08	1.08	2.2	2.02
3	3	2.1	2.3	2.0	1.05	1.05	2.0	6.35
4	4	1.4	1.8	6.2	0.23	0.23	6.2	10.68
5	1	19.9	10.7	16.4	1.21	1.21	16.4	15.01
6	2	24.4	22.2	22.2	1.10	1.08	22.6	19.34

Centered Moving Average (CMA) was used to define performance trend of indicators from Quarter 1 (Q1), 2019 through to Quarter 2 (Q4), 2020. Simple Linear Regression (SLR) analysis was used to report coefficients of relationships at intercept and period points. Statistical significance were accepted at $P < 0.05$.

Results

The study was able to identify rising numbers of <5 mortality rate over time (Table 2.0). This finding was significant ($P = 0.01$) across periodic quarters of 2019 and Q1, Q2 of 2020. Table 2.0 shows the time series analysis of the <5years indicator. Except in Q4, 2019, every other quarter performed above the Centered Moving Average (CMA). Q1 and Q2, 2020 reported the highest mortality with a seasonal variation of 21%

and 8% respectively above the baseline (CMA). However, Q4, 2019, witnessed the lowest mortality rate with 77% below the centered moving average.

Routine Immunization (RI) which is a key component of Primary Health Care (PHC) was represented and analyzed for using pentavalent vaccine 3 coverage as shown in Table 3.0. Similarly, a consistent decrease over time was observed for the Pentavalent vaccine 3 coverage which was in variance with <5 years mortality. There was no significant variation ($P = 0.2$) in the Pentavalent vaccine 3 coverage within quarters but strongly significant between quarters ($P < 0.000$). Again, the analysis showed seasonal performance above CMA at 3 periods – Q1, 2019, Q3, 2019 and Q1, 2020.

Table 3.0: Time Series Analysis of Pentavalent Vaccine 3 Coverage

t	Quarter (Q)	Penta 3 Coverage	Moving Average (MA)	Centered Moving Average (CMA)	Seasonal & Irregular Components (S_t, I_t)	Seasonal Component (S_t)	Deseasonalized	Trend Component (T_t)
1	1	*79.0	-	-	-	1.04	76.0	82.99
2	2	*82.4	80.72	81.92	1.01	0.96	85.8	81.14
3	3	*83.8	83.12	82.46	1.02	1.02	82.2	79.29
4	4	*79.8	81.80	80.76	0.99	0.99	80.6	77.44
5	1	*79.7	79.72	76.30	1.04	1.04	76.6	75.59
6	2	*66.1	72.88	72.88	0.91	0.96	68.9	73.74

*Significant at $P < 0.05$



Table 4.0: Time Series Analysis of Confirmed Uncomplicated Malaria Patients Given ACT

t	Quarters	% of confirmed uncomplicated malaria given ACT	Moving Average (MA)	Centered Moving Average (CMA)	Seasonal & Irregular Components (S_t, I_t)	Seasonal Component (S_t)	Deseasonalized	Trend Component (T_t)
1	1	99.9	-	-	-	1.01	98.91089	99.58
2	2	99.2	99.6	99.7	1.00	0.99	100.202	99.57
3	3	100.3	99.8	99.7	1.01	1.01	99.30693	99.57
4	4	99.1	99.7	99.9	0.99	0.99	100.101	99.56
5	1	101.1	100.1	99.8	1.01	1.01	100.099	99.56
6	2	97.8	99.5	99.5	0.98	0.99	98.78788	99.56

Table 4.0 shows a continuum of sustained performance for the percentage of patients with confirmed and uncomplicated malaria that were equally treated with ACT. The MA was $\geq 99\%$ which was strongly significant ($P < 0.05$) between Quarters. Seasonal and Irregular component values of the time series depicted $\pm 1\%$ deviation from the CMA connoting uniformity in performance and possible herd protection against malaria disease.

Performance data of family planning (Contraceptive Prevalence Rate), HIV and AIDS treatment (HIV Test Positive Rate (Facility)), Labor and delivery (Caesarian Delivery Rate) and Antenatal Care (ANC Coverage (4th Visits) were subjected to SLR as shown in table 5.0. Contraceptive prevalence rate consistently decreased from Q1, 2019 through to Q2, 2020.

The difference was markedly significant between Quarters (Qs). Similarly, the HIV test positive rate demonstrated a similar pattern to that of contraceptive prevalence rate. However, the later showed significant association between and within Qs.

Caesarian delivery rate significantly increased overtime between Qs with majority of seasonal variation points falling below the CMAs. Analyzed Trend component (T_t) of the time series analysis of ANC 4th visit coverage showed a continuous regression over time especially in Q1, 2020 and Q2,2020 (active lock down phase of the COVID-19 pandemic). The seasonal and irregular variations were significant ($P = 0.003$) between Qs.

Table 5.0: Simple Linear Regression (SLR) Analysis of Some PKIs

	Contraceptive Prevalence Rate		HIV Test Positive Rate		Caesarian Delivery Rate		ANC Coverage(4 th Visits)	
	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value	Coefficients	P-value
Intercept	13.6315	4.9E-07	4.6442	0.002	0.5189	0.001	68.4497	0.003
Period (t)	-0.0713	0.29467	-0.5651	0.024	0.0034	0.8341	-3.8042	0.252

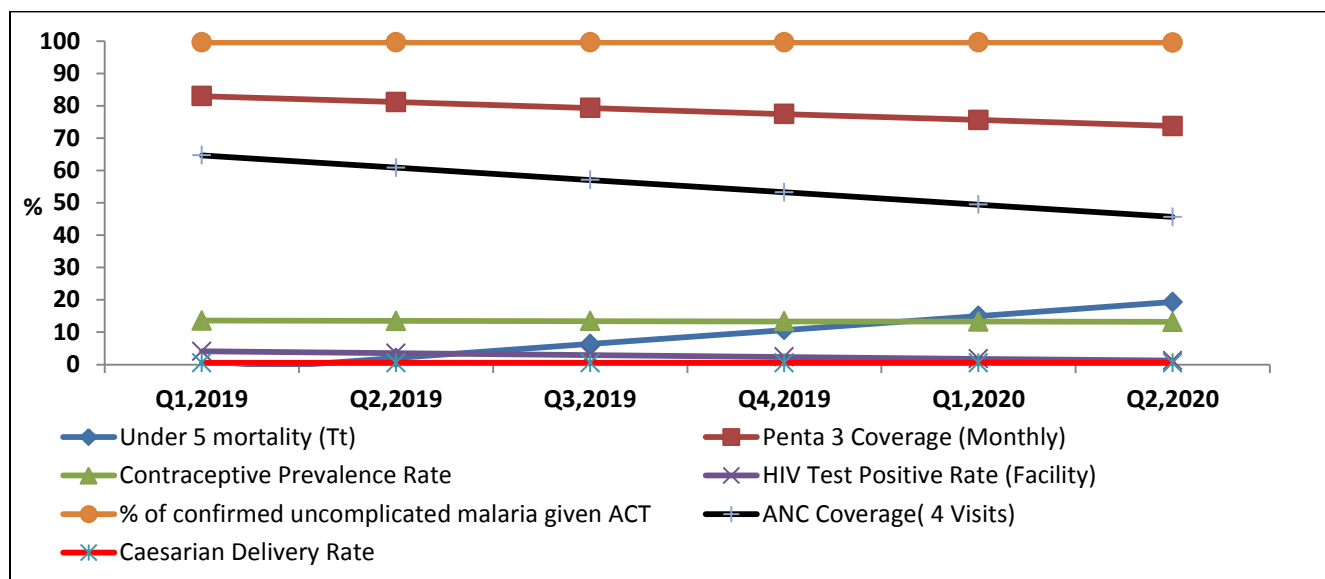


Fig.1.0: Performance Trend of KPIs from Q1, 2019 to Q2, 2020

From Fig.1.0 above, it is clear that there was a marked increase in <5years fatality rate and a corresponding decrease in RI Pentavalent vaccine 3-coverage. RI services may have been affected by the lock down resulting in decrease in herd immunity.

Discussion

Many clinical activities were reduced or halted in order to control COVID-19 transmission and this may have affected Primary Health Care Services (17). The fear of being infected by COVID-19 at health facilities and the lockdown order was also likely to limit access to health services routinely provided by CHWs. These included routine immunization, ante-natal services, maternal, neonatal and child health services, family planning, HIV/TB, management of minor ailments, disease surveillance and health management information system. Disruption of these health services could have led to reduction in immunization coverage, and increases in morbidity and mortality of infectious diseases as well as maternal, neonatal and childhood health issues (18).

In a study conducted in Katsina State on public health economy of the state, infant mortality was ranked 5th among the pertinent health related problems of the state (19). The COVID-19 pandemic has added up to the already existing health related problems of the state as access to health services were affected due to fear on the side of health workers and patients needing health care. This psychological impact of COVID-19 has been reported in China where the global index case was reported in Wuhan (20).

Decreased immunity against Vaccine Preventable Diseases (VPDs) can cause disease outbreaks amongst the most susceptible population. Of these are the <5years population. The decrease in RI coverage may be associated with the increased percentages of <5years mortality reported for the period in review. Vaccine Preventable Diseases are the number one killer diseases of children <5years (21).

The lock down had significantly reduced access and utilization to routine immunization services with the resultant rise in infant mortality rate and especially for children <5years who happen to be under the vulnerable population. In



Katsina State, the Nigeria Demographic and Health Survey (NDHS) reported Pentavalent vaccine 3 coverage of 33.7% in 2018 (22). With a CMA of 72.88% - 82.46%, the current study was not in tandem with the NDHS reports of 2018. There was a huge difference between administrative and survey coverage placing a concern on data quality of reported administrative data on DHIS. Equally, the disproportionate coverage depicts inequalities and inequities to accessing and utilizing RI services across the state.

Malaria, a preventable, treatable, and curable disease, is endemic in Nigeria and remains the foremost public health problem in the country, taking its greatest toll on children under age of 5 years and pregnant women. Africa still bears over 80% of the global malaria burden, of which Nigeria accounts for about 25% globally. It is estimated that approximately 57 million cases of malaria and nearly 100,000 malaria-related deaths occur each year (23). The sustained performance of this indicator is a clear indication of acceptability of malaria interventions at community levels and health facilities.

The decreased contraceptive prevalence rate was in agreement with NDHS, 2018. In 2018, NDHS reported an improvement in the knowledge of preventing HIV/AIDS from 34% in 2013 to 74% in 2018 (22). However, the decline in ANC 4th visit coverage was at variance with NDHS report of 2018 with an increase from 51% in 2013 to 57% in 2018 (22).

Conclusion

No doubt the COVID-19 pandemic had negatively affected primary health care services in Katsina State. The current study was able to demonstrate through ARIMA and SLR modeling the decline in key health performance indicators in Katsina state, Nigeria pre and post active lock phases.

Ethics Statement

The research proposal was been cleared by the Medical Ethics Committee, Hospital Service Management Board (HSMB) Katsina State Ministry of Health. The study was conducted according to the Declaration of Helsinki and all participants signed a written informed consent.

Author Contributions

Concept notes were drafted by Dr. Shamsuddeen Yahaya. Data analysis was carried out by Dr. Adamu Sule Ibrahim, Dr. Jamilu Runka Yahaya and RamatuObansa.

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