ORIGINAL RESEARCH ARTICLE

The impact of the COVID-19 pandemic on reproductive, maternal, neonatal, and child health care services in Kiambu County, Kenya

DOI: 10.29063/ajrh2024/v28i3.3

Davis Kamondo[1], Magoma Mwancha-Kwasa[1], Moses Kamita[2], Caroline Mwangi[1], Maxwell Murage[1], Prabhjot K. Juttla[1], Daniel Gicheru[1] and Jesse Gitaka[2]*

Department of Health Services, County Government of Kiambu, Kiambu County, Kiambu, Kenya[1]; Department of Research and Innovation, Mount Kenya University, Thika, Kiambu County, Kenya[2]

***For Correspondence:** Email: *kuldavis@gmail.com*; Phone: +254 721 905 041

Abstract

The global response to COVID-19 undermined established public health goals. This study investigated the impact of COVID-19 on reproductive, maternal, neonatal, and child health (RMNCH) services in Kiambu County, Kenya. It was a retrospective cross-sectional study, where data on antenatal care (ANC), delivery, postnatal care (PNC), and family planning (FP) before and after COVID-19 was retrieved and compared. New ANC clients and 4th ANC visits decreased by 2.9% and 17% respectively. New clients attending PNC increased by 13.3% (p = 0.007). Skilled deliveries reduced by 0.3%, maternal, neonatal deaths, and fresh stillbirths reduced by 0.7%, 23.9%, and 15.8% respectively. Caesarean sections rose by 12.7% (p=0.001). New clients and revisits for family planning reduced by 15.4% and 6.6% respectively. The pandemic adversely affected most of the RMNCH services. There is a need for health departments to institute robust strategies to recover the gains lost during COVID-19. *(Afr J Reprod Health 2024; 28 [3]: 20-29).*

Keywords: COVID-19, RMNCH, Antenatal care, Family planning, Kiambu

Résumé

La réponse mondiale à la COVID-19 a sapé les objectifs de santé publique établis. Cette étude a examiné l'impact du COVID-19 sur les services de santé reproductive, maternelle, néonatale et infantile (SRMNI) dans le comté de Kiambu, au Kenya. Il s'agissait d'une étude transversale rétrospective, dans laquelle les données sur les soins prénatals (ANC), l'accouchement, les soins postnatals (PNC) et la planification familiale (PF) avant et après la COVID-19 ont été récupérées et comparées. Les nouvelles clientes de CPN et les 4èmes visites de CPN ont diminué respectivement de 2,9 % et 17 %. Les nouveaux clients fréquentant la PNC ont augmenté de 13,3 % (p = 0,007). Les accouchements qualifiés ont diminué de 0,3 %, les décès maternels et néonatals et les nouvelles mortinaissances ont diminué respectivement de 0,7 %, 23,9 % et 15,8 %. Les césariennes ont augmenté de 12,7 % (p=0,001). Les nouveaux clients et les nouvelles visites pour la planification familiale ont diminué respectivement de 15,4% et 6,6%. La pandémie a eu des conséquences néfastes sur la plupart des services de RMNCH. Il est nécessaire que les services de santé mettent en place des stratégies solides pour récupérer les gains perdus pendant la COVID-19. *(Afr J Reprod Health 2024; 28 [3]: 20-29).*

Mots-clés: COVID-19, RMNCH, soins prénatals, planification familiale, Kiambu

Introduction

Reproductive, maternal, neonatal and child health (RMNCH) services are aimed at reducing maternal and child deaths. The continuum of care includes healthcare services for mothers and children from pre-pregnancy to delivery, the postnatal period and childhood[1]. Every woman is expected to have a minimum of eight antenatal care (ANC) contacts[2,3], and have skilled birth attendants at delivery. Because the majority of maternal and neonatal deaths occur in the immediate postpartum period[4], postnatal care (PNC) services within the first two days after delivery and thereafter family planning services are recommended under RMNCH guidelines. For children, immunization is associated with reduced childhood morbidity and mortality and overall better health outcomes[5].

The first case of coronavirus disease (COVID-19) was reported in December 2019[6]. On March 11, 2020, the World Health Organization (WHO) declared COVID-19 a global pandemic. A day later, the first laboratory-confirmed COVID-19 case was reported in Kenya[7]. In a bid to curb the spread of COVID-19, the government of Kenya implemented movement restrictions (into and

within the country), a 7 pm to 5 am curfew, the lockdown of various institutions and regulation of public gatherings. The Ministry of Health in Kenya recognised that these measures would disrupt usual RMNCH services and provided guidelines for its continuity[8].

During COVID-19, a study in the United Kingdom showed reductions in hospital admissions for childhood infections[9], and one in Pakistan showed similar findings at a primary health care level[10]. Similar findings were seen in Uganda[11], Uttar Pradesh in India[12], and Bangladesh, South Africa and Nigeria[13]. Modelling studies have suggested that limited access to health facilities may have reduced the use of all RMNCH services specifically in low- and middle-income countries[14]. However, a study conducted in Northern Ethiopia showed an increase in institutional delivery, stillbirths, postnatal care and children who received all immunizations during the COVID-19 pandemic[15].

The factors contributing to reduced utilization of RMNCH services went beyond physical access due to the restrictions to include patient factors. During the Ebola pandemic in Sierra Leone, RMNCH services dropped significantly due to a lack of personal protective equipment and fear of contracting the virus at the health facilities[16]. This fear has also been reported during the COVID-19 pandemic, whereby pregnant women reported anxiety associated with going to health facilities which altered their health-seeking behaviour[17]. Furthermore, a qualitative study conducted in Nairobi, Kenya found that financial insecurity such as the inability to afford protective equipment to attend clinics affected the access to family planning services[18].

In Kenya, the impact of COVID-19 on RMNCH services has been reported[19], but the study only included the first four months of the pandemic year and looked at the effect on the entire country. The extent of the effectiveness of the COVID-19 guidelines for continued RMNCH service delivery[20,21], at the county level is not well known. This paper aimed to measure the impact of the COVID-19 pandemic and associated control measures on the utilization of RMNCH services in Kiambu County, Kenya.

Methods

Study design and site

This was a retrospective cross-sectional study and the period under stud was January 2018 to December 2020.

The study area was Kiambu County, one of the 47 counties in the Republic of Kenya. Its geolocation is Latitude: -1.1667 Longitude: 36.8333. Kiambu County has 505 health facilities in total[22]. Of these, 108 are public. They include 70 dispensaries (Level 2), 24 health centers (Level 3), 11 hospitals (Level 4) and 3 hospitals (Level 5). Level two (2) facilities offer all mother and child health services but only as outpatient services, level three (3) facilities allow for normal deliveries, level four (4) have the capacity to perform caesarean deliveries and level five (5) provide specialized gynecological services[23].

Sample size calculation

All the three-level 5 hospitals and four level 4 hospitals were purposively selected in this study because they have a high workload. For the level 2 and 3, Cochrane's formula for small populations was used with a precision level of ± 20% a confidence level of 80%, a standard deviation of 0.5. This yielded a sample size of eight (8) level 3 facilities and ten (10) level 2 facilities. Of the latter, each was assigned a number and particular facilities chosen using a random-number generator for probability sampling. All the data in the selected facilities was included and aggregated.

Data collection

Aggregate data for the sampled study facilities was abstracted from the Kenya Health Information System (KHIS) on selected RMNCH indicators after verification. KHIS is the national health information system for data aggregation and analysis. It does not contain individual patient-level data. All data is de-identified and collated at facility, sub-county, county and national levels.

Data analysis

2018 and 2019 were considered the pre-COVID-19 period: averages were calculated for this period to

allow for comparison against 2020, the COVID-19 period. Trends in hospital attendance were determined monthly to allow for comparison and factor in seasonality, and presented in graphs. Analysis was done using Statistical Package for the Social Sciences (SPSS) version 24. To determine statistical differences between trends, monthly averages for the years 2018 and 2019 was determined and compared with the monthly data for the year 2020. Comparison between the two time periods was done using either t-test or Mann-Whitney U for normally distributed and non-normally distributed data respectively. A p-value less than 0.05 was considered statistically significant.

Ethical consideration

Ethical review and approval were sought from the University of Eastern Africa, Baraton Research Ethics Committee (UEAB/RE/08/06/2020). Thereafter, study approval was obtained from the Department of Health of Kiambu County..

Results

Routine Maternal Services (ANC, delivery and postnatal)

During the study period, the county had 67,334 total deliveries in 2018, 70,030 in 2019, and 68,454 in 2020. The trend in ANC new client attendance was higher in the first six months of 2020 followed by a decrease for the rest of the year in comparison to 2018 and 2019 (Figure 1A), culminating in a 2.9% decrease. ANC revisits decreased in April and May 2020 when compared to similar months in 2018 and 2019, a trend that worsened as the year progressed (Figure 1B). Overall, the number of clients who were able to complete 4 ANC visits was lower in 2020 compared with either 2018 or 2019, and this cumulative 17-point reduction started from April 2020 and continued for the rest of the year (Figure 1D).

New PNC attendance was generally higher in January to August 2020 than in similar months in 2018 and 2019 with a decrease in September and October (Figure 1C). Despite this, the increase in attendance in the year was statistically significant (13.3%, $\rho = 0.007$) compared with the average for 2018 and 2019 (Table 1).

The number of normal deliveries and deliveries conducted by Skilled Birth Attendants (SBAs) in health facilities showed a similar trend in all three years, until September 2020 where there was a decrease of 0.3% and -5.0%, respectively, in both indicators. Similarly, the number of women who underwent cesarean section (c-section) was higher in 2020 than in other years from January to September, after which the numbers decreased to lower than either of the two years by December (Figure 3G). The number of facility maternal deaths recorded in the three years fluctuated and varied across the years with no notable trend (Figure 2C). Comparison between the years yielded no statistically significant result ($p = 0.701$).

The number of facility neonatal deaths recorded from January to August was similar to those recorded in 2018 and 2019, after which the numbers declined steeply from September to December 2020 (Figure 2E). The number of facility Fresh stillbirths (FSBs) was lower in most months of 2020 than in either 2018 or 2019 (Figure 2F). Facility Macerated stillbirths (MSBs) were very high during the first four months of 2020, after which the numbers reduced to 2018 and 2019 levels. A further drop was noted in November and December, but there was an overall annual increase of 6.7% in facility MSBs in 2020 versus the two previous years.

Uptake of family planning services

Family planning (FP) uptake in new and revisiting clients, as well as the number of women of reproductive age (WRA) receiving FP commodities showed similar trends where the numbers were similar among the three years from January to September. However, sharp declines were observed from October to December, culminating in a -15.4%, -6.6%, and -2.4% change in 2020 for all indicators respectively. However, these differences were well above threshold and did not reach statistical significance.

Routine Child services (CWC clinics, Immunizations)

The results (Figure 4A-D and F) showed that trends in the number of services such as BCG vaccines,

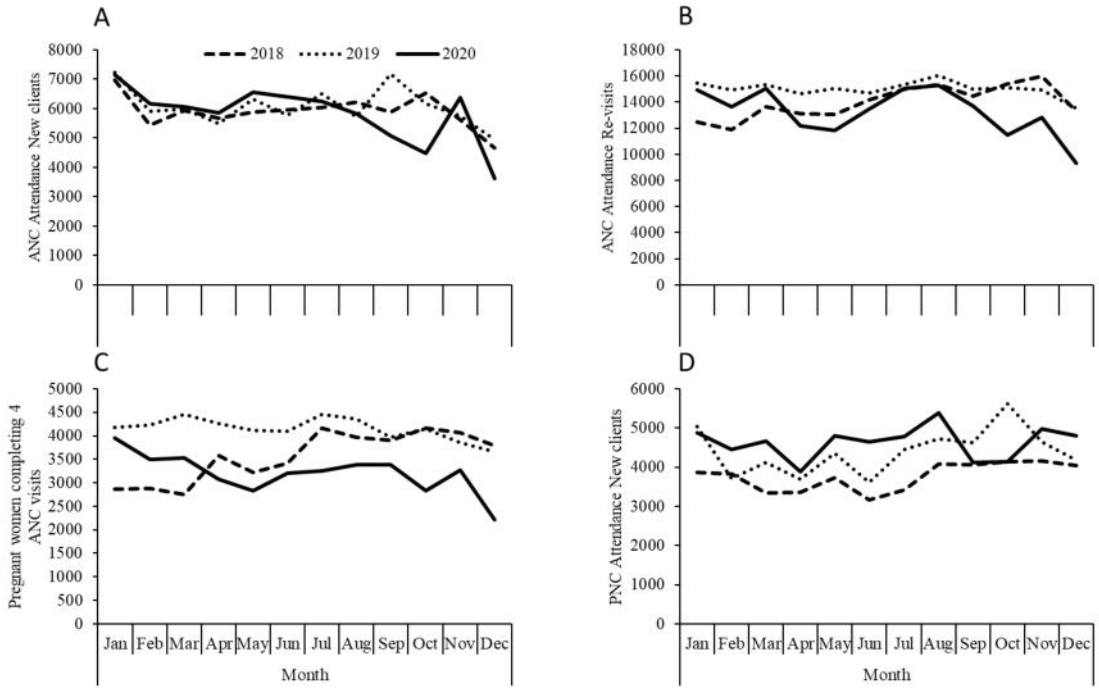

Figure 1: Monthly attendance from 2018 to 2020 for ANC and PNC services in Kiambu County. 1A - the number of new clients seeking ANC services; 1B - trend in number of ANC re-visits; 1C - trend in pregnant women completing 4 ANC visits and 1D - trend in PNC new visits

DPT-HepB-Hib (Penta) 1 and 3 vaccines, measles-rubella (MR) 1 vaccines, as well as trends in the number of children under 1 year who were fully immunized (FICs), were the same in the three years under investigation. However, trends in the Penta 1-3 dropout rates in 2020 showed a reduction in November and December of 2020 compared with the same months in 2018 and 2019 (Figure 3E).

Screening for cervical cancer

The results revealed a slight uptick in the annual number of WRA screened for cervical cancer during the pre-COVID period (3855.4). However, this increase was not maintained in 2020 (3198.9), resulting in a 17% decrease that did not reach statistical significance ($p = 0.064$).

From Table 1, it is evident that as the absolute number of children receiving Penta-1 and Penta-3 increased, the Penta-1 to Penta-3 dropout rate improved from 4.7% in the pre-COVID-19 period to 3.4% in the COVID-19 period. Additionally, the number FIC also increased by 1.3%.

While facility maternal mortalities remained unchanged, neonatal outcomes improved in the COVID-19 period, with facility FSBs declining by 15.8% and total neonatal deaths declining by 23.9%. However, facility MSBs increased by 6.7%.

It's noteworthy that all the changes in the indicators were not statistically significant, except for the 13.3% improvement in PNC attendance by new clients ($p = 0.007$) and the 12.7% increase in cesarean sections ($p = 0.001$).

Discussion

RMNCH services serve as a vital barometer for the broader health system, offering insights into its resilience and vulnerabilities. As the most vulnerable members of our population rely on these services, their response to the COVID-19 pandemic offers a poignant reflection of our entire healthcare system's adaptability and effectiveness. Consequently, exploring the pandemic's impact on RMNCH services not only exposes weakness in our healthcare infrastructure but also allows us to forge a better path forward while recovering from the effects of COVID-19.

The new clients attending ANC services decreased by 2.9% but though this change was not statistically significant, similar findings were

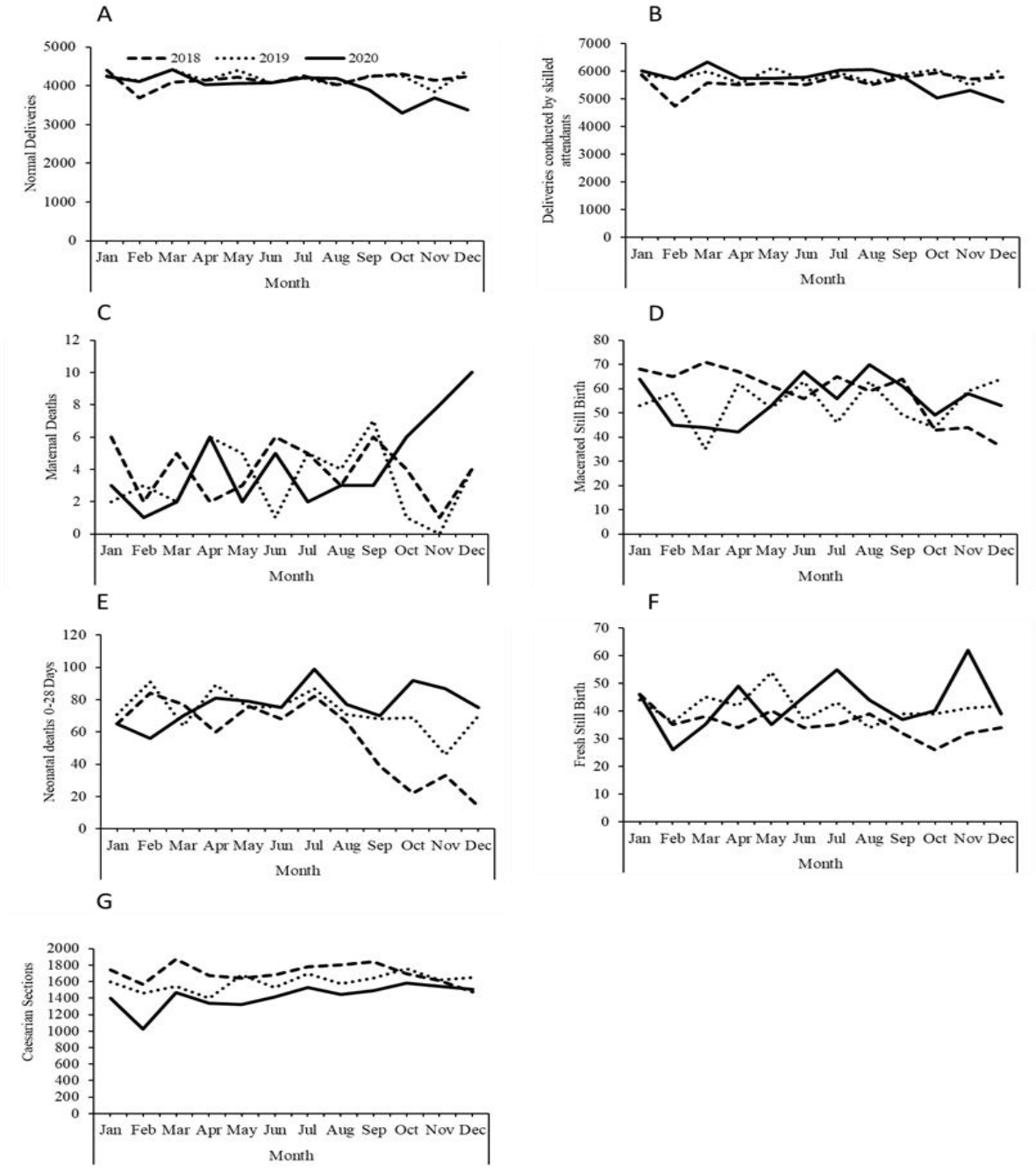

Figure 2: Trend of number of women who received different modes of deliveries and the number of deaths recorded in the three years. 2A - normal deliveries; 2B - deliveries conducted by SBAs; 2C number of facility maternal deaths; 2D - number of facilities MSBs; 2E - number of facility neonatal deaths; 2F number of facility FSBs and 2G - number of c-sections conducted

observed in Haiti where first ANC visits were 18% significantly lower than expected[24]. In the Haitian study, significant declines occurred from April to June 2020 and again in December 2020 for the first ANC visits. A study from Kampala, Uganda showed similar reductions[11]. However, the increase in new ANC clients in the current study in the first half of the year 2020 despite the existence of COVID19 shows the importance given to the first antenatal clinic visit by women. This may be due to

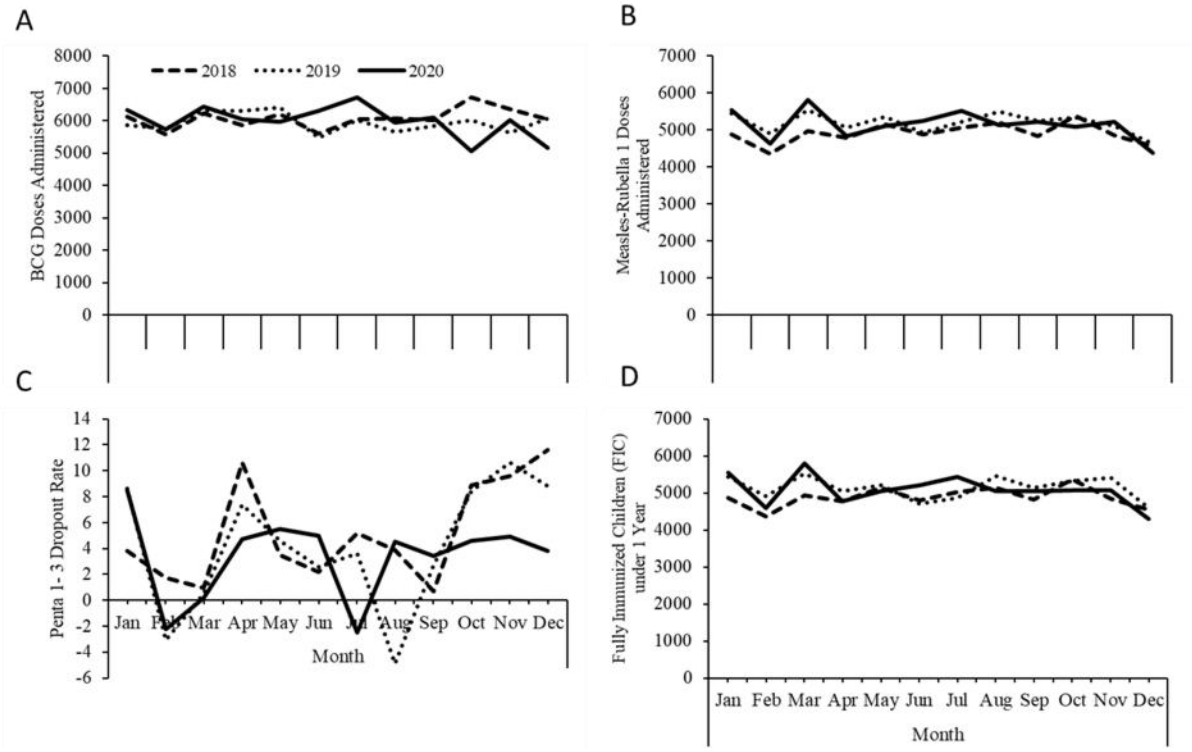

Figure 3: Recorded numbers for selected routine child services offered in Kiambu County from 2018 to 2020. 3A - BCG doses administered; 3B - Penta 1 doses administered; 3C - Penta 3 doses administered; 3D - MR 1 doses administered

Table 1: Average number of clients seeking different health services pre-COVID-19 and during COVID-19 and percentage change

	Monthly Average			
Indicator	Pre-COVID-19 Period	COVID-19 Period	% Change	P Value
ANC Attendance New clients	5992.5	5821.4	-2.9	0.862
ANC Attendance Re-visits	14489.7	13224.3	-8.7	0.036
PNC Attendance New clients	4081.6	4624	13.3	0.007*
Pregnant women completing 4 ANC visits	3855.4	3198.9	-17	0.334
C-Sections	1509	1700	12.7	0.001*
Normal Deliveries	4178	3967.8	-5	0.073
Deliveries conducted by SBA	5723.5	5704.5	-0.3	0.155
Facility FSB	42	35.4	-15.8	0.624
Facility Neonatal deaths 0-28 Days	75.1	57.2	-23.9	0.057
Facility MSB	54.6	58.3	6.7	0.159
Facility Maternal Deaths	3.9	3.9	-0.7	0.701
FP New Clients	10990.8	9299.2	-15.4	0.184
FP Re-visits	9958	9301.1	-6.6	0.862
WRA receiving FP commodities	21918.8	21385.9	-2.4	0.084
MR 1 Doses Administered	5050.5	5147.5	1.9	0.354
Penta 1 Dose Administered	5291.2	5379.9	1.7	0.673
Penta 3 Dose Administered	5034.5	5193.8	3.2	0.225
Penta 1- 3 Dropout Rate	4.7	3.4	-28.2	0.216
BCG Doses Administered	6008	5988.7	-0.3	0.133
FIC under 1 Year	5008.9	5075.7	1.3	0.686
WRA screened for cervical cancer	3855.4	3198.9	-17	0.064

the elaborate services given in the first ANC clinic including confirmation of pregnancy, ANC profile, and screening for various diseases/conditions. However, during the second half of 2020, the ANC clients decreased. This might be related to the continued implementation of COVID-19 policies, which has been demonstrated to result in decrease in social support, which buttresses RMNCH implementation[25]. It may also be explained by shifting priorities as the pandemic progressed, with demand for services in Kenya declining later in the pandemic due to patient financial constraints. This "demand impact" was exacerbated by the shift of ANC services to telemedicine, which was poorly executed and resulted in confusion at the facility level (some patients were turned away from clinics as "essential services" were not well defined)[26].

Deliveries conducted by SBAs demonstrated a minuscule decrease in 2020 in contrast to a study in Tigray where there was a significant increase in the percentage of skilled births[15]. This indicates that the measures taken by Kiambu County to ensure the continuity of RMNCH services cushioned a potentially fatal blow to SBA deliveries. These measures included giving curfew passes to taxi drivers, motorbike riders, and relatives who accompanied the mothers to the hospital and health education to the community through various media on continuity of maternity services amidst COVID-19[8].

The number of facility maternal deaths, facility FSBs, and facility neonatal deaths did not increase in 2020. A cross-sectional study conducted in Kenya showed there were significant increases in the numbers of FSBs and maternal deaths but a significant decrease in the neonatal deaths reported nationally[19]. A systematic review showed that during the pandemic year there was an increase in maternal deaths[27]. Both findings contrast the findings of the current study. We demonstrated that in Kiambu County, maternity services afforded to women were not affected by COVID-19 given that all three indicators reflect the quality of services provided. While there was continuity in the provision of RMNCH services, the overall objective of service delivery was also achieved: reduction of patient mortality. This is echoed by a qualitative study conducted on the quality of maternal services among Kenyan women which showed an improvement in the quality of the services[28].

However, there was an increase in the facility MSBs in the current study. A study conducted in Zimbabwe showed that there was an increased likelihood of stillbirths (including MSBs) during 2020[29]. MSBs are an indication of poor ANC care, and in our study, there was a reduction in the ANC attendance revisits (although not statistically significant). The RMNCH COVID-19 guidelines advocated that clients should be scheduled for visits to reduce influx and health care facility crowding.[20] Furthermore, it stipulated that the maximum number of in-facility visits for women without complications in pregnancy should be four and the rest of the appointments occur via telemedicine. Resultantly, there was a decrease in the total number of ANC clients completing four visits in the year 2020. This is in agreement with a study conducted in Northern Ethiopia where women completing four ANC visits dropped by 2.83% during the COVID-19 pandemic[15].

The rise in ANC attendance in the first half of 2020 is a strong indication that women did not adhere to the clinic return dates (mostly in their last trimester) possibly due to fear of contracting COVID-19. This fear of health facilities has been previously reported, both abroad[17], and among Kenyan women[28], and may have led to the increase in MSBs as reported in the current study. In Kenyan women, a previous study showed that this fear was coupled with not prioritizing maternal services[28]. However, the numbers of MSBs were comparable, and eventually declined towards the end of 2020, perhaps due to the actions taken by the county such as supporting the community health system.

The number of C-sections significantly increased during the COVID-19 pandemic year. This contrasts with a study in Nigeria where the C-section rate was lower during the pandemic year compared to pre-pandemic levels[30]. This may be a result of the COVID-19 measures that reduced access to healthcare implying that mothers were coming to deliver late and to ensure the life of the mother and live fetus, a c-section was necessary.

The PNC attendance for new clients increased significantly during the COVID-19 pandemic. This corresponds to two studies conducted in Ethiopia[15,31]. This may be due to the nationally stipulated PNC services tailored for the pandemic which laid emphasis on immediate FP services and breastfeeding to post-partum women

in Kenya[21]. This was achieved during the pandemic by streamlining out-patient services and socially-distanced PNC consultations, and also via the community health strategy[21].

The revisits and new clients for FP services dropped, though not significantly, in 2020 compared to the previous two years. This is in line with a study from Mozambique which demonstrated a short-term decrease in service utilization of FP, followed by a rapid rebound during the pandemic year[32]. This effect may be pinned on the RMNCH COVID-19 guidelines providing longer return dates for women in need of FP services by increasing the amount of FP commodities given to them during a visit[21]. This could explain the decline in the new clients and revisits towards the end of the year 2020. In addition, there is a probability that women opted to acquire contraceptive commodities from the private sector such as chemists[33].

There was no statistically significant difference in the Penta-1, Penta-3, and BCG doses administered, as well as FIC. These are in line with the study conducted in Northern Ethiopia[15], and the national RMNCH study in Kenya[19]. The findings contrast a study conducted in Uganda which showed that child immunization clinic attendance declined[11]. The trend in utilization of child immunization services was comparable over the three years, a strong indication of the importance that the community has given child immunization services. Moreover, the dropout rate towards the end of 2020 was lower compared to the same time period in other years, a dividend of the years of health education to communities on the importance of childhood immunizations.

The WRA screened for cancers demonstrated a decaying trend from 2018 until 2020. Low utilization of cervical cancer screening services has been previously reported in Shabadino District, Southern Ethiopia[34]. The number of women seeking cervical cancer screening services in Kiambu County declining over the three years indicates a gap for public health education on the utility of cancer screening. The measures put by the Government of Kenya in order to curb the spread of COVID 19 may have generally disrupted the provision of these services.

The use of aggregate county-wide data gives an overview of the county, and does not disaggregate the county by the different RMNCH uptakes that the different health facilities and sub-counties have. While this study paints a clear picture of the county status, there is a need to be cognizant of the rural-urban and other intra-county disparities.

Conclusion

In conclusion, the impact of the COVID-19 pandemic on RMNCH services in Kiambu county provides a microcosm of the broader health system challenges faced during this unprecedented global crisis. The stability in facility maternal deaths, FSBs, and facility neonatal deaths underscores the effectiveness of maintaining quality of care despite external disruptions. However, the increase in maternal near-miss indicators such as MSBs signals areas for improvement, particularly in addressing patient fears and ensuring timely access to care and ongoing monitoring of pregnancies via ANC visits. The rise in PNC attendance and consistent child immunization rates indicate community strategy resilience. Addressing the lingering effects of the pandemic on RMNCH services necessitates a holistic approach that considers both immediate responses and long-term health system strengthening. By leveraging lessons learned from the pandemic, Kiambu County and similar settings can build more resilient, equitable, and responsive health systems that prioritize the well-being of women, children, and families.

Acknowledgements

This study was made possible by the invaluable contributions of several individuals in both public and private institutions. We acknowledge the County Government of Kiambu and the County Health Management Team for supporting the study's conception and allowing its members to participate in various capacities. This study would not have been possible without the support of the University of Nairobi – CRISS project, EGPAF and LVCT.

Author contribution

DK was involved in the design, analysis, and preparation of the manuscript. MMK contributed to the conception, design, data collection, analysis, and preparation of the manuscript. MK conducted

data analysis. CM participated in data collection. MM contributed to the conception and design of the study. PKJ conducted analysis and prepared the initial and final version of the manuscript. JG was involved in the preparation of the manuscript, both initial and final. All authors approved the final version of the manuscript and qualify for authorship.

References

1. Akinyemi JO, Afolabi RF and Awolude OA. Patterns and determinants of dropout from maternity care continuum in Nigeria. *BMC Pregnancy Childbirth*. 2016;16(1). doi:10.1186/s12884-016-1083-9
2. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. 2014. Accessed March 10, 2022. https://www.who.int/publications/i/item/9789241549912
3. Yasuoka J, Nanishi K, Kikuchi K, et al. Barriers for pregnant women living in rural, agricultural villages to accessing antenatal care in Cambodia: A community-based cross-sectional study combined with a geographic information system. *PLoS One*. 2018;13(3). doi:10.1371/journal.pone.0194103
4. Warren C, Daly P, Toure L and Mongi P. Postnatal care. In: *Opportunities for Africa's Newborns*.
5. Mansour Z, Arab J, Said R, et al. Impact of COVID-19 pandemic on the utilization of routine immunization services in Lebanon. *PLoS One*. 2021;16(2 Febuary). doi:10.1371/journal.pone.0246951
6. Mallah SI, Ghorab OK, Al-Salmi S, et al. COVID-19: breaking down a global health crisis. *Ann Clin Microbiol Antimicrob*. 2021;20(1). doi:10.1186/s12941-021-00438-7
7. Republic of Kenya. 62 more new cases of Covid 19 Nairobi, Tuesday May 26, 2020 – MINISTRY OF HEALTH. Published May 26, 2020. Accessed March 8, 2022. https://www.health.go.ke/62-more-new-cases-of-covid-19-nairobi-tuesday-may-26-2020/
8. Kenya: Ministry of Health. *KENYA COVID19 RMNH GUIDELINES: A Kenya Practical Guide for Continuity of Reproductive, Maternal, Newborn and Family Planning Care and Services in the Background of COVID19 Pandemic*.; 2020.
9. Kadambari S, Goldacre R, Morris E, Goldacre MJ and Pollard AJ. Indirect effects of the covid-19 pandemic on childhood infection in England: population based observational study. *The BMJ*. 2022;376. doi:10.1136/bmj-2021-067519
10. Baloch AA, Baig N, Baloch F and Suhag Z. Impact on the Utilization of Reproductive, Maternal, Newborn and Child Health Care Services at Primary Health Care Level During First Wave of COVID-19 Outbreak in Pakistan. *Cureus*. Published online August 25, 2021. doi:10.7759/cureus.17430
11. Burt JF, Ouma J, Lubyayi L, et al. Indirect effects of COVID-19 on maternal, neonatal, child, sexual and reproductive health services in Kampala, Uganda. *BMJ Glob Health*. 2021;6(8). doi:10.1136/bmjgh-2021-006102
12. Singh A, Jain P, Singh N, et al. Impact of COVID-19 pandemic on maternal and child health services in Uttar Pradesh, India. *J Family Med Prim Care*. 2021;10(1):509. doi:10.4103/jfmpc.jfmpc_1550_20
13. Ahmed T, Rahman AE, Amole TG, et al. The effect of COVID-19 on maternal newborn and child health (MNCH) services in Bangladesh, Nigeria and South Africa: call for a contextualised pandemic response in LMICs. *Int J Equity Health*. 2021;20(1). doi:10.1186/s12939-021-01414-5
14. Roberton T, Carter ED, Chou VB, et al. Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: a modelling study. *Lancet Glob Health*. 2020;8(7):e901-e908. doi:10.1016/S2214-109X(20)30229-1
15. Desta AA, Woldearegay TW, Gebremeskel E, et al. Impacts of COVID-19 on essential health services in Tigray, Northern Ethiopia: A prepost study. *PLoS One*. 2021;16(8 August). doi:10.1371/journal.pone.0256330
16. United Nations. *Rapid Assessment of Ebola Impact on Reproductive Health Services and Service Seeking Behaviour in Sierra Leone March2015*.; 2015.
17. Corbett GA, Milne SJ, Hehir MP, Lindow SW and O'connell MP. Health anxiety and behavioural changes of pregnant women during the COVID-19 pandemic. *European Journal of Obstetrics and Gynecology and Reproductive Biology*. 2020;249:96-97. doi:10.1016/j.ejogrb.2020.04.022
18. Hassan R, Bhatia A, Zinke-Allmang A, et al. Navigating family planning access during Covid-19: A qualitative study of young women's access to information, support and health services in peri-urban Nairobi. *SSM - Qualitative Research in Health*. 2022;2:100031. doi:10.1016/j.ssmqr.2021.100031
19. Shikuku DN, Nyaoke IK, Nyaga LN and Ameh CA. Early indirect impact of COVID-19 pandemic on utilisation and outcomes of reproductive, maternal, newborn, child and adolescent health services in Kenya: A cross-sectional study. *Afr J Reprod Health*. 2021;25(6):76. doi:10.29063/ajrh2021/v25i6.9
20. Ministry of Health. Kenya COVID-19 RMNH Guidelines. Published online 2020. Accessed March 10, 2022. https://www.health.go.ke/wp-content/uploads/2020/04/KENYA-COVID19-RMNH.pdf.pdf.pdf
21. Plotkin MK, Williams KM, Mbinda A, et al. Keeping essential reproductive, maternal and child health services available during COVID-19 in Kenya, Mozambique, Uganda and Zimbabwe: analysis of early-pandemic policy guidelines. *BMC Public Health*. 2022;22(1):577. doi:10.1186/s12889-022-12851-4
22. Kiambu C: *County Health Sector Annual Performance Review Report*.; 2018.
23. World Health Organization. *Case Study from Kenya PRIMARY HEALTH CARE SYSTEMS (PRIMASYS)*

Abridged Version.; 2017. Accessed March 10, 2022. http://apps.who.int/bookorders.

24. Aranda Z, Binde T, Tashman K, et al. Disruptions in maternal health service use during the COVID-19 pandemic in 2020: Experiences from 37 health facilities in low-income and middle-income countries. *BMJ Glob Health*. 2022;7(1). doi:10.1136/bmjgh-2021-007247
25. Meaney S, Leitao S, Olander EK, Pope J and Matvienko-Sikar K. The impact of COVID-19 on pregnant womens' experiences and perceptions of antenatal maternity care, social support, and stress-reduction strategies. *Women and Birth*. 2022;35(3):307-316. doi:10.1016/J.WOMBI.2021.04.013
26. PATH. RMNCAH-N Services During COVID-19: A spotlight on Kenya's policy responses to maintain and adapt essential health services. *2021*. Accessed May 19, 2022. https://path.azureedge.net/media/documents/Kenya_RMNCH_Deep_Dive_brief.pdf
27. Chmielewska B, Barratt I, Townsend R, et al. Effects of the COVID-19 pandemic on maternal and perinatal outcomes: a systematic review and meta-analysis. *Lancet Glob Health*. 2021;9(6):e759-e772. doi:10.1016/S2214-109X(21)00079-6
28. Oluoch-Aridi J, Chelagat T, Nyikuri MM, et al. COVID-19 Effect on Access to Maternal Health Services in Kenya. *Front Glob Womens Health*. 2020;1:19. doi:10.3389/FGWH.2020.599267/BIBTEX
29. Bikwa Y, Murewanhema G, Kanyangarara M, Madziyire MG and Chirenje ZM. Impact of COVID-19 on maternal and perinatal outcomes in Harare, Zimbabwe: a comparative maternal audit. *J Glob Health Rep*. Published online November 24, 2021. doi:10.29392/001c.28995
30. Eleje GU, Ugwu EO, Enebe JT, et al. Cesarean section rate and outcomes during and before the first wave of COVID-19 pandemic. *SAGE Open Med*. 2022;10. doi:10.1177/20503121221085453
31. Abdela SG, Berhanu AB, Ferede LM and van Griensven J. Essential healthcare services in the face of COVID-19 prevention: Experiences from a referral hospital in Ethiopia. *American Journal of Tropical Medicine and Hygiene*. 2020;103(3):1198-1200. doi:10.4269/ajtmh.20-0464
32. Leight J, Hensly C, Chissano M and Ali L. Short-term effects of the COVID-19 state of emergency on contraceptive access and utilization in Mozambique. *PLoS One*. 2021;16(3 March). doi:10.1371/journal.pone.0249195
33. Keesara SR, Juma PA and Harper CC. Why do women choose private over public facilities for family planning services? A qualitative study of post-partum women in an informal urban settlement in Kenya. *BMC Health Serv Res*. 2015;15(1). doi:10.1186/S12913-015-0997-
34. Kasim J, Kalu A, Kamara B and Alema HB. Cervical Cancer Screening Service Utilization and Associated Factors among Women in the Shabadino District, Southern Ethiopia. *J Cancer Epidemiol*. 2020;2020. doi:10.1155/2020/6398394.