BMJ Open

Effects of the COVID-19 pandemic on essential health and nutrition service utilisations in Ghana: interrupted time-series analyses from 2016 to 2020

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To cite: Kawakatsu Y, Osei I, Debpuur C, *et al*. Effects of the COVID-19 pandemic on essential health and nutrition service utilisations in Ghana: interrupted time-series analyses from 2016 to 2020. *BMJ Open* 2023;**13**:e061608. doi:10.1136/bmjopen-2022-061608

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2022-061608).

Received 02 February 2022
Accepted 21 December 2022

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ABSTRACT

Objectives This study aimed to assess the national-level and subnational-level effects of the COVID-19 pandemic on essential health and nutrition service utilisation in Ghana.

Design Interrupted time-series.

Setting and participants This study used facility-level data of 7950 governmental and non-governmental health facilities in Ghana between January 2016 and November 2020.

Outcome measures As the essential health and nutrition services, we selected antenatal care (ANC); institutional births, postnatal care (PNC); first and third pentavalent vaccination; measles vaccination; vitamin A supplementations (VAS); and general outpatient care. We performed segmented mixed effects linear models for each service with consideration for data clustering, seasonality and autocorrelation. Losses of patient visits for essential health and nutrition services due to the COVID-19 pandemic were estimated as outcome measures.

Results In April 2020, as an immediate effect of the COVID-19 pandemic, the number of patients for all the services decreased except first pentavalent vaccine. While some services (ie, institutional birth, PNC, third pentavalent and measles vaccination) recovered by November 2020, ANC, VAS and outpatient services had not recovered to prepandemic levels. The total number of lost outpatient visits in Ghana was estimated to be 3 480 292 (95% CI: −3 510 820 to −3 449 676), followed by VAS (−180 419, 95% CI: −182 658 to −177 956) and ANC (−87 481, 95% CI: −93 644 to −81 063). The Greater Accra region was the most affected region by COVID-19, where four out of eight essential services were significantly disrupted.

Conclusion COVID-19 pandemic disrupted the majority of essential healthcare services in Ghana, three of which had not recovered to prepandemic levels by November 2020. Millions of outpatient visits and essential ANC visits were lost. Furthermore, the immediate and long-term impacts of the COVID-19 pandemic on service utilisation varied by service type and region.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This study used representative facility-level data of essential health and nutrition service utilisation at governmental and non-governmental health facilities in Ghana from 2016 to 2020.
⇒ Assessment of immediate and long-term effects of the COVID-19 pandemic on utilisation of eight essential health and nutrition services were conducted.
⇒ We conducted interrupted time-series analyses with segmented mixed effects linear models with consideration for data clustering, seasonality and autocorrelation.
⇒ Monthly aggregated facility data that was used in this study masks individual-level service utilisation status and behaviour.
⇒ This study assessed healthcare impacts from the beginning of the pandemic to November 20202, therefore further assessment of the long-term effects of the COVID-19 pandemic on health and nutrition service utilisation after November 2020 is needed.

INTRODUCTION

As of 21 March 2021, more than 122 million people were infected with the COVID-19. Of them, 2.7 million died.[1] The first COVID-19 case in sub-Saharan Africa was confirmed in Nigeria on 25 February 2020. The COVID-19 pandemic has caused considerable hardships in low-income and middle-income countries (LMICs), affecting almost all aspects of populations' daily life (eg, health, employment, education and food security).[2–6]

Disease outbreaks and pandemics threaten the continuity of essential health and nutrition services. For instance, during the 2013–2016 West African Ebola outbreak, utilisation of essential health services declined by 18% on average.[7] Early estimates of the indirect impacts of the COVID-19 pandemic indicate that an[8] additional 253 500 child deaths and 12 190 maternal deaths could occur globally in the following 6 months due to an approximately 15% reduction in essential health

and nutrition service delivery and utilisations. Therefore, ensuring adequate essential health and nutrition service delivery during the COVID-19 pandemic is crucial to minimise the indirect impacts of COVID-19.[9]

According to the WHO, 90% of surveyed countries reported disruption in the delivery of essential health and nutrition services during the COVID-19 pandemic as of August 2020.[5] LMICs were more likely to have suffered significant disruptions than high-income countries. Outreach routine immunisation was the most significantly disrupted health service (70%), followed by non-communicable disease diagnosis and treatment (69%), family planning and contraception (68%), mental health disorder treatment (61%), antenatal care (ANC) (56%) and cancer diagnosis and treatment (55%).[5] The causes of such service disruptions are multifaceted, involving factors related to both health service supply and demand. Reductions in outpatient care attendance owing to lower demand were reported by 76% of the WHO member states represented in the report. Factors influencing demand included lockdowns and household financial difficulties. The most commonly reported supply-side factors included the cancellation of elective services by health facilities, staff redeployment to provide COVID-19 relief, insufficient personal protective equipment (PPE) available for healthcare providers, limited availability of services due to closures of service departments or health facilities and interruptions in the supply of medical equipment and health products.[5]

The first case of COVID-19 in Ghana was confirmed on 12 March 2020. Since then, 83 212 confirmed cases had been recorded as of 28 February 2021, representing the second largest number of confirmed cases among West African countries at that time. The Government of Ghana (GoG) introduced several measures to slow the spread of COVID-19, ranging from closure of national borders to partial lockdowns and banning social and public gatherings. A 3-week-long partial lockdown was imposed in some districts of the Greater Accra and Ashanti regions from 30 March to 19 April 2020.[10] A number of studies have documented Ghana's comprehensive response to COVID-19.[11–14] The Ghana Health Service (GHS), in close collaboration with its partners and stakeholders, implemented a variety of health-related interventions in order to sustain essential health and nutrition services, for example, building capacity of health service delivery during the COVID-19 pandemic, ensuring the supply of PPE and setting up hand-washing facilities.

Those government efforts may have limited the degree to which health and nutrition services were compromised but might not have been able to thoroughly mitigate the impacts of the COVID-19 pandemic on service delivery and utilisation. However, a comprehensive, time-based, analysis assessing the effect of the COVID-19 pandemic on multiple essential services has not been conducted in Ghana. Estimates on a subnational level are also limited. Assessing national-level and subnational-level effects on essential health and nutrition service utilisation is necessary to identify priority areas for additional interventions and to guide the appropriate allocation of limited resources.

Therefore, this study aims to estimate the impacts of the COVID-19 pandemic on the delivery and utilisation of essential health and nutrition services at both national and subnational levels in Ghana.

METHODS

This study used monthly aggregated data on essential health and nutrition service utilisation reported by both governmental and non-governmental health facilities in 16 regions of Ghana from January 2016 to November 2020. We selected eight essential health and nutrition services for which data have been consistently collected since January 2016. We performed segmented mixed effects linear models for each service with consideration for data clustering, seasonality and autocorrelation to assess national-level and subnational-level effects of the COVID-19 pandemic on essential health and nutrition service utilisation during three different periods (April, May–July and August–November 2020). Detailed explanations are available in the following sections.

Study design

This study is designed as a secondary data analysis. Interrupted time-series analyses were employed for analysing the time-series data of all governmental and non-governmental health facilities in the District Health Information Management System (DHIMS), which is well known as DHIS2, between January 2016 and November 2020.

Target health facilities

All governmental and non-governmental health facilities in all 16 regions of Ghana having reported to the DHIMS were set as the health-related data collection points. There were a total of 8760 health facilities registered in the DHIMS along with details regarding the types of health facilities and operating agencies. Of them, 7950 health facilities (90.8%) were selected as the target data collection points, since they submitted seven or more monthly reports between January 2016 and March 2020 and five or more monthly reports between April and November 2020. Table 1 summarises the numbers of health facilities and confirmed COVID-19 cases by region. Of the 810 health facilities (=8760–7950) that were excluded due to inadequate number of monthly reports, 391 were non-governmental health facilities. Also, 27.6% and 16.8% of these health facilities were located in Greater Accra and Ashanti states, respectively. Although the percentage of non-governmental health facilities among the excluded ones was higher than that among 7950 health facilities, it could be due to the low compliance of submitting monthly reports to the government. We did not find other systematic difference between excluded facilities and the overall sample.

Table 1 Number of health facilities and confirmed COVID-19 cases by region in Ghana

	Total number of facilities		CHPS	Health centre/clinic	Hospital	Total confirmed COVID-19 cases*	
Regions	N	%	N	N	N	N	%
Ahafo	161	2	120	30	11	530	1
Ashanti	1486	19	1057	284	145	11 146	21
Bono	384	5	259	106	19	619	1
Bono East	342	4	272	56	14	788	1
Central	549	7	381	128	40	2063	4
Eastern	1000	13	776	185	39	2594	5
Greater Accra	939	12	584	250	105	29 083	55
North East	121	2	96	20	5	22	0
Northern	396	5	293	77	26	556	1
Oti	211	3	163	40	8	244	0
Savannah	150	2	106	38	6	62	0
Upper East	464	6	355	93	16	372	1
Upper West	409	5	310	85	14	90	0
Volta	493	6	314	149	30	719	1
Western	543	7	385	128	30	3073	6
Western North	302	4	222	65	15	662	1
All regions	7950	100	5693	1734	523	53 014	100

*Data source: WHO Country Office for Ghana—briefing on COVID-19 as of 9 December 2020.
CHPS, community-based health planning and services.

Data sources and outcome variable

The DHIMS database was used as the primary data source for this study. Aggregated monthly data on essential health and nutrition services for all health facilities in Ghana from January 2016 and November 2020 were extracted from the DHIMS database. As the outcome variables for the study, we selected the numbers of patients who received care within eight essential health and nutrition services: (1) ANC; (2) facility-based delivery, (3) postnatal care (PNC); (4) first pentavalent vaccination; (5) third pentavalent vaccination; (6) measles vaccination; (7) vitamin A supplementation (VAS); and (8) general outpatient care. These outcome variables were selected from key performance indicators for primary healthcare which have been consistently defined by the GHS since 2016. In addition to those outcome variables, information on the health facility level and operating type was extracted from DHIMS. The levels of health facilities were categorised into three levels: (1) community-based health planning and services (CHPS); (2) health centre or clinic; and (3) hospital. Operating agencies were categorised into two types: (1) governmental facility and (2) non-governmental facility. The data on catchment population size for respective health facilities were not readily available in the DHIMS database.

Data cleaning and data analyses

We conducted individual facility-level local regression analyses for each selected service type in order to detect the outliers that are defined as observations beyond 8 SD from a predicted mean value. These values were excluded due to the possibility that they could be wrongly recorded in the system. A previous study that was similarly designed adopted the same criterion.[15] All outliers, accounting for 0.97% of all the observations at 7950 health facilities, were set as missing. As a sensitivity analysis, we performed the analyses using including the outliers. The results did not significantly differ from those using the cleaned data.

We performed segmented mixed effects linear models for each outcome with random intercept and random slope over time for health facility since facility-level heterogeneity was found in intercept and trends over time. The effects of the COVID-19 pandemic were modelled using segmented parameters of prepandemic trends (from January 2016 to March 2020), immediate change due to the COVID-19 pandemic (April 2020), trends for the first 4 months of the COVID-19 pandemic (April to July 2020) and trends for the following 4 months of the COVID-19 pandemic (August to November 2020). We also included fixed effects by month to account for seasonality. The health facility levels and operating types were also included in the model, to account for facility size and facility management. A first-order autoregression structure was used to account for autocorrelation. The mixed models using maximum likelihood estimation accounted for missing data.[16] Systematic components of the models are shown below.

$$\begin{aligned} Outcome_{ijt} &= \left(\beta_0 + \theta_{1ij}\right) + \left(\beta_q + \theta_{2ij}\right) \cdot Time_t + \sum_{l=2}^{12} {}_m\beta_l Month + \\ &\quad {}_j\beta_1 Facility\_type_i + {}_f\beta_2 Government\_facility_i + \sum_{l=2}^{16} {}_r\beta_l Region_i + \\ &\quad {}_c\beta_0 COVID0_{ijt} + {}_c\beta_1 COVID1_{ijt} + {}_c\beta_2 COVID2_{ijt} \end{aligned}$$

$$\theta_{1ij} \sim N\left(0, \sigma_0^2\right)$$
$$\theta_{2ij} \sim N\left(0, \sigma_0^2\right) \quad \text{Eq.1}$$

where $Outcome_{ijt}$ represents number of patients for one of the eight essential health and nutrition services at ith health facility in jth region at month t; $\beta_0 + \theta_{1ij}$ represents intercept of ith health facility in jth region at time zero; *Time* represents number of months since January 2016 (min 0 - max 59) in the reference region; θ_{2ij} is a random slope of ith health facility in jth region; *Month* represents dummy variables for 11 months of calendar year (reference category: January); *Facility type* represents dummy variables of health facility types (reference category=CHPS); *Government facility* represents binary variable of governmental health facilities; *Region* represents dummy variables of 15 regions (reference category=Ahafo region); *COVID0* represents dummy variable of the month (April 2020) after COVID-19 pandemic occurred in Ghana; *COVID1* represents number of months having passed since the COVID-19 pandemic occurred; and *COVID2* represents number of months having passed since the peak of the first wave of COVID-19 in August 2020.

To estimate subnational level effects of the COVID-19 pandemic, interaction term between the segmented parameters and regions was added to the aforementioned model.

We predicted the number of patient visits for the respective essential health and nutrition services between April and November 2020, by applying the aforementioned linear mixed effects models with and without the COVID-19 pandemic related covariates (ie, the predicted numbers of visits with and without COVID-19 pandemic). Note that the predicted number of visits without the COVID-19 pandemic is the counterfactual one under the assumption that the COVID-19 pandemic had not occurred. The losses of patient visits were computed as the differences between the numbers of predicted visits with and without the COVID-19 pandemic. Those predicted numbers of visits with and without the COVID-19 pandemic for each facility and month by each outcome variable were computed 1000 times by using coefficient (Coef.) and variance–covariance matrixes of the models. Then, we computed the range of losses of patient visits from the percentiles 2.5 and 97.5 of simulated values as 95% CIs.

Patient and public involvement

The government officers in GHS were involved from study design to report writing and dissemination plan. Since this study uses the secondary data only, we do not involve patients/clients. The results will be disseminated through national conferences and scientific publications.

RESULTS

Total number of records on the number of patient visits for eight services was 2 223 342 in DHIMS, which were reported from 7950 governmental and non-governmental health facilities. Table 2 shows the numbers of health facilities where respective essential health and nutrition services are available and reported in DHIMS. While around 6000 health facilities provided and reported child immunisation services in DHIMS, the numbers of health facilities providing and reporting VAS and facility-based delivery services were 1472 and 1933, respectively.

Table 2 Number of health facilities with adequate monthly reports for analysis by type of essential health and nutrition services

Types of essential health and nutrition services as outcome variables	No. of health facilities whose data were analysed*	Percentage of health facilities whose data were analysed†
Antenatal care	4035	51
Facility-based delivery	1933	24
Postnatal care	2916	37
First pentavalent vaccination	5850	74
Third pentavalent vaccination	6887	87
Measles vaccination	6586	83
Vitamin A supplementation	1472	19
General outpatient care	4449	56

*Health facilities with seven or more monthly reports between January 2016 and March 2020 and five or more monthly reports between April and November 2020
†The denominator was 7950 health facilities reported in DHIMS.

National-level effects of the COVID-19 pandemic

Figure 1 shows the observed and fitted mean number of patient visits for essential health and nutrition services before and during the COVID-19 pandemic. Online supplemental tables 1–8 present the results of detailed analysis for each essential health and nutrition service. Table 3 shows the key results of the segmented mixed effects linear model analyses by type of health services. Online supplemental tables 1–8 present the Coefs. and their 95% CI of all the covariates. In April 2020, as an immediate impact of the COVID-19 pandemic, the numbers of patient visits for all types of health and nutrition services were significantly reduced overall, except for the first pentavalent vaccination, that is, ANC (Coef.: −9.84, 95% CI: −11.73 to −7.94, p value<0.001), facility-based delivery (Coef.: −1.76, 95% CI: −2.84 to −0.69, p value=0.001), PNC (Coef.: −0.94, 95% CI: −1.71 to −0.16, p value=0.018), third pentavalent vaccination (Coef.: −0.91, 95% CI: −1.27 to −0.55, p value<0.001), measles vaccination (Coef.: −1.46, 95% CI: −1.87 to −1.06, p value<0.001), VAS (Coef.: −7.81, 95% CI: −13.71 to −1.92, p value=0.010) and general outpatient care (Coef.: −144.22, 95% CI: −155.39 to −133.05, p value<0.001).

After a reduction in April 2020, the mean number of patient visits for ANC, facility-based delivery and PNC significantly increased during the period April–July 2020 (ANC: Coef.: 1.86, 95% CI: 1.19 to 2.53, p value<0.001; facility-based delivery: Coef.: 0.67, 95% CI: 0.28 to 1.07,

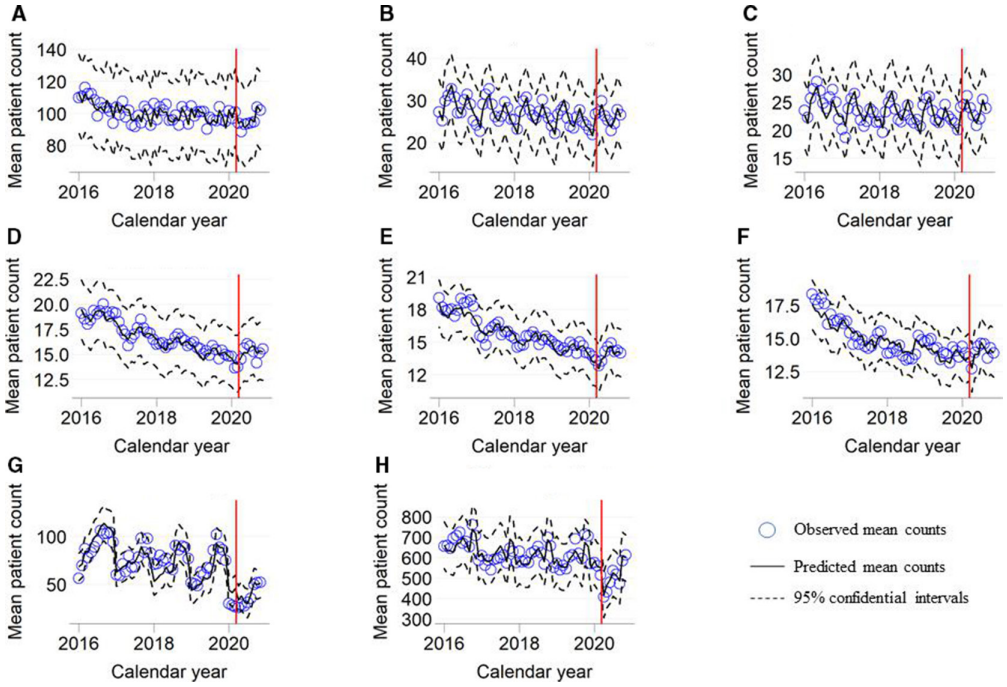

Figure 1 Mean patient counts before and after COVID-19 pandemic (January 2016–November 2020) in Ghana. (A) Antenatal care. (B) Facility-based delivery. (C) Postnatal care. (D) First pentavalent. (E) Third pentavalent. (F) Measles. (G) Vitamin A supplementation. (H) Other outpatient care. The black solid line represents the fitted mean from linear mixed models using a segmented regression parameterisation, random intercepts and slopes by facility, monthly indicator variables to adjust for seasonality, fixed effects to adjust for level and authority of facilities and a first-order autoregression structure to account for autocorrelation in residual errors. Grey dashed lines are 95% CIs around the fitted mean. The vertical red line is placed at 12 March 2020 when the first COVID-19 case was found in Ghana.

p value=0.001; PNC: Coef.: 0.51, 95% CI: 0.24 to 0.79, p value<0.001). The increasing trend was not sustained between August and November 2020 (ANC: Coef.: −1.02, 95% CI: −2.08 to 0.06, p value=0.058; facility-based delivery: Coef.: −0.83, 95% CI: −1.46 to −0.20, p value=0.010; PNC: Coef.: −0.45, 95% CI: −0.88 to 0.02, p value=0.041). The utilisation trends of two immunisation services (third pentavalent vaccination and measles vaccination) are similar to those of maternal health services (ANC, facility-based delivery and PNC). Overall, utilisation of the two immunisation services significantly increased during the period April–July 2020 (third pentavalent vaccination: Coef.: 0.36, 95% CI: 0.21 to 0.50, p value<0.001; measles: Coef.: 0.87, 95% CI: 0.73 to 1.01, p value<0.001). Yet, the increasing trend was not sustained between August 2020 and November 2020 (third pentavalent vaccination: Coef.: −0.49, 95% CI: −0.71 to 0.26, p value<0.001; measles vaccination: Coef.: −1.31, 95% CI: −1.53 to −1.08, p value<0.001). While the mean number of patient visits for VAS was significantly reduced during the period April–July 2020 (Coef.: −3.60, 95% CI: −5.71 to −1.49, p value=0.001), the mean number significantly increased during August–November (Coef.: 6.08, 95% CI: 2.71 to 9.45, p value<0.001). The number of patient visits for general outpatient care increased during both periods April–July 2020 (Coef.: 8.18, 95% CI: 4.19 to 12.16, p value<0.001) and August–November 2020 (Coef.: 5.20, 95% CI: −1.18 to 11.51, p value=0.107).

Table 4 shows the losses of patient visits during the COVID-19 pandemic by type of health and nutrition services. The total number of losses of patient visits for general outpatient care was the greatest −3 480 292 (95% CI: −3 510 820 to −3 449 676), followed by VAS −180 419 (95% CI: −182 658 to −177 956) and ANC −87 481 (95% CI: −93 644 to −81 063). While the losses of patient visits for other health and nutrition services (ie, facility-based delivery, PNC, third pentavalent vaccination and measles vaccination) were identified in April 2020, they recovered during the period May–November 2020. Overall, the total numbers of patient visits for these services were greater than the counterfactual ones in November 2020 (facility-based delivery: 3419 (95% CI: 2034 to 4905), PNC: 17 731 (95% CI: 16 453 to 18 981), third pentavalent vaccination: 5225 (95% CI: 4435 to 6007), measles vaccination: 41 317 (95% CI: 40 696 to 41 901)).

Table 5 shows the estimated percentage change between the predicted visits with and without the COVID-19 pandemic by type of health and nutrition services and period. The medians of percent change in ANC, VAS and general outpatient services from April to November 2020 were −3.91%, −43.04% and −47.02%, respectively. The interquartile range (IQR) of the percent change among health facilities was more than 50% inVAS (IQR: −77.27 to −23.88) and general outpatient services (IQR: −108.74 to −19.47).

Table 3 Effects of the COVID-19 pandemic from April to November 2020 based on the segmented mixed effects linear models for each health service in Ghana

	Antenatal care				Facility-based delivery			
		95% CI				95% CI		
	Coef.*	Lower	Upper	P value	Coef.*	Lower	Upper	P value
Immediate impact in April	−9.84	−11.74	−7.95	<0.001	−1.76	−2.84	−0.69	0.001
Impact during April–July	1.86	1.19	2.53	<0.001	0.67	0.28	1.07	0.001
Impact during August–November	−1.02	−2.08	0.04	0.058	−0.83	−1.46	−0.20	0.010
	Postnatal care				**First pentavalent vaccinations**			
		95% CI				95% CI		
	Coef.*	Lower	Upper	P value	Coef.*	Lower	Upper	P value
Immediate impact in April	−0.94	−1.71	−0.16	0.018	0.94	0.54	1.35	0.000
Impact during April–July	0.51	0.24	0.79	<0.001	−0.05	−0.21	0.10	0.483
Impact during August–November	−0.45	−0.88	−0.02	0.041	0.05	−0.19	0.29	0.667
	Third pentavalent vaccinations				**Measles vaccinations**			
		95% CI				95% CI		
	Coef.*	Lower	Upper	P value	Coef.*	Lower	Upper	P value
Immediate impact in April	−0.91	−1.27	−0.55	<0.001	−1.46	−1.87	−1.06	<0.001
Impact during April–July	0.36	0.21	0.50	<0.001	0.87	0.73	1.01	<0.001
Impact during August–November	−0.49	−0.71	−0.26	<0.001	−1.31	−1.53	−1.08	<0.001
	Vitamin A supplementation				**General outpatient care**			
		95% CI				95% CI		
	Coef.*	Lower	Upper	P value	Coef.*	Lower	Upper	P value
Immediate impact in April	−7.81	−13.71	−1.92	0.010	−144.22	−155.39	−133.05	<0.001
Impact during April–July	−3.60	−5.71	−1.49	0.001	8.18	4.19	12.16	<0.001
Impact during August–November	6.08	2.71	9.45	<0.001	5.20	−1.12	11.51	0.107

*All analyses include fixed effects by months, time trends, levels and authorities of health facilities with random effects.

Regional-level effects of COVID-19 pandemic

The results of detailed analyses for each essential health and nutrition service were presented in online supplemental tables 9–16. Overall, the effects of the COVID-19 pandemic on the number of patient visits for essential health and nutrition services differed by region. A significant reduction in the number of patient visits for ANC during the COVID-19 pandemic was identified in 5 of the 16 regions. A significant reduction in utilisations of VAS services was confirmed in Bono and Volta regions in April 2020. A significant reduction in the number of patient visits for general outpatient care was confirmed in Ahafo region, a reference category for variable 'Region' in the model (Eq.1) in April 2020. A further reduction in April, compared with Ahafo region, was identified in Ashanti and Greater Accra regions, while it was not in other regions.

As shown in online supplemental tables 9–16, in the Greater Accra region, the mean number of patient visits for four of the eight essential health and nutrition services was significantly reduced in April 2020: ANC (Coef.: −42.16, 95% CI: −58.25 to −26.07, p value<0.001), third pentavalent vaccination (Coef.: −5.15, 95% CI: −7.55 to −2.76, p value<0.001), measles vaccination (Coef.: −5.15, 95% CI: −7.55 to −2.76, p value<0.001) and general outpatient care (Coef.: −475.58, 95% CI: −563.14 to −388.03, p value<0.001). The numbers of patient visits for third pentavalent vaccination (Coef.: 1.77, 95% CI: 0.84 to 2.69, p value<0.001), measles vaccination (Coef.: 1.18, 95% CI: 0.20 to 2.15, p value=0.018) and general outpatient care (Coef.: 86.17, 95% CI: 54.15 to 118.18, p value<0.001) significantly increased on average in the Greater Accra region from April and July 2020, while patient visits for immunisation and general outpatient care services were significantly reduced from August to November 2020: third pentavalent vaccination (Coef.: −2.60, 95% CI: −4.02 to −1.17, p value<0.001), measles vaccination (Coef.: −1.55, 95% CI: −3.07 to 0.03, p value=0.045) and general outpatient care (Coef.: −52.84, 95% CI: −102.76 to −2.92, p value=0.038). The number of patient visits for ANC services in the Greater Accra region significantly increased from April and July 2020. This is in line with the trend observed in the Ahafo region, the reference region (Coef.: 5.54, 95% CI: 0.22 to 10.86, p value=0.041).

The total number of lost patient visits for essential health and nutrition services due to the COVID-19 pandemic from April to November 2020 are shown in table 6, by region. The Greater Accra region experienced the largest losses of patient visits for general outpatient

Table 4 The estimated loss of patient visits during the COVID-19 pandemic by essential health and nutrition services in Ghana

Target service indicator	April N (95% CI)*	May–July N (95% CI)*	August–November N (95% CI)*	Total N (95% CI)*
Antenatal care	−31 222 (−33 502 to −29 134)	−5319 (−9992 to −1275)	−50 939 (−54 605 to −46 951)	−87 481 (−93 644 to −81 063)
Facility-based delivery	−2024 (−2529 to −1540)	3989 (2992 to 4974)	1454 (601 to 2340)	3419 (2034 to 4905)
Postnatal care	−1178 (−1639 to −744)	13835 (12 954 to 14 739)	5074 (4271 to 5857)	17731 (16 453 to 18 981)
First pentavalent vaccination	4959 (4619 to 5255)	16071 (15 400 to 16 781)	13338 (12781 to 13 885)	34369 (33 452 to 35 341)
Third pentavalent vaccination	−3619 (−3871 to −3361)	5497 (4952 to 6048)	3347 (2889 to 3832)	5225 (4435 to 6007)
Measles vaccination	−3663 (−3884 to −3467)	23061 (22 632 to 23 470)	21 920 (21558 to 22 281)	41317 (40 696 to 41 901)
Vitamin A supplementation	−14 917 (−15 729 to −14 212)	−88 857 (−90 612 to −87 171)	−76 644 (−78 043 to −75 241)	−180 419 (−182 658 to −177 956)
General outpatient visits	−588 244 (−598 851 to −577 344)	−1 329 975 (−1 351 653 to −1 308 792)	−1562 072 (−1 582 054 to −1 544 019)	−3 480 292 (−3 510 820 to −3 449 676)

*The estimated loss of patient visits was computed as the differences between the predicted numbers of patient visits with and without the COVID-19 pandemic. The negative values indicate the loss of patient visits during COVID-19 pandemic.

Table 5 The estimated per cent change of patient visits during the COVID-19 pandemic by essential health and nutrition services in Ghana

Target service indicator	April Median (IQR)	May–July Median (IQR)	August–November Median (IQR)	Total Median (IQR)
Antenatal care	−19.09 (−29.94 to −9.04)	−0.1 (−2.90 to 0.37)	−10.42 (−18.70 to −4.55)	−3.91 (−12.62 to −0.14)
Facility-based delivery	−8.35 (−12.67 to −4.35)	4.58 (2.21 to 8.77)	1.78 (−1.56 to 5.93)	2.72 (−0.26 to 6.82)
Postnatal care	−3.5 (−4.90 to −2.04)	13.34 (6.91 to 21.18)	4.08 (0.85 to 10.02)	7.19 (0.95 to 16.05)
First pentavalent vaccination	12.96 (6.27 to 30.44)	9.31 (4.79 to 18.82)	10.13 (5.15 to 20.62)	9.98 (5.04 to 20.57)
Third pentavalent vaccination	−7.27 (−13.35 to −4.07)	2.01 (0.49 to 4.38)	1.75 (−1.37 to 5.03)	1.40 (0.01 to 4.08)
Measles vaccination	−7.39 (−12.57 to −4.25)	9.91 (4.24 to 21.27)	11.71 (4.24 to 27.54)	8.35 (2.65 to 21.11)
Vitamin A supplementation	−47.06 (−120.18 to −21.68)	−35.63 (−55.84 to −21.58)	−59.30 (−118.26 to −30.65)	−43.04 (−77.27 to −23.88)
General outpatient visits	−113.79 (−346.71 to −32.78)	−35.74 (−64.64 to −15.26)	−65.97 (−121.55 to −25.29)	−47.02 (−108.74 to −19.47)

Table 6 The estimated loss of patient visits during the COVID-19 pandemic by essential health and nutrition services and regions in Ghana

Region	Antenatal care N (95% CI)*	Facility-based delivery N (95% CI)*	Postnatal care N (95% CI)*	First pentavalent vaccinations N (95% CI)*	Third pentavalent vaccinations N (95% CI)*	Measles vaccinations N (95% CI)*	Vitamin A supplementation N (95% CI)*	General outpatient care N (95% CI)*
Greater Accra	−58 312 (−59 946 to −56 553)	−5315 (−5668 to −4915)	2556 (2230 to 2868)	5394 (5138 to 5640)	1083 (887 to 1290)	1874 (1639 to 2103)	−21 206 (−21 837 to −20 556)	−669 029 (−680 108 to −658 336)
Eastern	7284 (5504 to 8938)	−1590 (−1945 to −1229)	1663 (1355 to 2003)	3053 (2811 to 3294)	1397 (1194 to 1602)	6312 (6101 to 6530)	−37 582 (−38 300 to −36 874)	−433 415 (−444 143 to −421 436)
Central	−9793 (−11 500 to −8081)	−1070 (−1438 to −735)	−3372 (−3659 to −3060)	−930 (−1184 to −694)	1897 (1703 to 2096)	5981 (5754 to 6208)	−16 606 (−17 147 to −16 053)	−406 122 (−416 952 to −395 973)
Volta	−10 861 (−12 521 to −9221)	−4704 (−5083 to −4318)	1160 (882 to 1462)	1384 (1160 to 1607)	1549 (1339 to 1729)	2263 (2061 to 2467)	−2867 (−3447 to −2296)	−319 690 (−331 116 to −309 349)
Ashanti	−6830 (−8683 to −5092)	16 500 (16 180 to 16 826)	5902 (5562 to 6225)	9300 (9026 to 9569)	660 (456 to 879)	6759 (6513 to 6993)	−10 817 (−11 427 to −10 223)	−512 803 (−524 175 to −501 488)
Western	−11 515 (−13 117 to −9782)	236 (−110 to 566)	−1481 (−1794 to −1202)	−168 (−416 to 73)	1251 (1058 to 1448)	8067 (7855 to 8287)	−19 391 (−19 992 to −18 752)	−270 050 (−281 086 to −259 701)
Western North	1698 (56 to 3152)	579 (217 to 943)	25 (−268 to 301)	−1322 (−1571 to −1085)	−723 (−906 to −539)	1757 (1552 to 1964)	−322 (−847 to 249)	−74 169 (−84 577 to −64 289)
Ahafo	4846 (3317 to 6351)	−1114 (−1455 to −756)	1911 (1612 to 2187)	544 (330 to 772)	713 (531 to 904)	964 (764 to 1162)	−8114 (−8674 to −7583)	−78 626 (−88 867 to −68 093)
Bono East	−2783 (−4378 to −1264)	104 (−217 to 445)	2516 (2217 to 2794)	3249 (3038 to 3481)	494 (304 to 691)	4993 (4784 to 5215)	−20 304 (−20 973 to −19 680)	−119 724 (−130 275 to −109 374)
Bono	−11 327 (−12 815 to −9563)	−375 (−748 to −17)	328 (31 to 649)	1805 (1569 to 2043)	−1815 (−2006 to −1625)	176 (−38 to 396)	−5516 (−6129 to −4912)	−80 267 (−90 367 to −69 938)
Upper East	1035 (−511 to 2702)	−315 (−666 to 30)	−7 (−294 to 294)	1018 (780 to 1254)	−4404 (−4593 to −4221)	2164 (1950 to 2391)	−278 (−756 to 213)	−82 608 (−92 214 to −72 208)
Oti	3545 (2106 to 5040)	−230 (−583 to 96)	1284 (995 to 1568)	1231 (999 to 1472)	615 (422 to 796)	1697 (1495 to 1915)	2175 (1569 to 2756)	−56 521 (−67 175 to −46 195)
Savannah	2326 (838 to 3732)	−562 (−895 to −229)	436 (163 to 714)	1654 (1435 to 1882)	580 (391 to 763)	−377 (−579 to −180)	16 060 (15 289 to 16 789)	−26 236 (−35 900 to −16 440)
North East	7137 (5659 to 8618)	−227 (−571 to 118)	78 (−181 to 358)	1875 (1649 to 2108)	−1356 (−1525 to −1167)	−26 (−222 to 162)	−27 849 (−28 463 to −27 234)	1167 (−8719 to 10 620)
Upper West	10 628 (9159 to 12 114)	1691 (1341 to 2034)	50 (−250 to 328)	2160 (1935 to 2393)	−1316 (−1508 to −1133)	900 (692 to 1108)	−856 (−1380 to −348)	−87 533 (−98 016 to −76 607)
Northern	−15 027 (−16 630 to −13 366)	−140 (−474 to 185)	4450 (4147 to 4762)	5365 (5125 to 5606)	1231 (1030 to 1447)	−1948 (−2163 to −1736)	−23 064 (−23 682 to −22 440)	−95 287 (−105 601 to −84 561)

*The estimated loss of patient visits was computed as the differences between the predicted numbers of patient visits with and without the COVID-19 pandemic. The negative values indicate the loss of patient visits during COVID-19 pandemic.

care (−669 029, 95% CI: −680 108 to −658 336), ANC (−58 312, 95% CI: −59 946 to −56 553) and VAS (−21 206, 95% CI: −21 837 to −20 556). On the other hand, losses of patient visits for immunisation services in the Greater Accra region recovered in November 2020: first pentavalent vaccination (5394, 95% CI: 5138 to 5640), third pentavalent vaccination (1083, 95% CI: 887 to 1290) and measles vaccination (1874, 95% CI: 1639 to 2103). In 15 of the 16 regions, losses of patient visits for general outpatient care were the greatest of all the essential health and nutrition services.

DISCUSSION

This study is the first to assess of the effects of the COVID-19 pandemic on the utilisation of essential health and nutrition services, in Ghana, at both national and subnational levels. To estimate the trends before and during the COVID-19 pandemic using the segmented mixed effects linear models, we used and analysed nationally representative facility-based time-series data from January 2016 to November 2020. We found a significant reduction in the utilisation of essential health and nutrition services in April 2020, as an immediate impact of the COVID-19 pandemic, which was also reported in other countries.[17] After April 2020, a quick recovery of service provision and utilisation were observed in facility-based delivery, PNC, pentavalent vaccination and measles vaccination, while utilisation of ANC, VAS and general outpatient care had not recovered in November 2020.

General outpatient care was the only service type that was disrupted in all regions of Ghana in April 2020. The loss of patient visits for general outpatient care during the period April–November 2020 was estimated at approximately three million in Ghana. A similar reduction in the number of outpatient visits during the initial stage of the COVID-19 pandemic was reported by other countries.[18–22] Outpatient services target not only children, pregnant women and mothers but also all age groups. In Ghana, these outpatient care services are used as needed, usually without making routine appointments. Therefore, reductions in outpatient care service utilisation might be largely due to fear of being infected with COVID-19 infection on visiting health facilities.[23] Most populations must have been aware of the announcement of the first case of COVID-19 infection in Ghana, along with the country's risk communication measures (eg, 'stay home' if they feel unwell) at the initial stage of its pandemic. Thus, the general populations could be advised not to seek healthcare services unless it is an emergency. Moreover, to limit and control the spread of COVID-19, the GoG introduced lockdowns and restrictions on movements late March through April 2020 until they were gradually relaxed between April and May 2020. The lockdowns and restrictions could have also prevented people from using outpatient care services, particularly where these services were perceived as not an emergency by clients. Notably a number of hospitals that previously provided a great deal of outpatient care services were redesignated as COVID-19 treatment centres in Ghana. Some hospitals in Ghana were forced to undergo emergency staffing adjustments, for example, by temporarily transferring part of clinical staff either to COVID-19 treatment centres or to other clinical departments within the hospital as part of the initial response to the COVID-19 pandemic. Other hospitals had to temporarily close down some clinical departments and redesign hospital patient flow to enhance internal preventive and control measures. These initial responses could also have contributed to reduced availability of and access to outpatient care services at health facilities in Ghana.

Overall, ANC services were also disrupted during the COVID-19 pandemic. Its reduction in April 2020 did not recover as of November 2020. The results of our study indicate that pregnant women in Ghana are likely to defer or cancel their ANC visits during the COVID-19 pandemic. Studies in other countries such as Liberia and Nigeria have also reported that access to medical check-ups and care for pregnant women was disrupted,[18] while a study in Kenya did not find a negative impact on ANC service utilisation.[19] Due to the fear of infection, pregnant women could strategically reduce the number of ANC visits that they attended during the COVID-19 pandemic.[24] Possible reasons for this reduction include limited availability of outpatient care services or inadequate PPE at health facilities until November 2020. Needless to say, lack of PPE at health facilities generally makes pregnant women less confident in visiting health facilities and receiving safe ANC services.

VAS services in Ghana were significantly disrupted during the early stage of the COVID-19 pandemic. On the other hand, a significant improvement in service delivery was observed at a later stage of the pandemic (ie, August–November 2020). Lost opportunities for VAS services attributable to the COVID-19 pandemic were estimated at approximately 180 000 in Ghana. Although a large part of VAS doses are usually distributed during semiannual expanded programmes on immunisations campaigns, the campaign in early 2020 was deferred due to the COVID-19 pandemic. Ghana successfully conducted the campaign in October 2020 during a period with a relatively fewer number of COVID-19 cases while taking adequate preventive measures against COVID-19 infection. Other countries were similarly required to find an appropriate balance between infection prevention and implementing the campaigns. The framework for decision-making on VAS campaign published by the Global Alliance of Vitamin A would help identify ways to balance COVID-19 prevention and VAS.[25]

The numbers of facility-based deliveries and vaccination services were reduced in April 2020, but soon recovered in May 2020. Delivery care is an emergency care service for pregnant women, while ANC and PNC visits are routine services and possible to be postponed. Though the number of ANC visits was significantly reduced, the number of facility-based deliveries was not, and delivery

services continued to be used even during the COVID-19 pandemic. Pregnant women may tend to think that the benefits of facility-based delivery are greater than their risks of infection with COVID-19. This could also be an effective opportunity to promote facility-based deliveries since health facilities take better preventive measures against infection from COVID-19 than other places such as traditional birth attendants' homes. Vaccination services in Ghana were readily available at the majority of both governmental and non-governmental health facilities regardless of the level of health facilities, as vaccination services do not require expensive PPE that is often not available at lower-level health facilities. Well-defined vaccination schedule with an adequate number of service delivery points would help maintain the vaccine service coverage to a certain extent, too.

We also found varying effects of the COVID-19 pandemic on the utilisation of essential health and nutrition services by region. The Global Financing Facility for Women, Children and Adolescents reported a variety of patterns of service disruptions by service type and by country.[18] Assessing subnational impacts is key to identifying the most COVID-19-affected regions and to implementing the necessary actions for pre-empting and mitigating further impacts. This study found significant service disruptions in ANC, child vaccinations and general outpatient care in the Greater Accra region, the epicentre of Ghana's COVID-19 outbreak. This region accounted for 55% of Ghana's confirmed COVID-19 cases as of 9 December 2020. Also, reductions in service utilisation in April 2020 should have been attributed to a 3-week partial lockdown in the Ashanti and Greater Accra regions. During the lockdown period, movements of non-essential workers and the general population were restricted.[11] It would make pregnant women and mothers with children as well as the general population hesitate to visit health facilities for non-emergency services.

One limitation of this study is that we did not assess the effects of the COVID-19 pandemic after November 2020, which would be different from the immediate and intermediate effects that were assessed. Further studies are needed to assess whether and how the trends in service utilisation would be maintained or changed after November 2020. They should also identify the reasons why some essential health and nutrition services were elastically maintained and while other health and nutrition services were not. However, several earlier studies already reported some key factors influencing essential health and nutrition service delivery in Ghana during the pandemic. As a COVID-19 response, Ghana developed several mobile apps to trace contact and share data and patient information.[26] Also, GoG established Ghana Infectious Disease Centre as a first infectious disease isolation and treatment centre.[26] In addition, health workers stationed at COVID-19 treatment centres provided health services in greater compliance with infection prevention and control (IPC),[27] while IPC preparedness at other health facilities in Ghana was generally not as high as the stationed COVID-19 treatment centres.[28] The GoG, however, deployed other intervention strategies quickly to mitigate, in part, the disruptions in health and nutrition service delivery, for example, involvement of private sectors in the COVID-19 responses[12 29] and a call to action for sustaining health and nutrition service delivery. These responses would be one of the factors influencing essential service utilisation. Effective mass media communications are key to mitigating the effects of the COVID-19 pandemic in essential health and nutrition service utilisation through timely delivery of appropriate information while mitigating patients' fears about accessing safe care in healthcare facilities. Increasing measures for the prevention of COVID-19 infections and using mobile healthcare service such as online consultation could be an effective option to receive necessary advice from health personnel and to reduce the risk of infection at health facilities.[30 31] Scheduling patients' appointments would also reduce the risk of infection, by ensuring the optimal number of patients in waiting areas.

CONCLUSION

We found a significant reduction in the utilisation of essential health and nutrition services in April 2020, as an immediate impact of the COVID-19 pandemic. After April 2020, a quick recovery of service provisions and utilisation were observed in facility-based delivery, PNC, pentavalent vaccination and measles vaccination, while utilisation of ANC, VAS and general outpatient care had not recovered in November 2020. The total losses of patient visits for ANC, VAS and general outpatient care during the COVID-19 pandemic were estimated at approximately 80 000, 180 000 and 3.4 million visits, respectively. Greater Accra was the most affected region by the COVID-19 pandemic, as evidenced by disrupted utilisation in four of the eight essential health and nutrition services. Effective communication through mass media, improvement of preventive measures at health facilities and utilisation of mHealth tools would reduce the risks of COVID-19 infection while further mitigating patients' hesitation in accessing health facilities out of fear of possible COVID-19 infection. Further studies are needed to assess whether and how the trends of patients' health service utilisation were sustained or changed after November 2020. In addition, it is critical to further examine why some regions in Ghana were successful in sustaining health service delivery and utilisation even during the COVID-19 pandemic, in comparison to other regions and countries.

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Funding This study was funded by the Government of Japan as a part of Emergency Assistance for Prevention of Further Spread of the Novel Coronavirus (COVID-19) Infection (Grant No. SC200336).

Disclaimer The information expressed in this paper is authors' personal views and does not necessarily represent the corporate views of UNICEF and Ghana Health Service.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval The ethical approval was obtained from Ghana Health Service (GHS) ethics review committee (GHS-ERC No. 014/09/20). The use the District Health Information Management System data for this study was officially approved by the GHS.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request with the approval of the Ministry of Health or Ghana Health Services.

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