THE IMPACT OF THE COVID-19 PANDEMIC

on essential reproductive, maternal, newborn, and child health services in East and Southern Africa: Analysis of routine data from public health delivery systems

Partner:

Acknowledgements

This study assessed the direct and indirect impact of COVID-19 on health services and outcomes using Health Management Information Systems (HMIS) data from 22 countries across East and Southern Africa (ESA) and its mitigation measures on sexual, reproductive, maternal, and neonatal public health service utilization and outcomes.

This study was conducted under the leadership of Regional Directors for the World Health Organization (WHO), the United Nations Population Fund (UNFPA), the United Nations Children's Fund (UNICEF), and the Joint United Nations Programme on HIV/AIDS (UNAIDS) under the banner of the 2gether 4 SRHR Programme, the Joint United Nations Regional Programme that aims to improve the sexual and reproductive health and rights (SRHR) of all people in ESA. The study was conducted by Dr. Clara Calvert, Chancellor's Fellow, Centre for Global Health, Usher Institute, University of Edinburgh.

This study would not have been possible without the collaboration of the Ministries of Health and national Technical Working Groups for the 23 countries in ESA that provided data at key intervals to track the impact of the COVID-19 pandemic on sexual, reproductive, maternal, neonatal, and child health. Technical support was provided by the Regional Technical Advisory Group comprising of: Dr. Ayotunde Adegboyega, Medical Officer, RMNH Programme, WHO/IST/ESA; Jenny Cresswell; Dr. Teshome Desta Woldehanna, Medical Officer - RMNCAH & Healthy Ageing MCATs- Kenya; Dr. Hayfa Elamin, Technical Officer, RMH/SRH, UHC and Life Course Cluster, ESA, WHO AFRO; Dr. Leopold Ouedraogo, Regional Adviser: RMH/SRH, UHC and Life Course Cluster, WHO AFRO; Jyoti Tewari, Health Systems Adviser, UNFPA East and Southern Africa Regional Office (ESARO); Muna Abdullah, Health System Specialist, UNFPA ESARO ; Angela Baschieri, Population Dynamics Policy Adviser, UNFPA ESARO; Anna-Klara Berglund, Programme Coordinator: 2gether 4 SRHR; Richard Delate, Programme Manager: 2gether 4 SRHR; Dr. Ider Dungerdorj, Senior Health/HIV Specialist, UNICEF ESARO; Laurie Gulaid, Regional HIV/AIDS Adviser, UNICEF ESARO; Dr. Narmada Dhakal, Regional Programme Adviser, UNAIDS Regional Support Team, East and Southern Africa (UNAIDS RST-ESA); and Dr. Muhammad Saleem, Senior Programme Officer, UNAIDS RST-ESA.

Additional inputs were provided by Daisy Diamante Leoncio, Regional Communications Adviser and Lindsay Barnes, Media Specialist, while Sara Chitambo-Hatira contributed to UNFPA publication compliance, and Pumla Golimpi and Miriam Mphuthi provided administrative support.

The publication was professionally proofread by Dr. Josianne Roma-Reardon and designed by REC DESIGN.

This publication was made possible with the generous financial support of the Swedish International Development Cooperation Agency (SIDA) through the Regional SRHR Team of Sweden.

Authors: The impact of the COVID-19 Pandemic on essential reproductive, maternal, neonatal and child health services in East and Southern Africa: Analysis of Routine Data from Public Health Service Delivery Systems. University of Edinburgh & WHO, UNFPA, UNICEF, UNAIDS. Calvert C, Adegboyega AA, Baschieri A, Berglund A, Cresswell J, Delate R, Dhakal N, Dungerdorj I, Elamin H, Gohar F, Gulaid L, Muna A, Onyiah PA, Ouedraogo L, Saleem M, Tewari J and Woldehanna TD.

Contents

Acronyms

ANC	Antenatal care
CI	Confidence interval
DRC	Democratic Republic of the Congo
ESA	East and Southern Africa
HIV	Human immunodeficiency virus
HMIS	Health Management Information Systems
iMMR	Institutional Maternal Mortality Ratio
LBW	Low birth weight
MMR	Maternal Mortality Ratio
MTCT	Mother-to-child transmission
NMR	Neonatal mortality rate
RMNCH	Reproductive, maternal, newborn, and child health
RR	Rate ratio
SBR	Stillbirth rate
SDGs	Sustainable Development Goals
SRHR	Sexual and reproductive health and rights
SSA	Sub-Saharan Africa
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
WHO	World Health Organization


PLASCON
Luxury

Summary

Background: There are concerns that the COVID-19 pandemic may have disrupted global progress made pre-pandemic towards achieving the sexual and reproductive health and rights (SRHR) related-targets of the Sustainable Development Goals (SDGs) and the Global Strategy for Women's, Children's and Adolescents' Health (2016-2030). There has, however, been limited empirical data published from East and Southern Africa (ESA) on the direct and indirect impact of COVID-19 on utilization of SRHR services and health outcomes.

Methods: A secondary data analysis was conducted utilizing Health Management Information Systems (HMIS) statistics from 14 countries in ESA to assess the impact of COVID-19 on essential reproductive, maternal, newborn, and child health (RMNCH) services as captured using 22 indicators. HMIS are intended to capture utilization of health services from government/public health delivery systems. After interrogating the quality of the data, a negative binomial model was used to assess whether there was any evidence for a change for each indicator for each country in the COVID-19 period by comparing the mean monthly numbers reported in May-July 2020 (early stage of the COVID-19 pandemic in the ESA region), and May-July 2021 (nearly a year after the outbreak of the COVID-19 pandemic in the ESA region) to those in May-July 2019 (pre-COVID-19). For a sub-set of countries with data covering the full study period (January 2019-August 2021), interrupted time series analyses using segmented negative binomial regression models were conducted.

Results: There were between-country differences in the impact of the COVID-19 pandemic period on utilization of RMNCH services from the public health delivery systems based on most HMIS indicators. Although some common patterns were noted, public health delivery systems of no country appeared to be unaffected by the pandemic. There was a tendency of reduced general health-care utilization from public sector health facilities with COVID-19. Utilization of RMNCH services and outcomes varied between different countries, with some showing no negative impacts of the pandemic and others showing deterioration in the COVID-19 period.

Discussion: This report presents one of the largest analyses of the impact of the COVID-19 pandemic and its associated mitigation measures in ESA, and indicates that utilization of RMNCH services from the public sector in all included countries were impacted by the pandemic, but not in a uniform way. To ensure adequate responses of public health systems in ESA in providing continuity of RMNCH services and other essential health services for both the ongoing COVID-19 pandemic, as well as any future pandemics, requires comprehensive access to timely data to track any impacts and monitor any improvements with interventions.

Background

The emergency response to the COVID-19 pandemic overwhelmed many countries' health systems. When health systems are overwhelmed and people fail to access needed care, both direct mortality from an outbreak and indirect mortality from preventable and treatable conditions increase dramatically (Brolin et al., 2016; Elston et al., 2017; Parpia et al., 2016). Early modelled estimates suggested that there could be a substantial impact of COVID-19 and its mitigation measures on maternal, newborn and child health (Hogan et al., 2020; Robertson et al., 2020). Robertson and colleagues, for example, predicted that there could be an additional 253,500 child deaths and 12,200 maternal deaths over a six-month period under the scenario of a reduction in service coverage of between 9.8 and 18.5 per cent due to the COVID-19 pandemic in low- and middle-income settings (Robertson et al., 2020).

Determined to forestall the excess mortality, morbidity and disability from indirect impact of the pandemic, most countries have made stringent efforts to maintain provision and uptake of essential health services whilst responding to COVID-19. Despite this, there is an emerging body of empirical evidence documenting a decline in health service utilization with the COVID-19 pandemic. Studies from India, the United Kingdom and Uganda, for example, have documented a decline in the utilization of antenatal care (ANC) or obstetric services (Khalil et al., 2021; Kumari et al., 2020; Burt et al., 2021; Townsend et al., 2021). However, this pattern is not universal across all health services and settings; a study conducted in rural KwaZulu-Natal in South Africa, for example, found no evidence of a change in HIV care visits among adults, although it did find a 50 per cent reduction in child health-care visits at the beginning of the strictest lockdown period (Siedner et al., 2020). There are fewer studies published looking at whether there were changes in the quality of health-care provision during the pandemic, but several surveys of frontline health-care providers have suggested that there was a detrimental impact on maternal and neonatal services (Semaan et al., 2020; Rao et al., 2021).

There have been limited empirical data published from ESA on the direct and indirect impact of COVID-19 on health outcomes, despite the implementation of a range of stringent mitigation measures (i.e. "lockdowns") early in the pandemic across many countries in the region (e.g. restriction of movement between cities or subnational administrative units, workplace and school closures and stay at home or shelter in place requirements) (Salyer et al., 2021). A systematic review published in March 2021 examining the effects of COVID-19 on maternal and perinatal outcomes (Chmielewska et al., 2021) only identified a single study from sub-Saharan Africa (SSA) (Caniglia et al., 2020). This study was conducted in Botswana using facility-based data, and found a modest decrease in adverse perinatal outcomes in the period since the lockdown was implemented for COVID-19, compared with the period before lockdown (Caniglia et al., 2020). Studies based on data from national HMIS in both South Africa and Kenya show mixed impacts of COVID-19 and its mitigation measures on health service utilization and health outcomes (Shikuku et al., 2021; Pattinson et al., 2021). In Kenya, there was no difference observed in attendance for ANC, hospital delivery and family planning between the pre- and COVID-19 periods, but there was evidence of an increase in fresh stillbirths, and an increasing trend in maternal mortality was noted, but the change was not statistically significant (Shikuku et al., 2021). Similarly, in South Africa, there was no evidence of a decline in facility deliveries, but an increase in maternal mortality, a reduction in women attending ANC before 20 weeks and a reduction in contraception prescriptions (Pattinson et al., 2021).

Considering the paucity of data from ESA on the direct and indirect impact of COVID-19 on health services and outcomes, HMIS data were used from 22 countries[1] across ESA to assess the impact of the COVID-19 pandemic and its mitigation measures on sexual, reproductive, maternal, neonatal and child public health service utilization and outcomes.

1 Angola, Botswana, Burundi, Comoros, Democratic Republic of Congo (DRC), Ethiopia, Eritrea, Eswatini, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, South Sudan, Uganda, United Republic of Tanzania, Zambia, and Zimbabwe

Methods

DATA SOURCES

This report presents a secondary data analysis of aggregated data from the HMIS from 22 countries across ESA that have been collated by the World Health Organization (WHO), the United Nations Population Fund (UNFPA) and the United Nations Children's Fund (UNICEF). HMIS are designed to record public health facility data and are used to track health-care coverage and support the planning of health-care services. For this report, national-level monthly data for January 2019 to July 2021 were reported to WHO, UNFPA and UNICEF by the respective Ministries of Health. Data were reported during three data collection phases during different stages of the COVID-19 outbreak: phase 1 covered May-July 2019 (pre-COVID-19) and May-July 2020 (early stage of the COVID-19 outbreak); phase 2 covered August-December 2019 (pre-COVID-19) and August-December 2020 (during the COVID-19 outbreak); and phase 3 covered January-April 2019 (pre-COVID-19), January-April 2020 and January-August 2021 (nearly one year after the COVID-19 outbreak). The 22 countries which reported data during at least one of these data collection phases were: Angola, Botswana, Burundi, Comoros, Democratic Republic of Congo (DRC), Ethiopia, Eritrea, Eswatini, Kenya, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, South Sudan, Uganda, United Republic of Tanzania, Zambia, and Zimbabwe.

Countries reported up to 40 indicators in total, depending on data availability in their HMIS, of which 22 were grouped into eight domains for this report. These indicators are shown in Table 1. One additional indicator - *"percentage of health facilities reporting in HMIS"* - was used for data quality checks, as described in the data preparation section.

Table 1 | Indicators from Health Management Information Systems available for this study

Domain	Indicator
General health utilization	• Number of outpatient visits • Number of inpatient visits • Number of outpatient attendances/consultations for children <5 years for any cause
Family planning	• Number of clients who accept oral contraceptives at the facility and community • Number of clients who accept injectable contraceptives at the facility and community

Domain	Indicator
Abortion	• Number of women presenting to facility with abortion related complications
Access to maternal and neonatal care	• Number of ANC 4 visits/contacts provided by any trained provider • Number of pregnant women attending antenatal clinics who were tested for HIV • Number of pregnant women living with HIV who received antiretroviral medicines to reduce the risk of mother-to-child-transmission (MTCT) • Number of HIV exposed infants who receive a virological test for HIV within two months of birth • Number of caesarean sections (c-sections)
Number of births	• Number of facility births • Number of home births • Number of live births in facilities
Maternal outcomes	• Number of maternal deaths
Neonatal outcomes	• Number of stillbirths • Number of live births that weigh less than 2500g • Number of newborn deaths (up to 28 days postpartum)
Child health	• Number of deaths to children (Under 5 years) • Number of pneumonia cases (Under 5 years) • Number of diarrhoea cases (Under 5 years) • Number of malaria cases (Under 5 years)

It was initially planned to also include indicators around the number of cases of violence against women and children, the number of health facilities reporting stock-outs for RMNCH essential commodities and drugs and the number of children aged 6-59 months admitted for severe acute malnutrition, but too few countries collated data for these indicators.

DATA QUALITY ASSESSMENT AND PREPARATION

Firstly, the quality of the data from each country were examined. This included: (1) examining the extent of missing data for each country; (2) exploring the percentage of health facilities that were included in the HMIS data for each country and assessing whether this has changed over time; and (3) exploring whether there were outliers for any of the indicators.

Countries were only included in the analysis if:

1. They provided data for at least May-July 2019 and May-July 2020.
2. At least 80 per cent of public health facilities reported to HMIS for all months included in the analysis.

For each country included, the monthly reported numbers for each indicator were examined, and any indicators were excluded from the analysis if there were <20 cases reported on average across months May to July in at least one of the years in which data were provided for. Where outliers were identified for any indicators, the country teams who extracted data from the HMIS were approached to check these; where a response was not received, it was assumed that the provided data was correct. Graphs were created to visually examine if there were substantial changes in the indicators between the data collection periods and excluded any indicators for a particular country where large differences were observed as these were most likely to arise from data entry errors (as each data collection phase spanned multiple years).

Where data were available for a given country, the risk of four health outcome measures were calculated using the HMIS data for each month as follows:

- Institutional Maternal Mortality Ratio (iMMR): number of maternal deaths/number of live births x 100,000.
- Stillbirth rate (SBR): number of stillbirths/number of births (where number of births = live births + stillbirths) x 1000.
- Neonatal mortality rate (NMR): number of newborn deaths/number of live births x 1000.
- Percentage of births that were low birth weight: number of live births that weigh less than 2500g/total number of live births x 100.

It is important to note that these measures cannot be considered population-level (as events occurring in the community and facilities outside the public health sector will not be captured).

STATISTICAL ANALYSIS

All analyses were conducted in Stata 15.0, an integrated statistical software package used for data analysis.

Descriptive graphs were produced showing month numbers reported for each indicator for each country over time. There were two different approaches taken to the analysis depending on data availability, as described in more detail below.

1. Pre-post comparison in mean monthly numbers

To assess whether there was any evidence for a change in the mean monthly numbers for each indicator for each country with COVID-19, a negative binomial model was used to compare the mean monthly numbers reported in May-July 2020, and May-July 2021 to those in May-July 2019. A summary of results is presented for countries, categorizing for a given indicator as: seeing an increase for either May-July 2020 or May-July 2021 if there was a relative change greater than 1 and a p-value<0.05; seeing a decrease for either May-July 2020 or May-July 2021 if there was a relative change less than 1 and a p-value<0.05; or no change if there was no evidence for a change based on a p-value≥0.05.

2. Interrupted time series analysis

For a sub-set of countries with data covering the full study period (January 2019-August 2021), interrupted time series analyses were conducted using segmented regression models (Wagner et al., 2002; Bernal et al., 2017). A segmented negative binomial model was used to examine if there was any evidence for a change in the level and trend for each indicator before and after COVID-19. A similar approach was taken when looking at whether there was any evidence for a change in the risk of health outcomes (i.e. the iMMR, the SBR, the NMR and the percentage of babies that were low birthweight), with the population at risk in each month included as an offset variable to convert the outcome into a ratio/proportion. For all countries, April 2020 was considered as the first month of the COVID-19 period, based on a combination of the first reports of COVID-19 cases and the introduction of pandemic related restrictions (as inferred from the Oxford COVID-19 Government Response Stringency index) (Hale et al., 2021) (further details provided in Supplementary Table 1 in Appendix 1).

ETHICAL APPROVAL

This report only used aggregate level data available as part of routine data collection. Ethical approval was granted for this study by the Edinburgh Medical School Research Ethics Committee (reference: 21-EMREC-049).


ONETOUCH

Results

STUDY POPULATIONS

Of the 22 ESA countries that reported data, four (Botswana, Eritrea, Kenya, and Malawi) were excluded as they did not provide data for May-July 2019 and May-July 2020, two (Burundi and Seychelles) were excluded as they did not provide information on the indicator *"percentage of health facilities reporting in HMIS"* and two (Angola and South Sudan) were excluded due to having low levels of facilities reporting to HMIS. Fourteen countries were therefore included in this report, as follows: Comoros, Democratic Republic of the Congo (DRC), Eswatini, Ethiopia, Lesotho, Madagascar, Mauritius, Mozambique, Namibia, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe. The availability of each indicator for each country is provided in Supplementary Table 2 (Appendix 2).

COUNTRIES INCLUDED IN THIS HMIS DATA REPORT

Some indicators for specific countries were excluded due to dramatic changes in numbers reported over the different data collection phases. These are highlighted in yellow in Supplementary Table 2. Data were only available in 2020 and not 2021 for the DRC, Eswatini, Ethiopia, Madagascar, and Tanzania. Outliers were noted for several countries as reported in Supplementary Table 3 (Appendix 2).

Four of the countries (Namibia, South Africa, Zambia, and Zimbabwe) reported data for the full study period (January 2019 to August 2021) for most indicators and were therefore included in the interrupted time series analyses.

ASSOCIATION BETWEEN COVID-19 PANDEMIC AND HEALTH-CARE UTILIZATION

Analysis one: pre-post comparison in mean monthly numbers

Table 2 provides an overview of the number of ESA countries in which there was no evidence for change, or an increase or a decrease in health-care utilization in May-July 2020 and May-July 2021 compared with May-July 2019, with detailed country-level results provided in Supplementary Table 4, Supplementary Table 5 and Supplementary Table 6 (Appendix 3).

Eleven countries provided data to assess whether there was a change in the mean number of **outpatient visits** in May-July 2020 compared to May-July 2019, of which five also provided data for this indicator for May-July 2021. There was evidence for a decrease in the mean number of outpatient visits in 2020 compared to 2019 in over half of these countries (n=6). Two out of five countries still had lower number of visits in 2021 when compared with 2019. Of the 11 countries which provided data on the mean number of **outpatient visits for children<5 years**, there was evidence of decreased numbers in 2020 compared with 2019 in eight (72.7 per cent). This percentage was very similar among the seven countries which also provided data for 2021 (71.4 per cent, n=5).

There was evidence for a decrease in the mean number of **inpatient visits** for the majority of the ten countries which provided data for this indicator in 2020 compared to 2019 (70.0 per cent, n=7). Of the seven countries that also provided data for 2021, four (57.1 per cent) still had lower numbers of inpatient visits when compared with 2019.

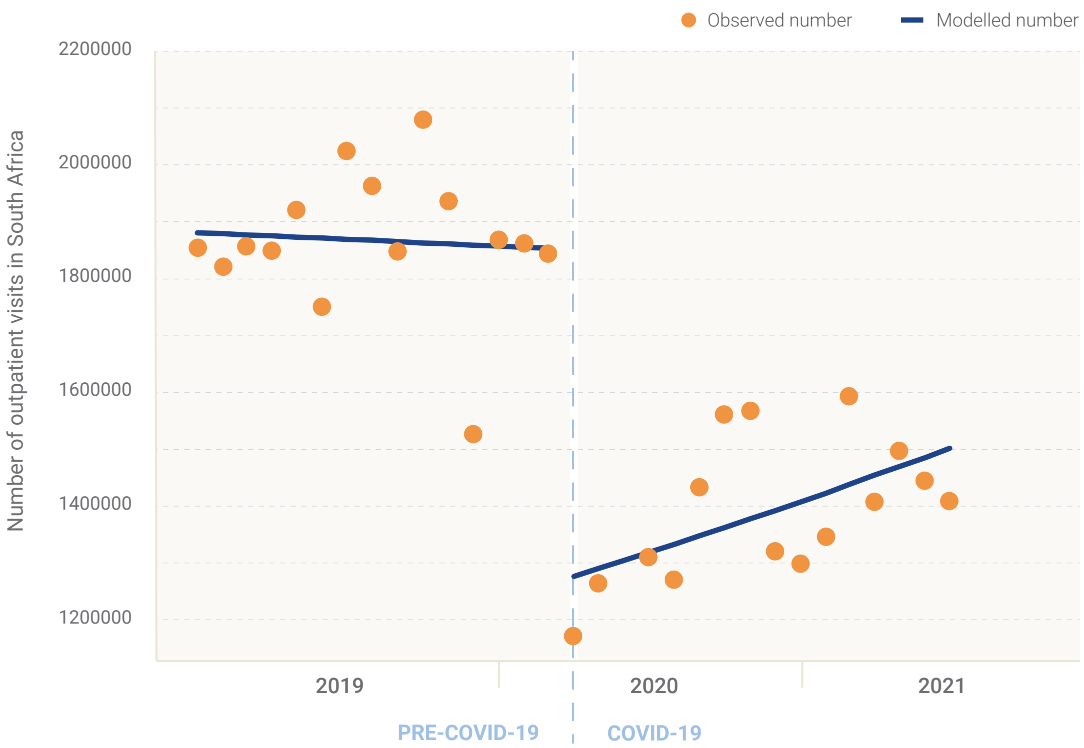
Table 2 | **Number and percentage of East and Southern African countries by whether any change was observed in health-care utilization indicators in May-July 2020 and May-July 2021, compared to May-July 2019**

	Mean monthly number of outpatient visits		Mean monthly number of outpatient visits for children <5 years		Mean monthly number of inpatient visits	
	2020 vs 2019 n=11	2021 vs 2019 n=5	2020 vs 2019 n=11	2021 vs 2019 n=7	2020 vs 2019 n=10	2021 vs 2019 n=7
No Change	4 (36.4%)	3 (60.0%)	2 (18.2%)	2 (28.6%)	3 (30.0%)	3 (42.9%)
Increase	1 (9.1%)	0 (0%)	1 (9.1%)	0 (0%)	0 (0%)	0 (0%)
Decrease	6 (54.5%)	2 (40.0%)	8 (72.7%)	5 (71.4%)	7 (70.0%)	4 (57.1%)

Analysis two: interrupted time series

Only South Africa provided data for all time points for the mean number of **outpatient visits**, and in the interrupted time series analysis, there was a relative reduction in the number of outpatients visits of 32 per cent with the start of COVID-19 and its mitigation measures (95 per cent confidence interval [CI]: 0.62-0.75, p<0.001) (Figure 1).

Figure 1 | **Interrupted time series of monthly number of outpatient visits in South Africa**



As shown in Figure 2, there was a relative reduction of 16 per cent in the number of **inpatient visits** in Namibia with COVID-19 (95 per cent CI=0.75-0.94, p=0.002), 31 per cent in Zambia (95 per cent CI=0.50-0.97, p=0.03) and 27 per cent in Zimbabwe (95 per cent CI=0.60-0.88, p=<0.001). No data were available on this indicator from South Africa.

For the number of **outpatient visits for children less than 5 years**, there was a 32 per cent relative decline in South Africa with COVID-19 (95 per cent CI=0.62-0.74, p<0.001), a 28 per cent decline in Namibia (95 per cent CI=0.54-0.95, p=0.02) and a 20 per cent decline in Zambia (95 per cent CI=0.70-0.93, p=0.003) (Figure 3). There was no evidence for a change with COVID-19 in Zimbabwe (rate ratio [RR]= 0.60, 95 per cent CI=0.19-1.92, p=0.39).

Figure 2 | Interrupted time series of monthly number of inpatient visits in Namibia, Zambia and Zimbabwe

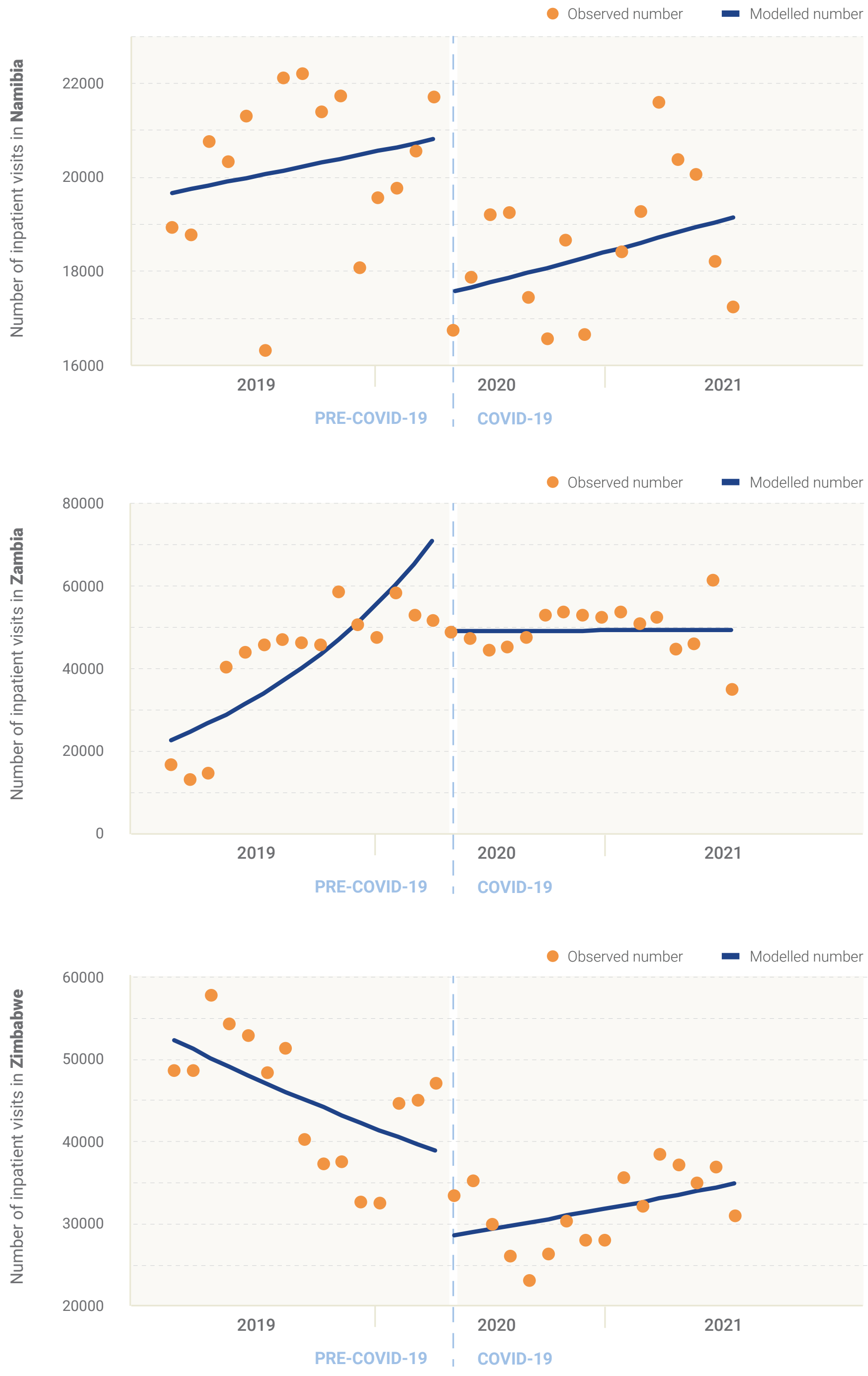
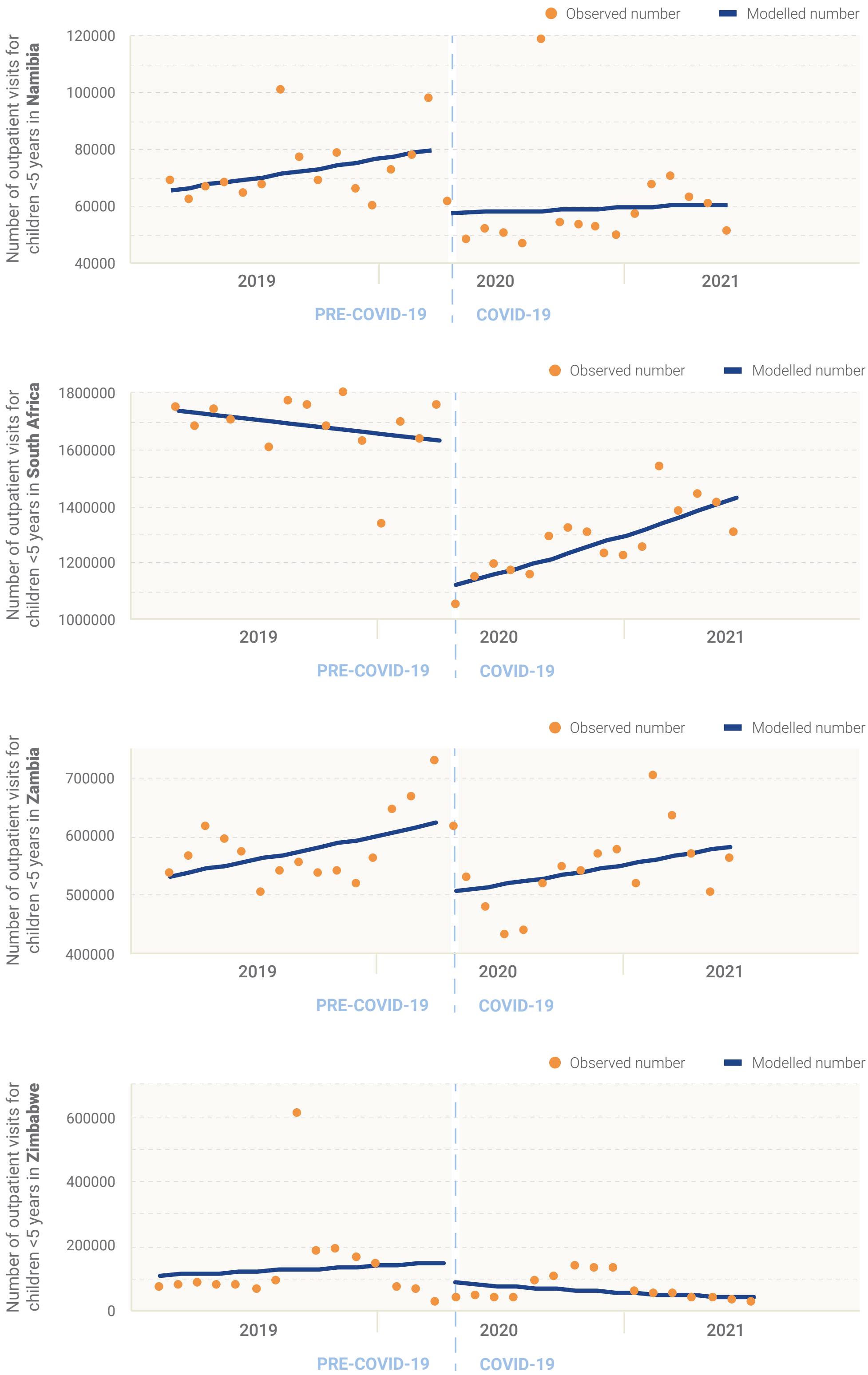


Figure 3 | **Interrupted time series of monthly number of outpatient visits for children less than 5 years in Namibia, South Africa, Zambia, and Zimbabwe**



ASSOCIATION BETWEEN COVID-19 PANDEMIC AND FAMILY PLANNING

Analysis one: pre-post comparison in mean monthly numbers

Data for twelve countries were provided relating to the use of oral and injectable contraceptives. Of the twelve countries, eleven provided data relating to the mean monthly number of clients who accept oral contraceptives and all twelve provided data on the mean number of clients who accept injectable contraceptives.

Detailed country-level results are provided in Supplementary Table 7 and Supplementary Table 8 (Appendix 4), with a summary provided in Table 3. Of the eleven countries with data on oral contraceptives for the period 2020 vs 2019, declines in the mean number of clients who accept **oral contraceptives** were observed in 45.5 per cent (n=5) (Table 3). Declines in the mean number of clients who accept **injectable contraceptives** were observed in just under 60 per cent of the countries reporting.

Of the seven countries who provided data on oral contraceptives for the period 2021 vs 2019, declines in the mean number of clients who accept **oral contraceptives** were observed in 57.1 per cent (n=4). Declines in the mean number of clients who accept **injectable contraceptives** were observed in 25 per cent of the countries reporting (n=2).

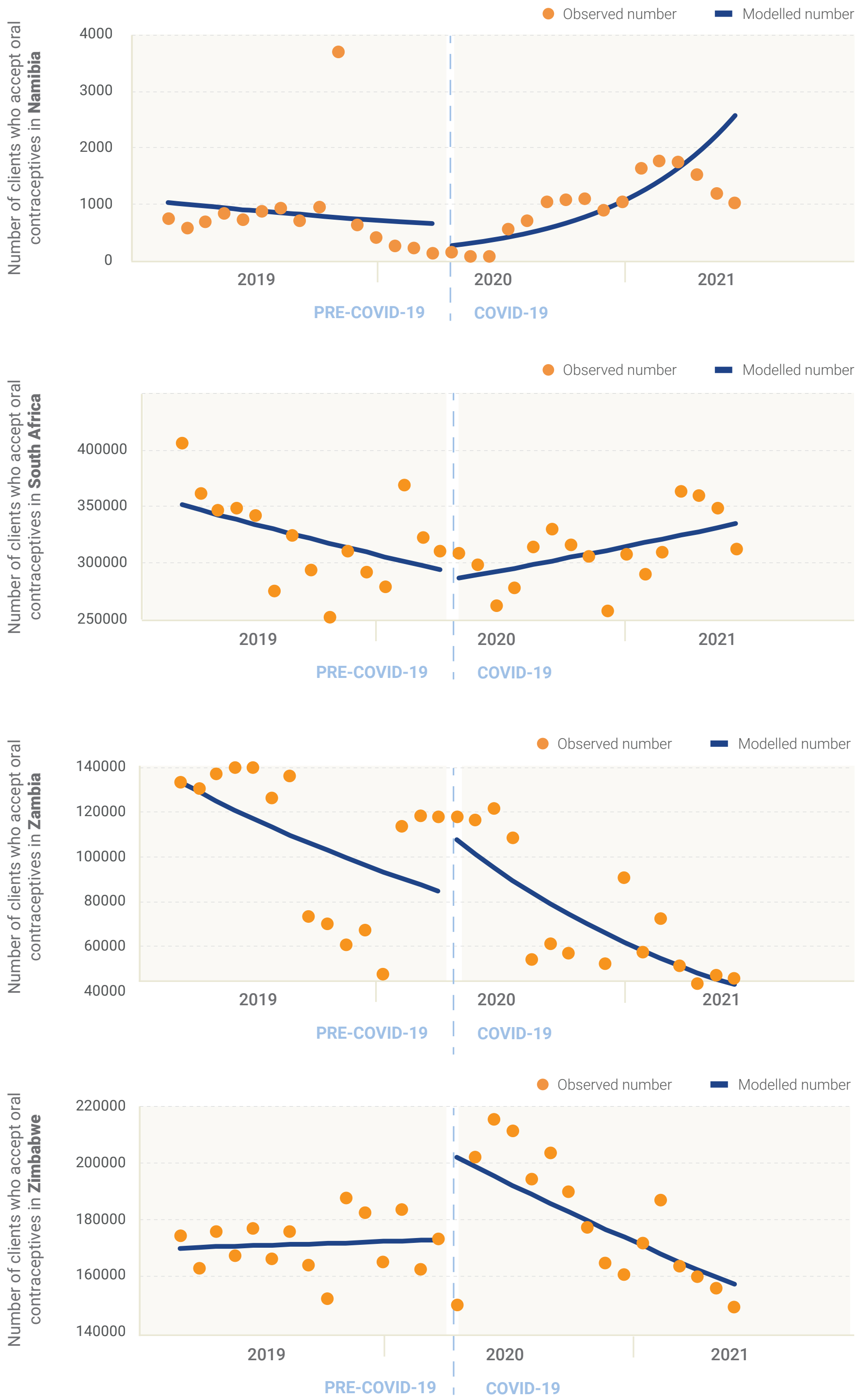
Table 3 | **Number and percentage of East and Southern African countries by whether any change was observed in family planning indicators in May-July 2020 and May-July 2021, compared to May-July 2019**

	Mean monthly number of clients who accept oral contraceptives		Mean monthly number of clients who accept injectable contraceptives	
	2020 vs 2019 n=11	2021 vs 2019 n=7	2020 vs 2019 n=12	2021 vs 2019 n=8
No Change	3 (27.3%)	2 (28.6%)	2 (16.7%)	4 (50.0%)
Increase	3 (27.3%)	1 (14.3%)	3 (25.0%)	2 (25.0%)
Decrease	5 (45.5%)	4 (57.1%)	7 (58.3%)	2 (25.0%)

Analysis two: interrupted time series

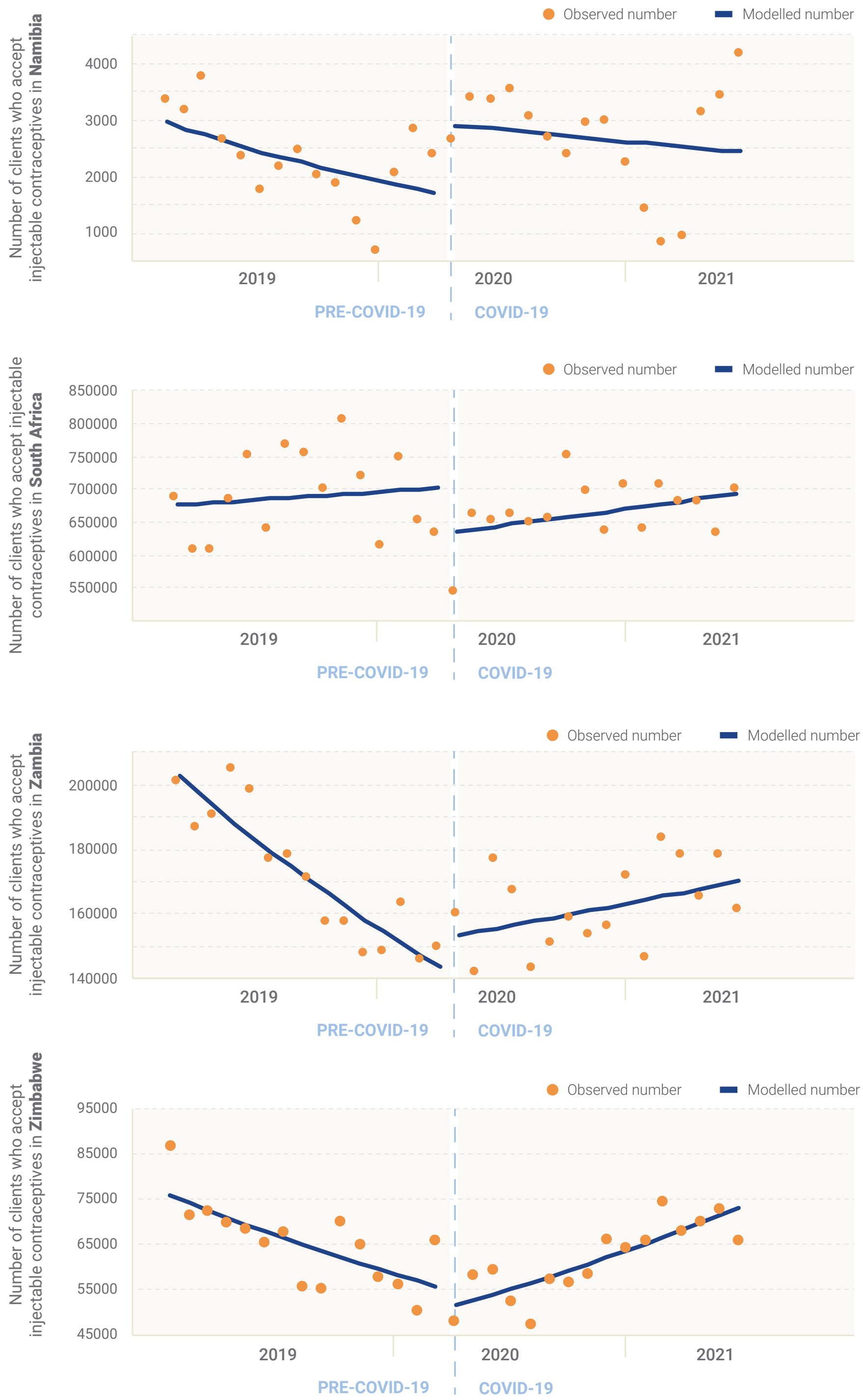
As shown in Figure 4, there was no evidence in interrupted time series analyses for a drop in the number of clients accepting **oral contraceptives** with COVID-19 in Namibia (RR=0.36, 95 per cent CI=0.12-1.06, p=0.06), South Africa (RR=0.96, 95 per cent CI=0.84-1.10, p=0.58) or Zambia (RR=1.35, 95 per cent CI=0.93-1.97, p=0.12). There was, however, a 19 per cent increase in Zimbabwe (95 per cent CI=1.07-1.33, p=0.002).

Figure 4 | **Interrupted time series of monthly number of clients who accept oral contraceptives in Namibia, South Africa, Zambia, and Zimbabwe**



There was evidence for a 72 per cent relative increase in the number of clients accepting **injectable contraceptives** at the start of the COVID-19 pandemic in Namibia (95 per cent CI=1.04-2.84, p=0.03). There was no evidence for change in South Africa (RR=0.90, 95 per cent CI=0.81-1.01, p=0.06), Zambia (RR=1.06, 95 per cent CI=0.97-1.16, p=0.18) or Zimbabwe (RR=0.90, 95 per cent CI=0.80-1.01, p=0.08) (Figure 5).

Figure 5 | **Interrupted time series of monthly number of clients who accept injectable contraceptives in Namibia, South Africa, Zambia, and Zimbabwe**



ASSOCIATION BETWEEN COVID-19 PANDEMIC AND ABORTION-RELATED COMPLICATIONS

Analysis one: pre-post comparison in mean monthly numbers

There were ten countries reporting data on the mean number of **women presenting to facilities with abortion-related complications** (Table 4, with more detailed results provided in Supplementary Table 9 – Appendix 5), all of which provided data to look at differences between 2020 and 2019, and six of which also provide data for comparison between 2021 and 2019. Increases in the number of abortion-related complications were documented in 25 per cent of countries reporting (n=2), with most countries showing no evidence for a change (n=6). Three out of the six countries with data for 2021 showed evidence for an increase in the number of women presenting with abortion-related complications in 2021 compared with 2019. There were two countries (Mozambique and Zambia) where there was no evidence for a change in 2020, but an increase in numbers in 2021.

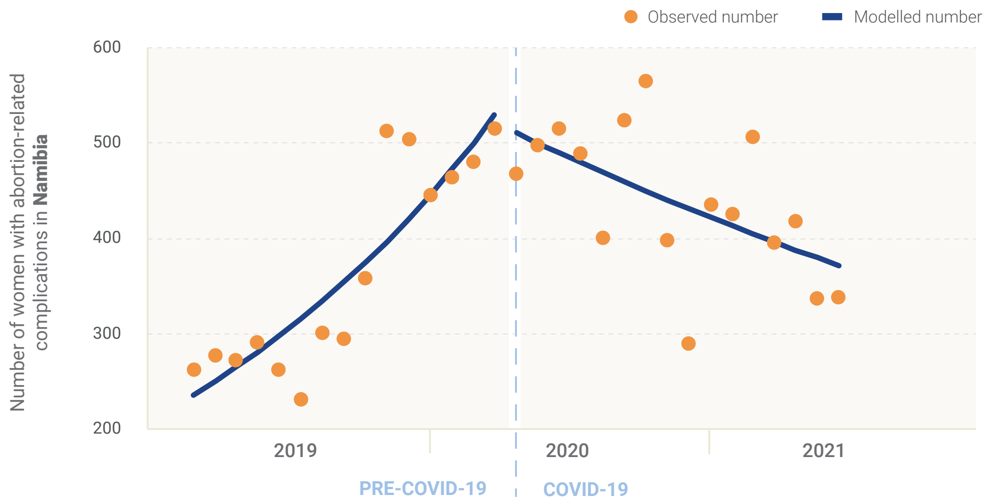
Table 4 | **Number and percentage of East and Southern African countries by whether any change was observed in the number of abortion-related complications reported to facilities in May-July 2020 and May-July 2021, compared to May-July 2019**

	Mean monthly number of women presenting to facilities with abortion-related complications	
	2020 vs 2019 n=10	**2021 vs 2019 n=6**
No Change	6 (60.0%)	1 (16.7%)
Increase	2 (20.0%)	3 (50.0%)
Decrease	2 (20.0%)	2 (33.3%)

Analysis two: interrupted time series

There were only data available on the number of women presenting with abortion-related complications for the full time series in Namibia, where there was no evidence that the numbers changed with the start of the COVID-19 pandemic (RR=0.99, 95 per cent CI=0.81-1.20, p=0.89). There was, however, a change from an increasing trend in numbers pre-COVID-19, which reversed to a declining trend in the COVID-19 period (Figure 6).

Figure 6 | **Interrupted time series of monthly number women presenting with abortion-related complications in Namibia**



ASSOCIATION BETWEEN COVID-19 PANDEMIC AND ACCESS TO MATERNAL AND NEONATAL HEALTH CARE

Analysis one: pre-post comparison in mean monthly numbers

As shown in Table 5, the majority of the twelve countries which provided data for a comparison between 2020 and 2019 for the mean monthly **number of fourth ANC visits/ contacts** in May-July showed no evidence for a change (7/12, 58.3 per cent). Three of the 12 countries (25 per cent) actually documented an increase in the number of visits in 2020 (country-level results in Supplementary Table 10 – Appendix 6), while 50 per cent of the six countries with data for 2021 vs 2019 showed an increase.

Fourteen countries reported data on the mean monthly **number of c-sections** (Table 5). Detailed country-level results on the change in the number of c-sections in May-July 2020 and May-July 2021 compared with May-July 2019 are provided in Supplementary Table 11 (Appendix 6). In brief, there was no evidence for a change in the number of c-sections in 2020 compared with 2019 in six countries (42.9 per cent), and evidence of an increase in six countries (42.9 per cent). For three of the countries with evidence of an increase in 2020 compared to 2019, there was also evidence of an increase in the number of facility births with COVID-19 (results in section: *"Association between COVID-19 pandemic and number of births"*) so this is likely to be attributable, at least in part, to the rising caseload within public health facilities in these countries and does not necessarily that women attending the facilities were more like to have a c-section in the pandemic period compared with pre-pandemic. Of the six countries with data for 2021, there was evidence of an increase in the number of c-sections compared with 2019 in two (33.3 per cent).

Table 5 | **Number and percentage of East and Southern African countries by whether any change was observed access to maternal health care in May-July 2020 and May-July 2021, compared to May-July 2019**

	Mean monthly number of fourth ANC visits/contacts		Mean monthly number of c-sections	
	2020 vs 2019 n=12	2021 vs 2019 n=6	2020 vs 2019 n=14	2021 vs 2019 n=6
No Change	7 (58.3%)	2 (33.3%)	6 (42.9%)	2 (33.3%)
Increase	3 (25.0%)	3 (50.0%)	6 (42.9%)	2 (33.3%)
Decrease	2 (16.7%)	1 (16.7%)	2 (14.3%)	2 (33.3%)

As shown in Table 6, there was no evidence for a change in the mean **number of pregnant women attending ANC who were tested for HIV** for the majority of countries with data available for 2020 versus 2019 (10/13; 76.9 per cent) and for those with data available for 2021 (6/7; 85.7 per cent) (country-level results in Supplementary Table 12 – Appendix 6). There was no evidence for a change in the number of **pregnant women living with HIV who received antiretroviral medicines to reduce the risk of mother-to-child-transmission** (**MTCT)** in 2020 compared with 2019 in any of the ten countries that provided data for this indicator. Two out of five countries with data for 2021, however, had evidence of a decrease in 2021 compared with 2019 (country-level results in Supplementary Table 13 – Appendix 6).

Fewer countries provided data on the mean **number of HIV exposed infants who received a virological test for HIV** within two months of birth (seven countries for 2020 vs 2019 and four countries for 2021 vs 2019) (Table 6, with full country-level details in Supplementary Table 14 – Appendix 6). The majority of countries (n=4, 57.1 per cent) showed no difference between 2020 and 2019, but two out of four countries showed a decrease in 2021 compared with 2019.

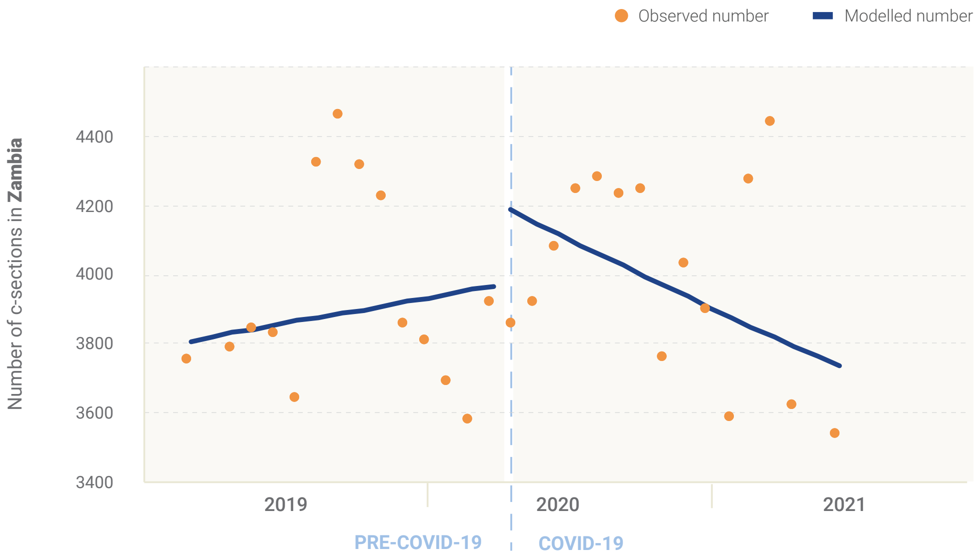
Table 6 | **Number and percentage of East and Southern African countries by whether any change was observed in access to maternal and neonatal HIV testing and treatment in May-July 2020 and May-July 2021, compared to May-July 2019**

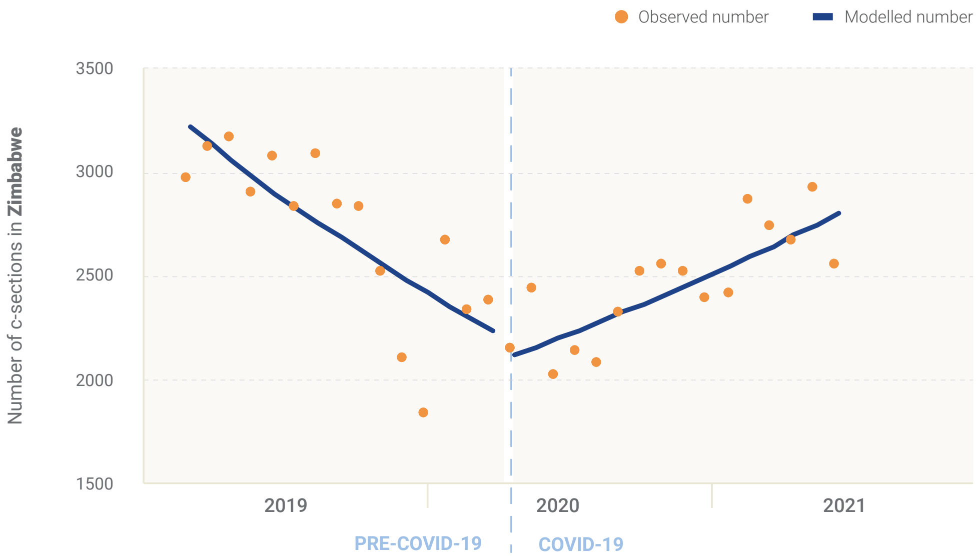
	Mean monthly number of pregnant women attending ANC who were tested for HIV		Mean monthly number of pregnant women living with HIV who received antiretroviral medicines to reduce the risk of MTCT		Mean monthly number of HIV exposed infants who received a virological test for HIV within two months of birth	
	2020 vs 2019 n=13	2021 vs 2019 n=7	2020 vs 2019 n=10	2021 vs 2019 n=5	2020 vs 2019 n=7	2021 vs 2019 n=4
No Change	10 (76.9%)	6 (85.7%)	10 (100%)	3 (60.0%)	4 (57.1%)	1 (25.0%)
Increase	1 (7.7%)	0 (0%)	0 (0%)	0 (0%)	1 (14.3%)	1 (25.0%)
Decrease	2 (15.4%)	1 (14.3%)	0 (0%)	2 (40.0%)	2 (28.6%)	2 (50.0%)

Analysis two: interrupted time series

Data were only available to conduct interrupted time series analysis on the number of c-sections in Zambia and Zimbabwe. As shown in Figure 7, there was no evidence for a change in numbers of c-section at the start of the COVID-19 pandemic in Zambia (RR=1.06, 95 per cent CI=0.96-1.18, p=0.27) or Zimbabwe (RR=0.93, 95 per cent CI=0.83-1.05, p=0.23) in the interrupted time series. However, there did appear to be a reversal of previous trends in the COVID-19 period compared with pre-COVID-19.

Figure 7 | **Interrupted time series of monthly number of c-sections in Zambia and Zimbabwe**



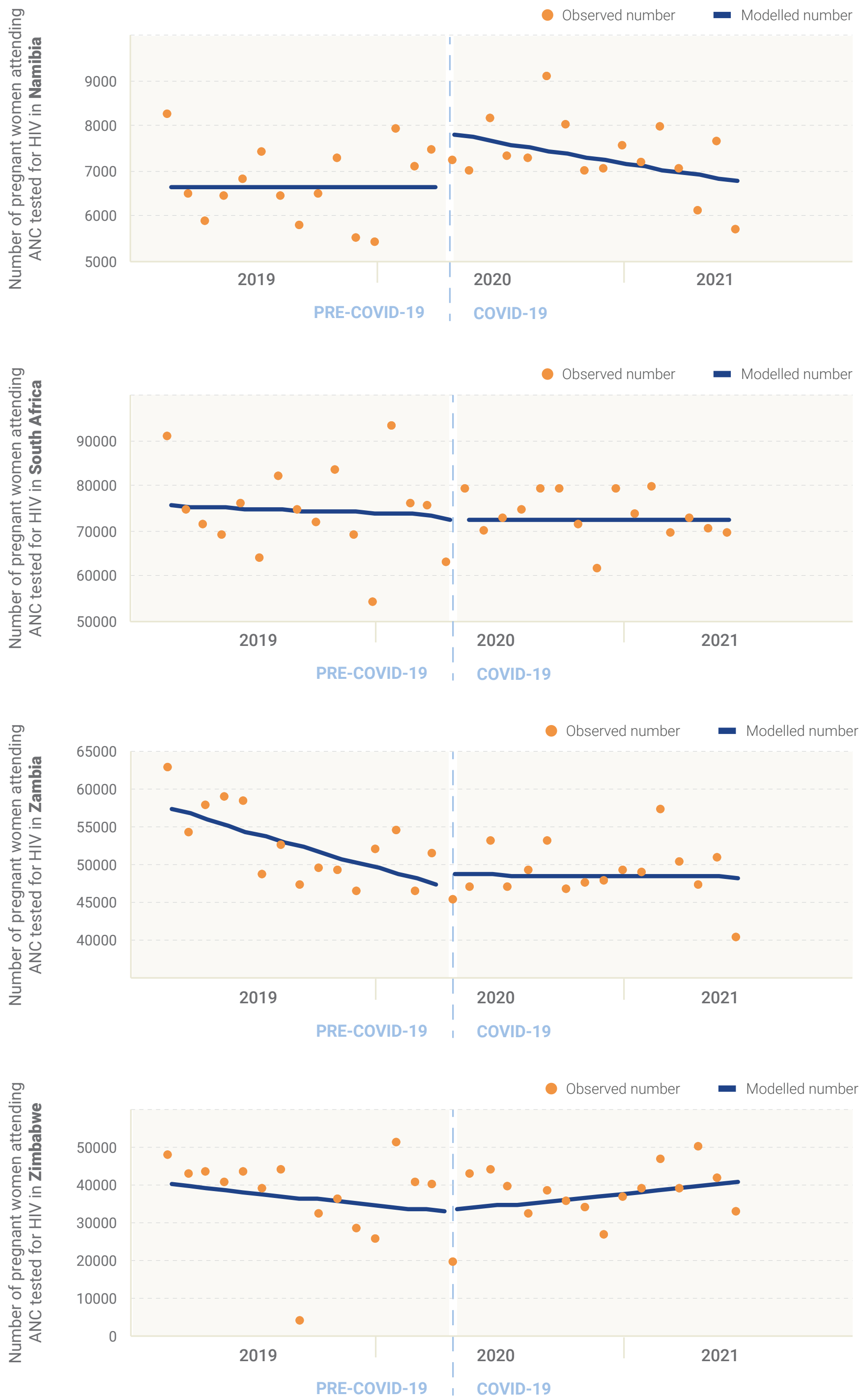


In interrupted time series analysis, there was no evidence for a change in the number of fourth ANC visits with COVID-19 in Namibia (RR=1.06, 95 per cent CI=0.96-1.17, p=0.28) or Zambia (RR=0.89, 95 per cent CI=0.58-1.37, p=0.60), but strong evidence for a 38 per cent relative decline in Zimbabwe (95 per cent CI=0.55-0.70, p<0.001) (Figure 8).

Figure 8 | **Interrupted time series of the monthly number of fourth ANC (ANC4) visits/contacts in Namibia, Zambia and Zimbabwe**

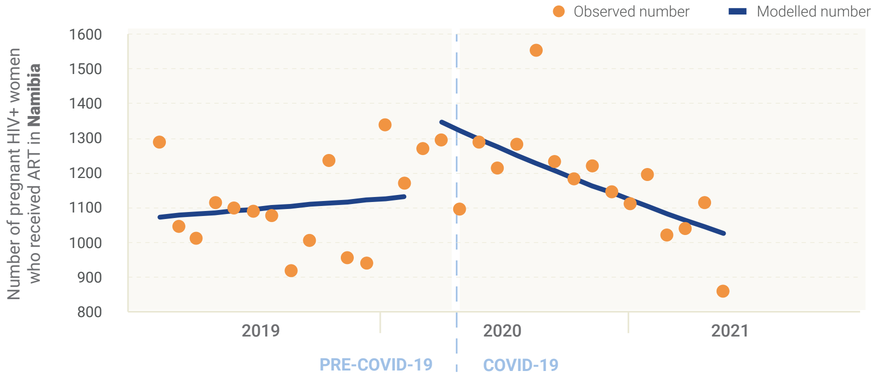
For the number of pregnant women tested for HIV, there was no evidence for an association with the COVID-19 pandemic in South Africa (RR=0.98, 95 per cent CI=0.85-1.14, p=0.84), Zambia (RR=1.03, 95 per cent CI=0.93-1.14, p=0.63) or Zimbabwe (RR=0.98, 95 per cent CI=0.59-1.62, p=0.92). There was evidence for nearly 20 per cent increase in Namibia (RR=1.19, 95 per cent CI=1.01-1.39, p=0.03) (Figure 9).

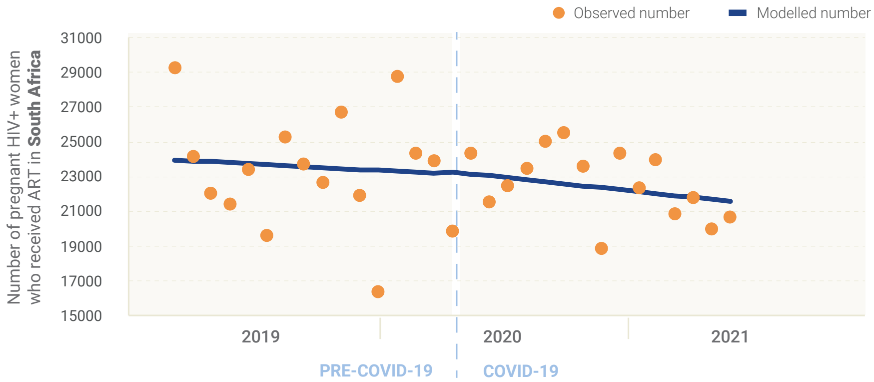
Figure 9 | **Interrupted time series of the monthly number of pregnant women attending ANC who were tested for HIV in Namibia, South Africa, Zambia, and Zimbabwe**

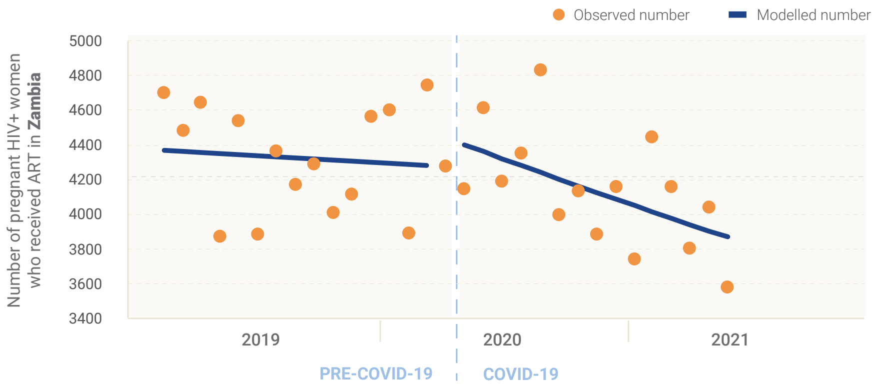


There was no evidence for a change in the number of pregnant women living with HIV who received antiretrovirals to reduce the risk of MTCT with the start of the pandemic in South Africa (RR=1.01, 95 per cent CI=0.86-1.18, p=0.92) or Zambia (RR=1.05, 95 per cent CI=0.95-1.15, p=0.34). There was, however, evidence of an increase in Namibia (RR=1.21, 95 per cent CI=1.04-1.40, p=0.01) (Figure 10).

Figure 10 | **Interrupted time series of the number of pregnant women living with HIV who received antiretroviral medicines (ART) to reduce the risk of mother-to-child-transmission in Namibia, South Africa and Zambia**

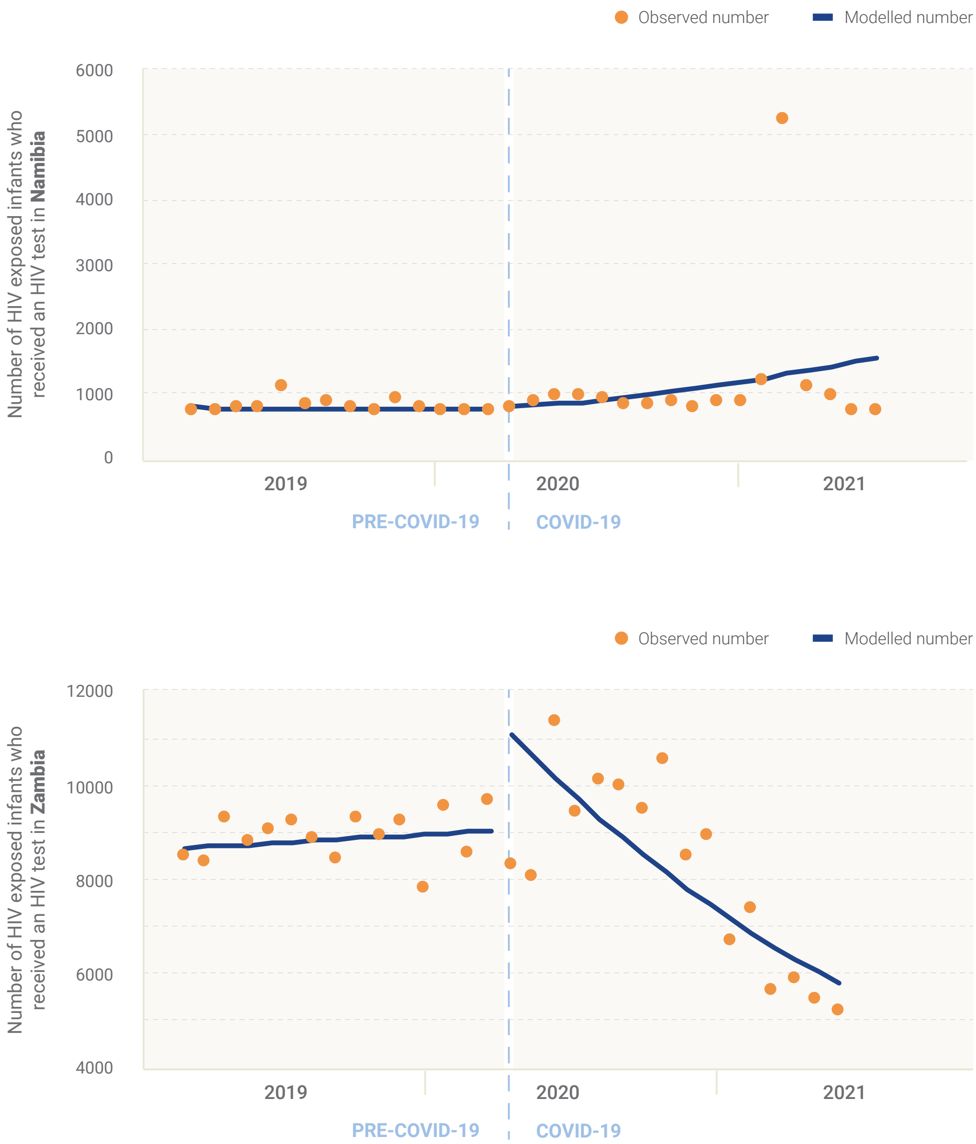






As shown in Figure 11, there was no evidence that the start of the COVID-19 pandemic was associated with a change in the monthly number of HIV exposed infants who received a virological test for HIV within two months of birth in Namibia (RR=1.04, 95 per cent CI=0.58-1.86, p=0.89). There was evidence of an increase in Zambia (RR=1.28, 95 per cent CI=1.08-1.51, p=0.004).

Figure 11 | Interrupted time series of the monthly number of HIV exposed infants who received a virological test for HIV within two months of birth in Namibia and Zambia



ASSOCIATION BETWEEN COVID-19 PANDEMIC AND NUMBER OF BIRTHS

Analysis one: pre-post comparison in mean monthly numbers

Table 7 provides an overview of the evidence for a change in indicators that capture the number of births in May-July 2020 and May-July 2021 compared with May-July 2019, with detailed results provided in Supplementary Table 15 to Supplementary Table 17 (Appendix 7). All 14 countries provided data on the **number of facility births** and **number of live births** in 2020 and 2021, with eight countries also providing data for 2021. A smaller number of countries provided data on the **number of home births**, with nine countries with data for 2019 providing data for 2020 and six for 2021.

There were very similar changes in the number of facility births and number of live births in facilities across countries, with most countries showing no evidence for a change in 2020 compared with 2019 (seven countries for facility births and eight countries for live births). Of the eight counties with data to look at changes between 2021 and 2019 for these two indicators, there was no evidence for a change in three countries, evidence for an increase in three and evidence for a decrease in two.

Over 50 per cent of the nine countries with data on the mean monthly number of home births showed no evidence for a change between 2020 and 2019, with this dropping down to 50 per cent for the six countries with data to compare 2021 to 2019.

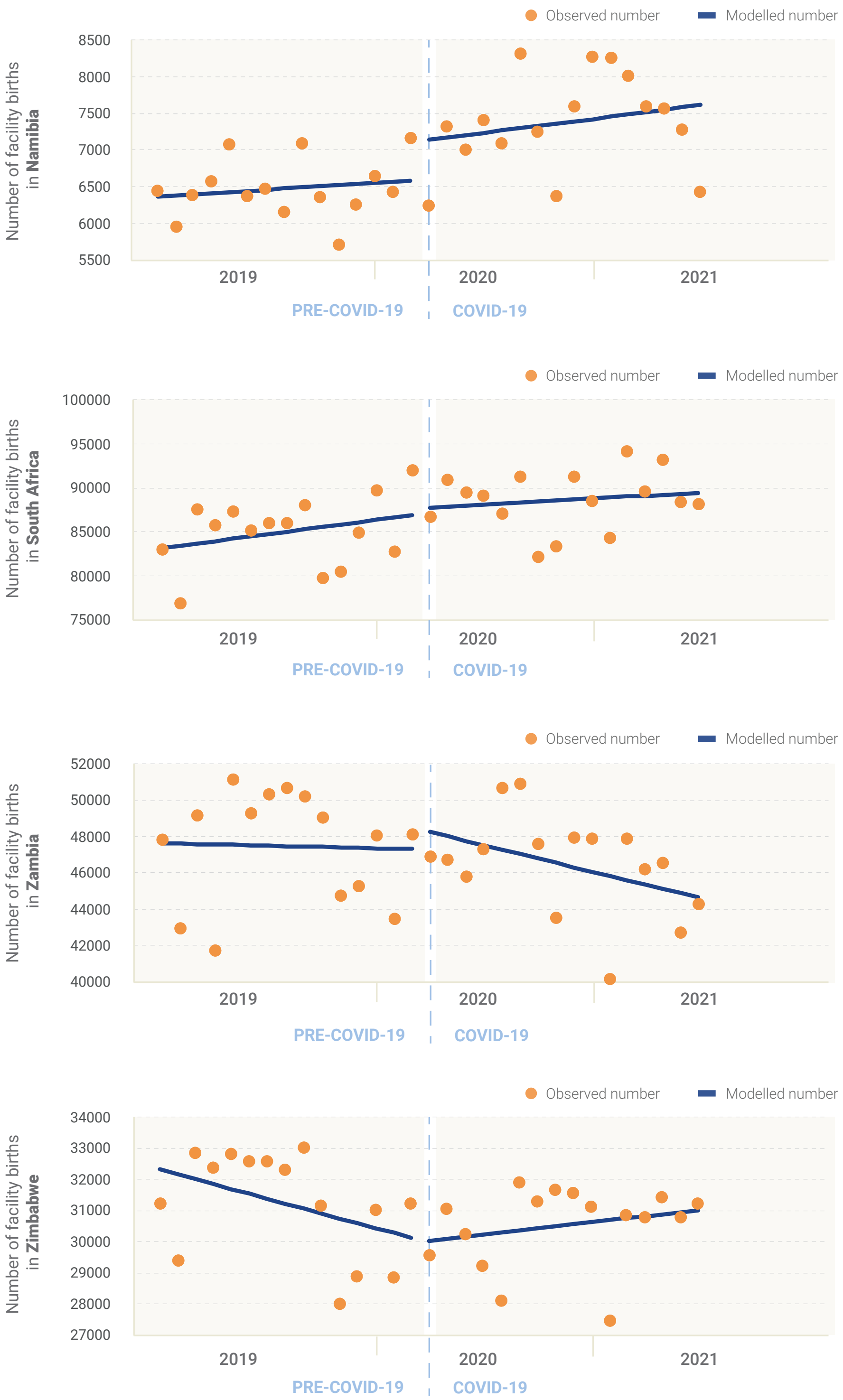
Table 7 | **Number and percentage of East and Southern African countries by whether any change was observed in the number of births in May-July 2020 and May-July 2021, compared to May-July 2019**

	Mean monthly number of facility births		Mean monthly number of home births		Mean monthly number of live births	
	2020 vs 2019 n=14	2021 vs 2019 n=8	2020 vs 2019 n=9	2021 vs 2019 n=6	2020 vs 2019 n=14	2021 vs 2019 n=8
No Change	7 (50.0%)	3 (37.5%)	5 (55.6%)	3 (50.0%)	8 (57.1%)	3 (37.5%)
Increase	5 (35.7%)	3 (37.5%)	3 (33.3%)	2 (33.3%)	4 (28.6%)	3 (37.5%)
Decrease	2 (14.3%)	2 (25.0%)	1 (11.1%)	1 (16.7%)	2 (14.3%)	2 (25.0%)

Analysis two: interrupted time series

In time series analysis, there was no evidence for a change in the number of facility births in Namibia (RR=1.08, 95 per cent CI=0.97-1.20, p=0.15), South Africa (RR=1.01, 95 per cent CI=0.95-1.07, p=0.77), Zambia (RR=1.03, 95 per cent CI=0.94-1.11, p=0.56) or Zimbabwe (RR=0.99, 95 per cent CI=0.93-1.06, p=0.85) (Figure 12).

Figure 12 | Interrupted time series of monthly number of facility births in Namibia, South Africa, Zambia, and Zimbabwe

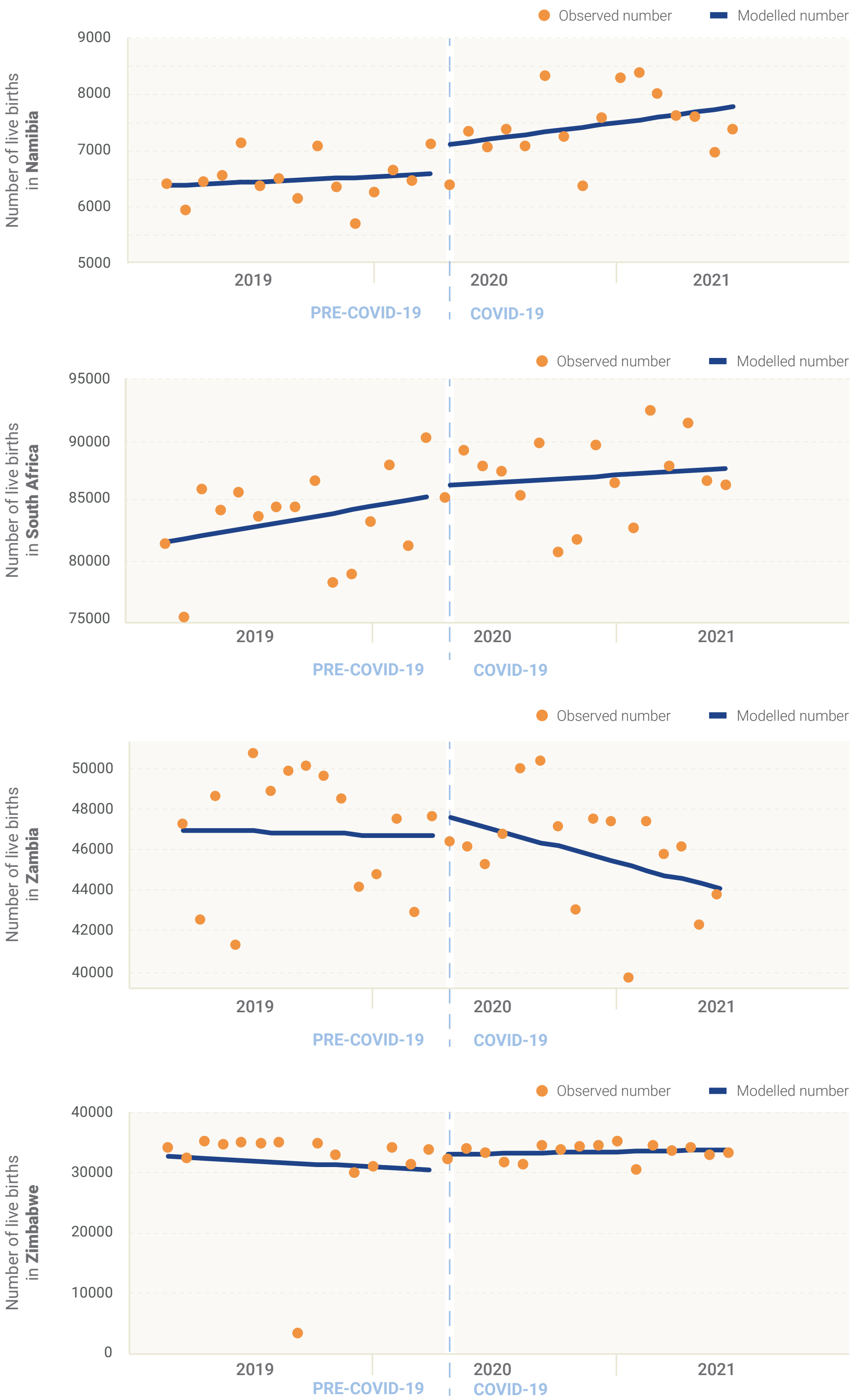


As shown in Figure 13, there was no evidence for a change in the number of home births in Namibia (RR=0.94, 95 per cent CI=0.81-1.09, p=0.39), South Africa (RR=0.93, 95 per cent CI=0.86-1.01, p=0.10) or Zambia (RR=1.12, 95 per cent CI=0.91-1.38, p=0.30), but there was a 29 per cent relative increase documented in Zimbabwe (95 per cent CI=1.05-1.58, p=0.02).

Figure 13 | **Interrupted time series of monthly number of home births in Namibia, South Africa, Zambia, and Zimbabwe**

There was no evidence for a change in the number of live births in Namibia (RR=1.07, 95 per cent CI=0.98-1.18, p=0.14), South Africa (RR=1.01, 95 per cent CI=0.95-1.07, p=0.73), Zambia (RR=1.02, 95 per cent CI=0.94-1.11, p=0.57) or Zimbabwe (RR=1.08, 95 per cent CI=0.72-1.64, p=0.71) (Figure 14).

Figure 14 | **Interrupted time series of monthly number of live births in Namibia, South Africa, Zambia, and Zimbabwe**



ASSOCIATION BETWEEN COVID-19 PANDEMIC AND MATERNAL OUTCOMES

Analysis one: pre-post comparison in mean monthly numbers

Only eight countries had data available on the monthly **number of facility maternal deaths**, with several smaller countries excluded from this analysis due to low numbers. Of the eight countries with data for 2020 versus 2019, there was evidence of an increase in three (37.5 per cent). Of the four countries with data for 2021 versus 2019, there was evidence of an increase in two. As shown in Supplementary Table 18 (Appendix 8), both Zambia and South Africa had evidence of increase in the number of maternal deaths in 2020 and 2021 when compared with 2019, with bigger increases in maternal deaths in 2021 versus 2019 than 2020 versus 2019.

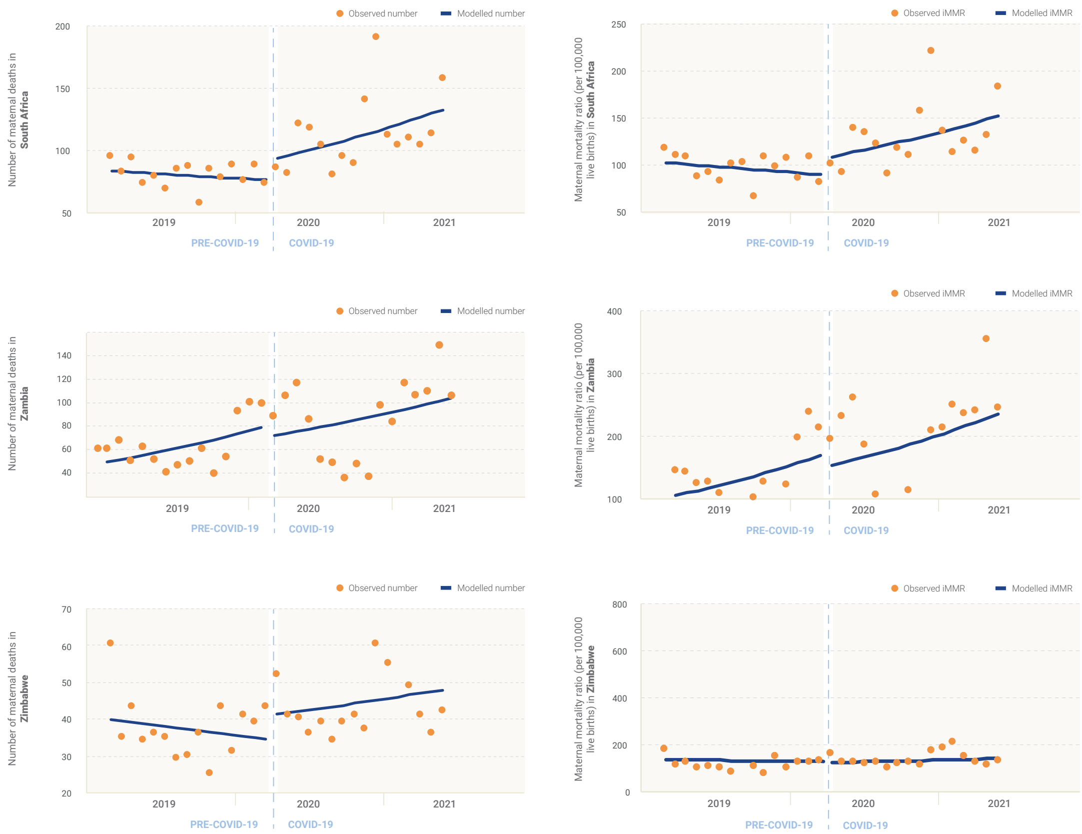
Table 8 | **Number and percentage of East and Southern African countries by whether any change was observed in maternal outcomes in May-July 2020 and May-July 2021, compared to May-July 2019**

	Mean monthly number of maternal deaths	
	2020 vs 2019 n=8	**2021 vs 2019 n=4**
No Change	4 (50.0%)	1 (25.0%)
Increase	3 (37.5%)	2 (50.0%)
Decrease	1 (12.5%)	1 (25.0%)

Analysis two: interrupted time series

There was no evidence that the start of the COVID-19 pandemic was associated with either a change in the number of maternal deaths (RR=0.89, 95 per cent CI=0.57-1.39, p=0.60) or the iMMR (RR=0.88, 95 per cent CI=0.55-1.40, p=0.58) in Zambia (Figure 15). This was also the case in Zimbabwe, for both the number of maternal deaths (RR=1.17, 95 per cent CI=0.88-1.58, p=0.28) and the iMMR (RR=0.96, 95 per cent CI=0.57-1.60, p=0.87) (Figure 15). Similarly, in South Africa, there was no evidence for an initial change in the numbers of maternal deaths (RR=1.20, 95 per cent CI=0.93-1.55, p=0.16) or the iMMR (RR=1.18, 95 per cent CI=0.91-1.54, p=0.22). However, in South Africa, there is a reversal of the declining trend in maternal mortality to an increasing trend in the COVID-19 period.

Figure 15 | **Interrupted time series of monthly number of maternal deaths (L) and the maternal mortality ratio (R) in South Africa, Zambia and Zimbabwe; iMMR = Institutional Maternal Mortality Ratio**



ASSOCIATION BETWEEN COVID-19 PANDEMIC AND NEONATAL OUTCOMES

Analysis one: pre-post comparison in mean monthly numbers

Twelve counties provided data on the monthly **number of stillbirths**, seven of which provided data for 2021, as well as for 2020 (Table 8, with country-level results in Supplementary Table 19 – Appendix 9). There was evidence for an increase in the number of stillbirths in three countries in 2020 compared with 2019 (25.0 per cent) and in one out of seven countries for 2021 compared with 2019 (14.3 per cent).

Of the 13 countries which provided data on the mean monthly **number of live births <2500g**, there was evidence of an increase in 2020 compared with 2019 in three countries (23.1 per cent) (Supplementary Table 20 – Appendix 9). Three countries out of eight countries with data, showed evidence of an increase in 2021 compared with 2019 (37.5 per cent).

There was no evidence for an increase in the **number of newborn deaths** in 2020 compared to 2019 or in 2021 compared with 2019 in any of the countries with data available (Supplementary Table 21– Appendix 9).

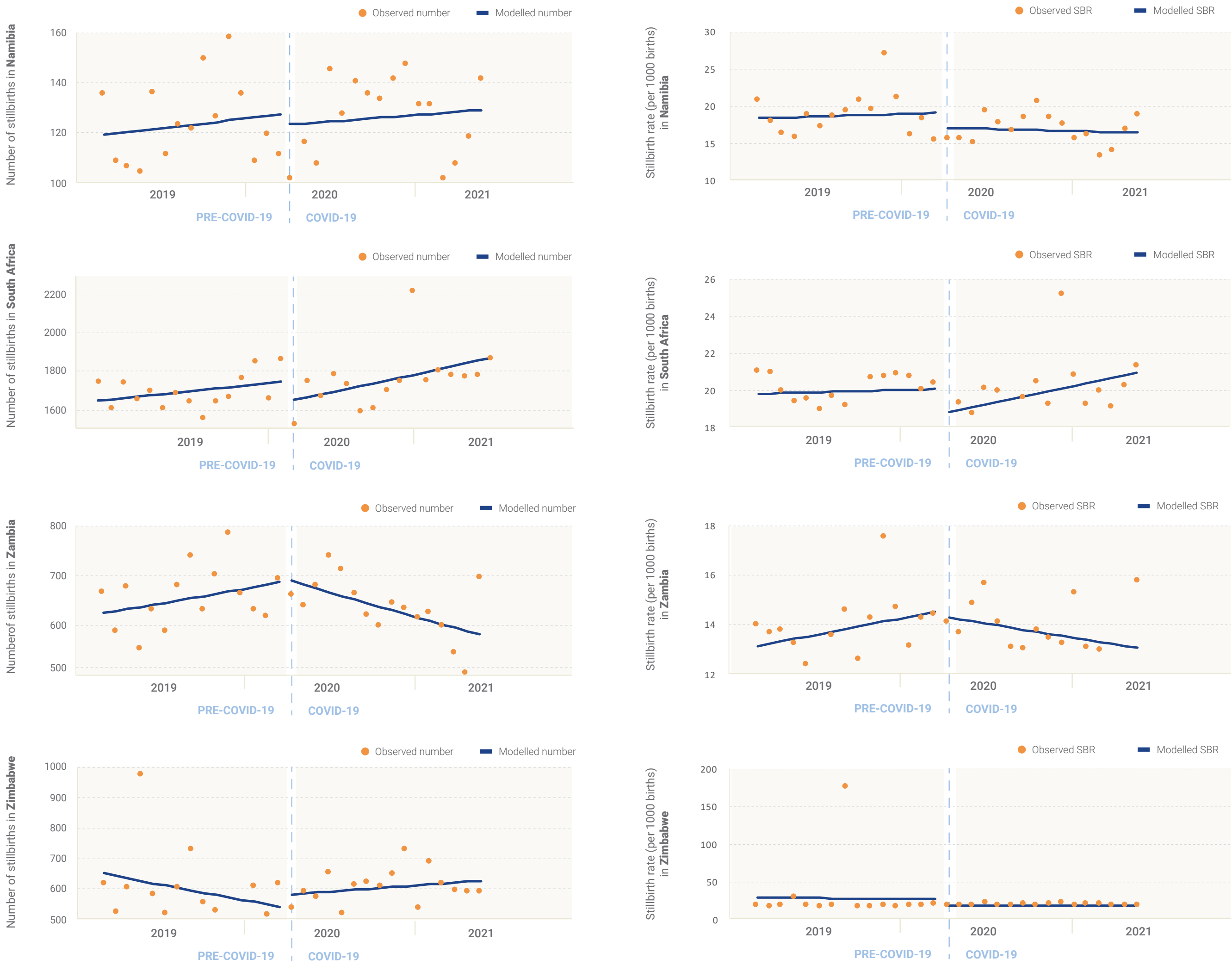
Table 9 | **Number and percentage of East and Southern African countries by whether any change was observed in neonatal outcomes in May-July 2020 and May-July 2021, compared to May-July 2019**

	Mean monthly number of stillbirths		Mean monthly number of live births <2500g		Mean monthly number of newborn deaths	
	2020 vs 2019 n=12	2021 vs 2019 n=7	2020 vs 2019 n=13	2021 vs 2019 n=8	2020 vs 2019 n=7	2021 vs 2019 n=5
No Change	8 (66.7%)	5 (71.4%)	8 (61.5%)	3 (37.5%)	5 (71.4%)	3 (60.0%)
Increase	3 (25.0%)	1 (14.3%)	3 (23.1%)	3 (37.5%)	0 (0%)	0 (0%)
Decrease	1 (8.3%)	1 (14.3%)	2 (15.4%)	2 (25.0%)	2 (28.6%)	2 (40.0%)

Analysis two: interrupted time series

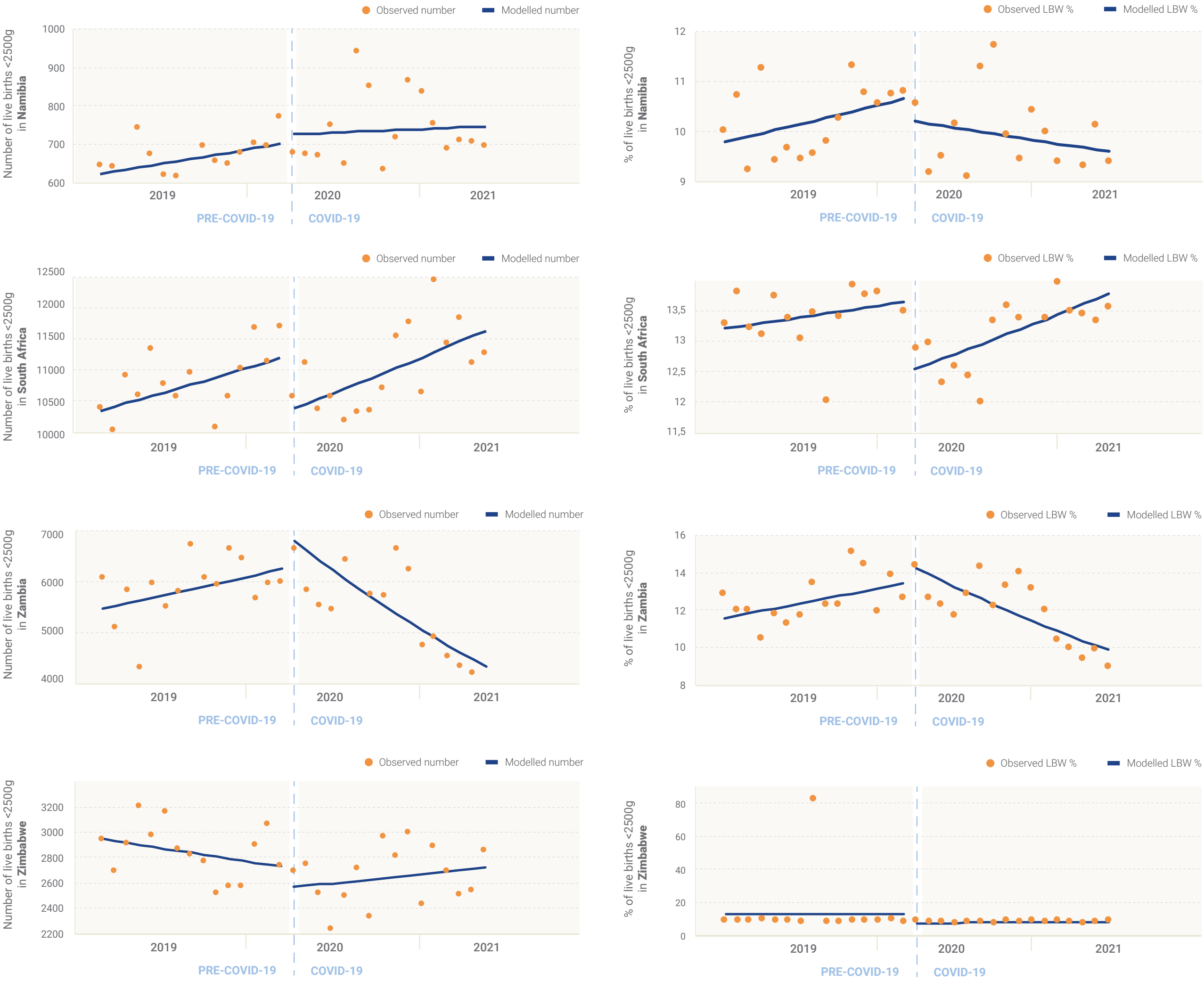
There was no evidence for a change in the number of stillbirths with the start of the COVID-19 pandemic in Namibia (RR=0.97, 95 per cent CI=0.81-1.15, p=0.70), South Africa (RR=0.94, 95 per cent CI=0.86-1.02, p=0.15), Zambia (RR=1.02, 95 per cent CI=0.90-1.14, p=0.80) or Zimbabwe (RR=1.07, 95 per cent CI=0.89-1.29, p=0.49) (Figure 16). There was also no evidence for change in the stillbirth rate in Namibia (RR=0.90, 95 per cent CI=0.75-1.08, p=0.24), South Africa (RR=0.93, 95 per cent CI=0.85-1.02, p=0.11), Zambia (RR=0.99, 95 per cent CI=0.88-1.11, p=0.87) or Zimbabwe (RR=0.67, 95 per cent CI=0.28-1.57, p=0.35) (Figure 16).

Figure 16 | **Interrupted time series of monthly number (L) and rate (R) of stillbirths in Namibia, South Africa, Zambia, and Zimbabwe; SBR=stillbirth rate**



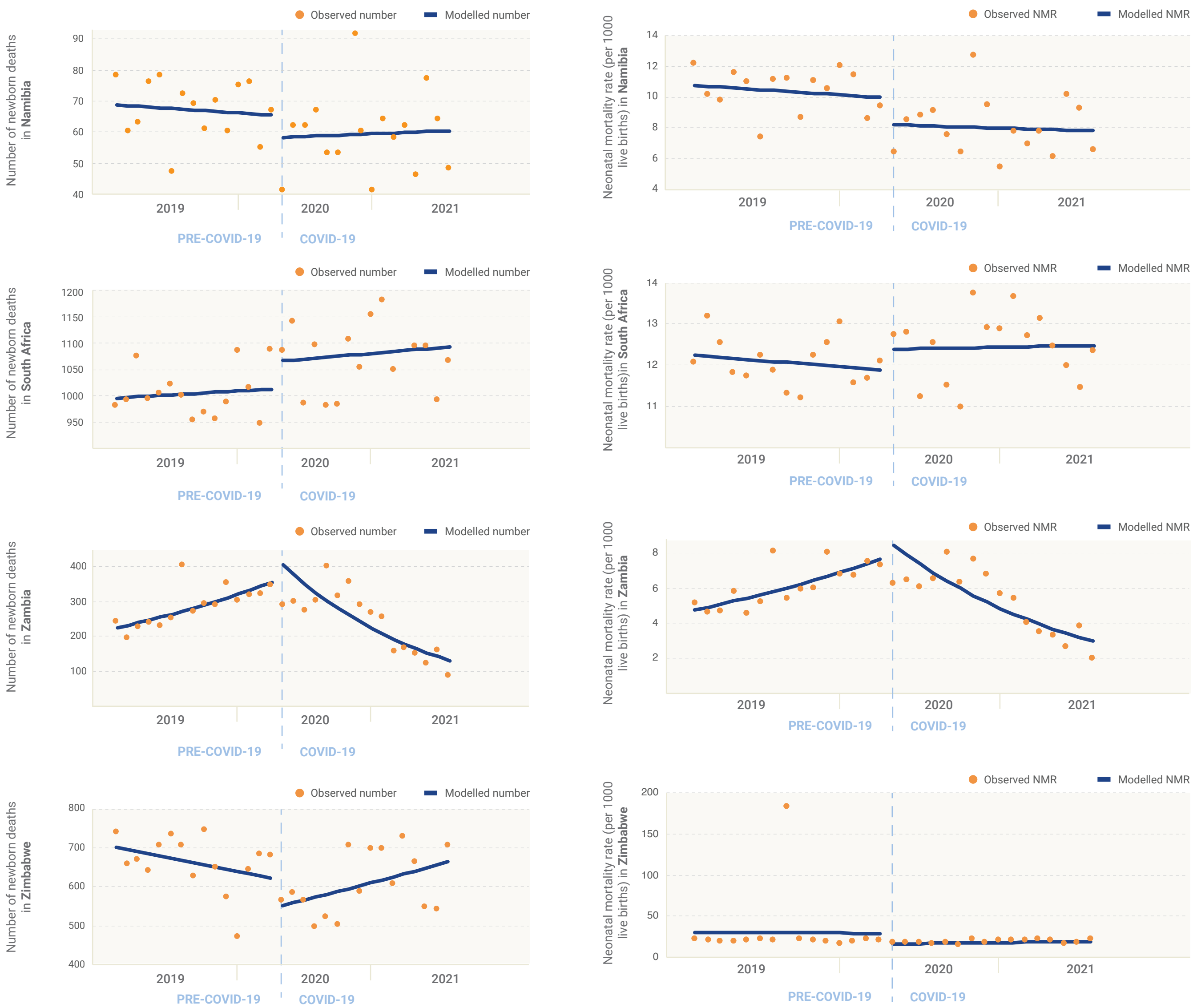
There was also no evidence for a change in the number of live births that were <2500g in Namibia (RR=1.03, 95 per cent CI=0.91-1.18, p=0.62), Zambia (RR=1.12, 95 per cent CI=0.96-1.30, p=0.14) or Zimbabwe (RR=0.94, 95 per cent CI=0.84-1.04, p=0.22) at the start of the COVID-19 pandemic. A dramatic decline in the number of live births that were <2500g was documented in Zambia throughout the COVID-19 period (Figure 17). The same was observed for the percentage of live births that were less than 2500g in Namibia (RR=0.96, 95 per cent CI=0.87-1.06, p=0.40), Zambia (RR=1.09, 95 per cent CI=0.96-1.23, p=0.20) and Zimbabwe (RR=0.58, 95 per cent CI=0.26-1.32, p=0.20). There was evidence of declines in the number (RR=0.92, 95 per cent CI=0.86-0.98, p=0.009) and percentage (RR=0.91, 95 per cent CI=0.87-0.96, p=0.0004) of live births that were <2500g with the start of the COVID-19 pandemic in South Africa.

Figure 17 | **Interrupted time series of monthly number (L) and percentage (R) of live births<2500g in Namibia, South Africa, Zambia, and Zimbabwe; LBW=low birth weight**



There was no evidence for a change in the number of newborn deaths with the start of the COVID-19 pandemic in Namibia (RR=0.89, 95 per cent CI=0.69-1.14, p=0.35), South Africa (RR=1.05, 95 per cent CI=0.97-1.14, p=0.21) or Zimbabwe (RR=0.88, 95 per cent CI=0.75-1.02, p=0.09) (Figure 18). Although there was no evidence of a change in the number of newborn deaths in Zambia at the start of the pandemic (RR=1.23, 95 per cent CI=0.94-1.61, p=0.13), a dramatic decline in the number of newborn deaths was documented in Zambia throughout the COVID-19 period. Similar results were observed when looking at the neonatal mortality rate, with the exception of Zimbabwe where the low number of live births reported in one of the pre-pandemic months drove a high rate obscuring the other time points (Figure 18).

Figure 18 | **Interrupted time series of monthly number (L) and rate (R) of neonatal deaths in Namibia, South Africa, Zambia, and Zimbabwe; NMR=neonatal mortality rate**



ASSOCIATION BETWEEN COVID-19 PANDEMIC AND CHILD OUTCOMES

Analysis one: pre-post comparison in mean monthly numbers

Table 10 provides an overview of the evidence for a change in indicators that capture child outcomes in May-July 2020 and May-July 2021 compared with May-July 2019, with detailed country-level results provided in Supplementary Table 22-Supplementary Table 25 (Appendix 10).

Of the six countries with data on the monthly **number of deaths to children less than five years**, one showed evidence on an increase in 2020 compared with 2019 (16.7 per cent), while there was evidence of a decrease in three countries (50.0 per cent). Two out of four countries that also had data to compare 2021 to 2019, showed evidence of increases in the number of deaths to children less than five years (50.0 per cent).

There was no evidence for an increase in the **number of malaria, pneumonia or diarrhoea cases** in most countries that provided data for these indicators in either 2020 or 2021 when compared to 2019. A majority of countries, however, did have documented decreases in the number of pneumonia and diarrhoea cases to children less than five years in 2020 compared with 2019, and this pattern persisted in 2021 compared to 2019 for the number of pneumonia cases to children <5 years.

Table 10 | **Number and percentage of East and Southern African countries by whether any change was observed in child outcomes in May-July 2020 and May-July 2021, compared to May-July 2019**

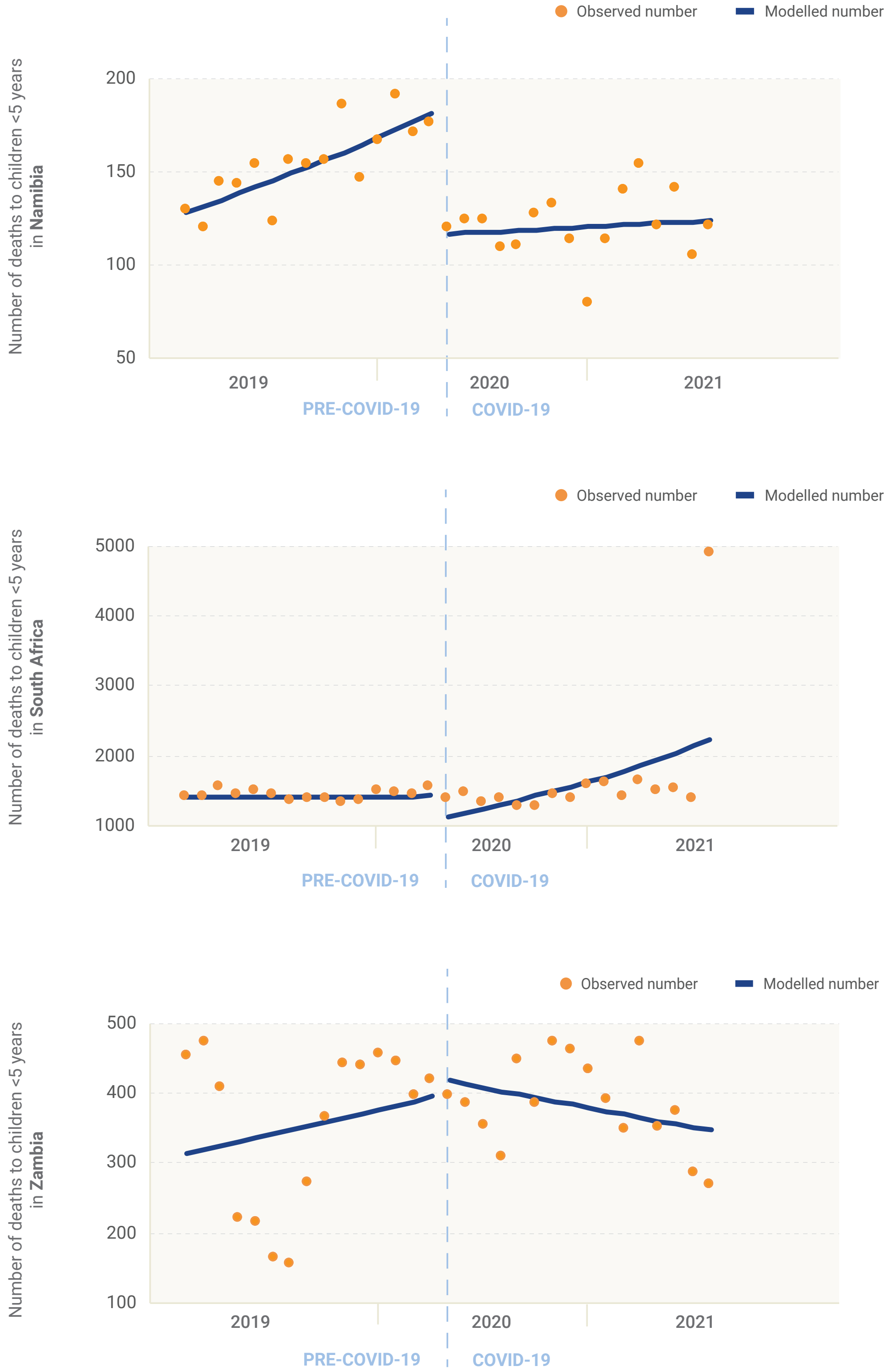
	Mean monthly number of deaths to children <5 years		Mean monthly number of malaria cases <5 years		Mean monthly number of pneumonia cases <5 years		Mean monthly number of diarrhoea cases <5 years	
	2020 vs 2019 n=6	2021 vs 2019 n=4	2020 vs 2019 n=8	2021 vs 2019 n=4	2020 vs 2019 n=10	2021 vs 2019 n=6	2020 vs 2019 n=11	2021 vs 2019 n=6
No Change	2 (33.3%)	1 (25.0%)	6 (75.0%)	3 (75.0%)	3 (30.0%)	1 (16.7%)	2 (18.2%)	3 (50.0%)
Increase	1 (16.7%)	2 (50.0%)	1 (12.5%)	0 (0%)	0 (0%)	1 (16.7%)	2 (18.2%)	0 (0%)
Decrease	3 (50.0%)	1 (25.0%)	1 (12.5%)	1 (25.0%)	7 (70.0%)	4 (66.7%)	7 (63.6%)	3 (50.0%)

Analysis two: interrupted time series

In the interrupted time series analysis, there was strong evidence for a reduction in the number of deaths to children <5 years reported in the HMIS in Namibia (RR=0.64, 95 per cent CI=0.55-

0.75, p<0.001), but not in South Africa (RR=0.76, 95 per cent CI=0.57-1.02, p=0.07) or Zambia (RR=1.07, 95 per cent CI=0.74-1.55, p=0.71) (Figure 19).

Figure 19 | Interrupted time series of monthly number deaths to children less than five years in Namibia, South Africa and Zambia



There was no evidence for an association between the start of the COVID-19 pandemic and a change in the numbers of malaria cases in children less than five years in Namibia (RR=0.85, 95 per cent CI=0.22-3.27, p=0.81), Zambia (RR=1.15, 95 per cent CI=0.72-1.83, p=0.56) or Zimbabwe (RR=1.14, 95 per cent CI=0.28-4.69, p=0.85) (Figure 20).

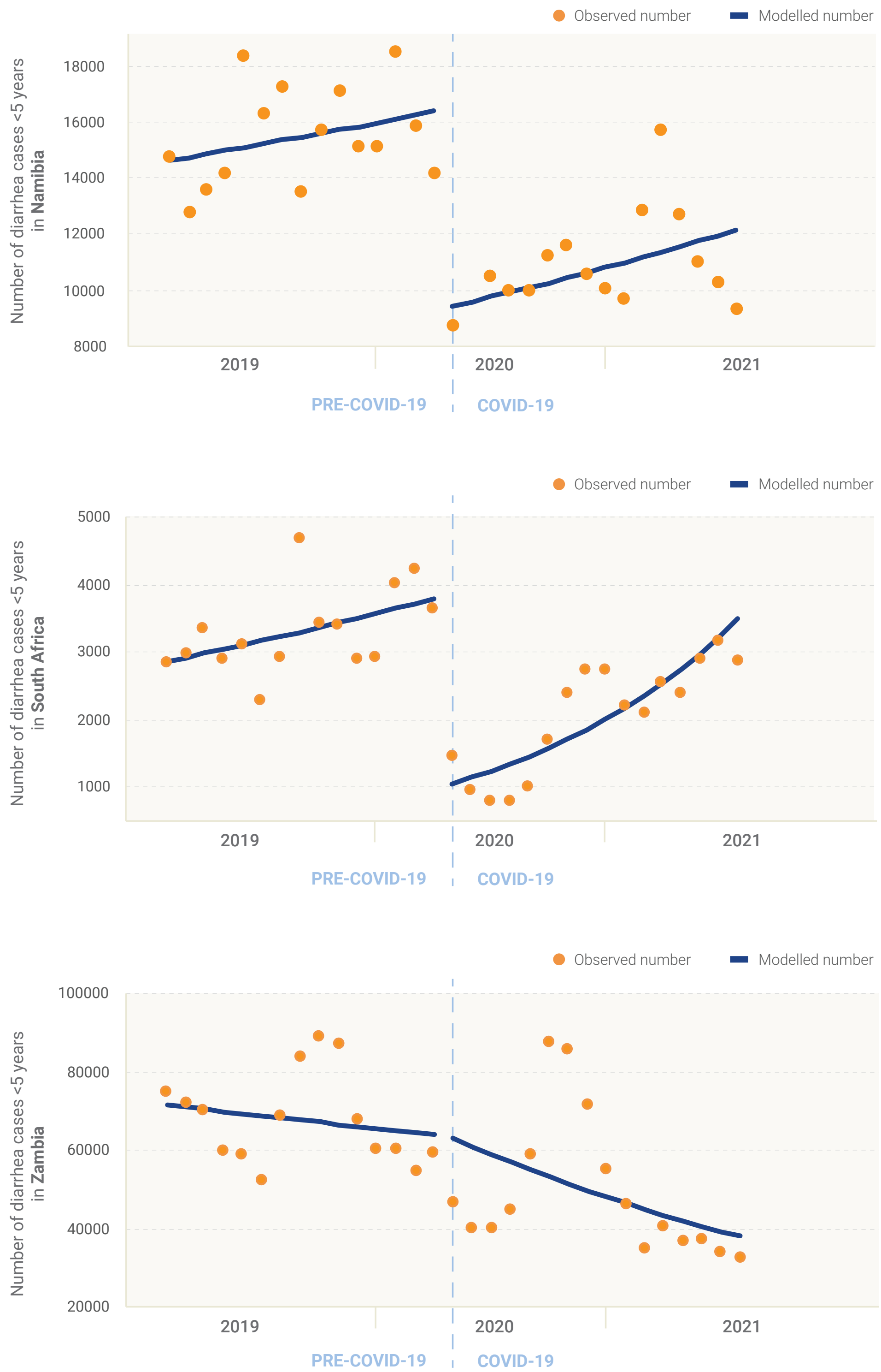
Figure 20 | **Interrupted time series of monthly number of malaria cases to children less than five years in Namibia, Zambia and Zimbabwe**

As shown in Figure 21, there was no evidence in a change in the numbers of pneumonia cases with the start of the COVID-19 pandemic in Namibia (RR=0.86, 95 per cent CI=0.51-1.44, p=0.81), but a substantial decline in the number of cases in South Africa (RR=0.38, 95 per cent CI=0.28-0.53, p<0.001) and Zimbabwe (RR=0.34, 95 per cent CI=0.21-0.54, p<0.001).

Figure 21 | **Interrupted time series of monthly number of pneumonia cases to children less than five years in Namibia, South Africa and Zimbabwe**

Finally, there was a substantial reduction in the number of diarrhoea cases reported in Namibia at the start of the COVID-19 pandemic (RR=0.57, 95 per cent CI=0.47-0.68, p<0.001) and in South Africa (RR=0.26, 95 per cent CI=0.19-0.35, p<0.001), but not in Zambia (RR=1.02, 95 per cent CI=0.72-1.43, p=0.93) (Figure 22).

Figure 22 | Interrupted time series of monthly number of diarrhoea cases to children less than five years in Namibia, South Africa and Zambia



Discussion

KEY FINDINGS

- There were between-country differences in the impact of the COVID-19 pandemic period on reproductive, maternal, newborn and child health-care utilization at public health facilities, although no country appeared to be unaffected by the pandemic.
- There was a tendency to reduced health-care utilization with COVID-19, with decreases documented more in inpatient than outpatient visits.
- In many countries, there were substantial declines in the number of cases of malaria, pneumonia or diarrhoea among children under five years reported at public health facilities in the COVID-19 period, which may reflect changes in health-care utilization or a real drop in cases of these diseases due to the mitigation measures put in place to reduce the spread of COVID-19.
- For most countries, there was no evidence that the COVID-19 pandemic led to a reduction in the utilization of maternal health-care services, as measured based on a small number of indicators.
- There was no evidence for an association between COVID-19 and most maternal and neonatal outcomes (e.g. maternal mortality and stillbirth) for most countries. It is important to note, however, that there was limited power to explore these relatively rare outcomes in many countries, and it is possible that these adverse outcomes were more likely to happen outside of health-care facilities during the COVID-19 pandemic.
- Facility based data, such as those available through HMIS, are very useful for tracking health-care utilization, but need to be interpreted with caution as they will not capture events, such as maternal deaths, that occur in the community.

OVERVIEW OF RESULTS

In this comprehensive analysis of routine HMIS data that captures utilization of health services in the public sector from 14 countries in ESA, the indirect impacts of the COVID-19 pandemic on a wide range of indicators related to reproductive, maternal, newborn and child health-care utilization and outcomes were explored. There were between-country differences in the impact of the COVID-19 pandemic period on health-care utilization and outcomes based on most HMIS indicators, although there were some common patterns, and no country appeared to be unaffected by the pandemic. Firstly, there was a tendency to reduced health-care utilization with COVID-19, with decreases documented more in inpatient than outpatient visits. There was a decline in the number of outpatient visits for children less than five years across the majority of countries, which is likely to be linked with the reductions observed in most countries in the number of cases of malaria, pneumonia or diarrhoea with the COVID-19 pandemic. This may reflect real reductions in the numbers of these diseases in children under five years, with mitigation measures designed to reduce the risk of COVID-19 also leading to lower levels of these other diseases. It is also plausible, however, that parents and carers were less likely to take their children to hospital for these diseases during the pandemic, and so cases were going undocumented within the HMIS systems. For most countries there was no evidence that the COVID-19 pandemic led to a reduction in the provision of maternal health-care utilization, the indicators of which largely focussed on the HIV testing and treatment among pregnant women and neonates. This might explain why there was no evidence for an association between COVID-19 and most maternal and neonatal outcomes (e.g. maternal mortality and stillbirth). It is important to note, however, that there was limited power to explore these relatively rare outcomes in many countries, and there were some countries where there was evidence for an association between the COVID-19 pandemic and these outcomes. This highlights the importance of using country-specific data to monitor the impact of pandemics, such as COVID-19, and not extrapolating from other settings.

The decrease in health-care utilization in most, but not all, countries and affecting some aspects of health-care provision more than others largely reflects what the published evidence emerging from Sub-Saharan Africa (Quaglio et al., 2022; Arsenault et al., 2022; Tessema et al., 2021). In a scoping review of literature published up to March 2021 by Tessema and colleagues, 19 studies assessing the impacts of COVID-19 on access to general and essential health-care services across SSA were identified (Tessema et al., 2021). There was a reduction in inpatient hospitals admissions in the COVID-19 period in more than half of the included studies, but the authors noted that other services (including the number of institutional deliveries) did not appear to be impacted in many settings. More recently, Quaglio and colleagues published an interrupted time series analysis using data from six public hospitals across four countries (Ethiopia, Sierra Leone, Tanzania, and Uganda), and found no evidence that the COVID-19 period was associated with a change in ANC visits or institutional deliveries, but did find evidence for a reduction in outpatient visits and hospital admissions (Quaglio et al., 2022).

METHODOLOGICAL CONSIDERATIONS

Due to varying data availability across different countries, there were two different approaches to the analysis adopted, both of which have been used in other studies using aggregate data to look at the impact of COVID-19 on health services and outcomes. For all countries included in this study, there was a pre-post COVID-19 comparison using an average for each indicator in May-July in the years since COVID-19 compared with the numbers reported for May-July 2019. For a subset of countries, there were also interrupted time series analyses conducted. Each of these analyses allowed for data to be used to explore the impact of the COVID-19 period in slightly different ways, and there were some different results depending on the analysis used. For example, in South Africa, the impact of the COVID-19 pandemic on the number of births <2500g appears to be different depending on whether the results are looked at from the

pre-post comparison or the interrupted time series. Using the interrupted time series, there was evidence of an 8 per cent relative decline in the number of births <2500g with the start of the COVID-19 pandemic period (95 per cent CI=0.86-0.98) compared to pre-pandemic, but no evidence for a difference if relying on the pre-post comparison of data from May-July 2020 compared to May-July 2019 (RR=0.98; 95 per cent CI=0.94-1.03). Looking at the plot of full time series of data, there was an increasing trend in the number of births weighing <2500g in the pre-pandemic period, and by not accounting for this in the pre-post comparison, it ends up looking like there was no evidence for a difference in 2020 compared with 2019. Where possible, studies should collect and analyse data using time series analyses, to capture underlying temporal trends.

STRENGTHS AND LIMITATIONS

The strengths of this study include the availability of data across many different countries and, together with a standardized analytical approach used for all the countries, means that results on the impact of the COVID-19 pandemic period can be compared between different indicators in different countries. However, there are some important limitations, many of which are inherent to the use of aggregate-level facility-based data and have, as such, been detailed elsewhere (World Health Organization, 2019). Firstly, data from HMIS do not generally capture events that occur in private health-care services or in the community; there were dramatic changes in where people were seeking health care during the pandemic and so there is only part of the picture when relying on HMIS data. It is possible, for example, that there was an increase in some indicators in some countries in the COVID-19 period using the HMIS data (e.g. the number of c-sections) because women were having (or opting) to use public health-care services rather than private health-care services. Secondly, the impacts of the COVID-19 pandemic will not be felt equally within countries, with certain groups particularly vulnerable to the impacts (e.g. by socio-economic status and region); unfortunately, due to the aggregate nature of the HMIS data it was not possible to explore the inequity of the impacts of COVID-19 pandemic by socio-demographic characteristics of the population. Thirdly, the raw data from the HMIS systems were not available for this report for most countries, with these data reported from each country by questionnaire. This is more likely to lead to errors, as individuals need to fill out the questionnaire based on what was reported in the HMIS. Indeed, in a comprehensive exploration of data quality, some outliers that may be due to human error in filling out the questionnaire (but may also indicate an error in the data available in the HMIS or may reflect a true dramatic change in numbers) were noted. As the data were collected across different data collection phases, numbers reported in data collection phases were compared. Some unexpected changes in numbers reported between different data collection phases were noted (for example, for one country the mean monthly number of outpatient visits in May-July 2019 and 2020 was between approximately 35,000 and 45,000, and for August-December 2019 and 2020 was <200). Where distinct differences in reporting between data collection phases for an indicator were observed, data for that particular country for the indicator were excluded. Finally, it cannot be ruled out that changes over time were attributable to other temporal changes, and not necessarily attributable to the COVID-19 pandemic. For example, there may have been changes in data recording practices (i.e. there may have been poorer recording in the COVID-19 period if health-care workers had heavy workloads related to service provision within the pandemic).

CONCLUSIONS

This report presents one of the largest analyses of the impact of the COVID-19 pandemic and its associated mitigation measures in ESA, and indicates that all countries were impacted by the pandemic, but not in a uniform way. The COVID-19 pandemic has once again exposed the huge inequity in data availability to help inform and track progress in health services, with many systematic reviews and multi-country studies noting an absence of evidence from settings in SSA (Chmielewska et al., 2021; Moynihan et al., 2021), and this report demonstrates the utility of HMIS data to fill some of this void. There was quite a lot of variation between different countries with respect to the availability of indicators, and given the extensive impact that COVID-19 has had across health systems, reinforces the need to collect data on a wide range of services and health outcomes. In particular, a lack of data available on services for adolescents across many of the countries is noted, and this inclusion is recommended in all HMIS data collection efforts. To ensure adequate responses of health systems in ESA to both the ongoing COVID-19 pandemic, as well as any future pandemics, requires comprehensive access to timely data to track any impacts and monitor any improvements with interventions.

References

Arsenault, C., Gage, A., Kim, M.K., Kapoor, N.R., Akweongo, P., Amponsah. F., et al. (2022). COVID-19 and resilience of healthcare systems in ten countries. *Nature Medicine, vol. 28, pp. 1314-1324. Available at* https://www.nature.com/articles/s41591-022-01750-1.

Bernal, J.L., Cummins, S., and Gasparrini, A. (2017). Interrupted time series regression for the evaluation of public health interventions: a tutorial. *International Journal of Epidemiology, vol. 46, issue 1, pp. 348-355. Available at* https://academic.oup.com/ije/article/46/1/348/2622842.

Brolin Ribacke, K.J., Saulnier, D.D., Eriksson, A., and von Schreeb, J. (2016). Effects of the West Africa Ebola Virus Disease on Health-Care Utilization - A Systematic Review. *Frontiers in Public Health, vol. 4, article 222. Available at* https://www.frontiersin.org/articles/10.3389/fpubh.2016.00222/full.

Burt, J.F., Ouma, J., Lubyayi, L., Amone, A., Aol, L., Sekikubo, M., et al. (2021). Indirect effects of COVID-19 on maternal, neonatal, child, sexual and reproductive health services in Kampala, Uganda. *BMJ Global Health, vol. 6, issue 8. Available at* https://gh.bmj.com/content/6/8/e006102.

Caniglia, E.C., Magosi, L.E., Zash, R., Diseko, M., Mayondi, G., Mabuta, J., et al. (2020). Modest reduction in adverse birth outcomes following the COVID-19 lockdown. *American Journal of Obstetrics and Gynecology, vol. 224, issue 6, pp. 615.e1-615.e12 Available at* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7817370/.

Chmielewska, B., Barratt, I., Townsend, R., Kalafat, E., van der Meulen, J., Gurol-Urganci, I., et al. (2021). Effects of the COVID-19 pandemic on maternal and perinatal outcomes: A systematic review and meta-analysis. *Lancet Global Health, vol. 9, issue 6, pp. e759-772. Available at* https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(21)00079-6/fulltext.

Elston, J.W., Cartwright, C., Ndumbi, P., and Wright, J. (2017). The health impact of the 2014-15 Ebola outbreak. *Public Health, vol. 143, pp. 60-70. Available at* https://pubmed.ncbi.nlm.nih.gov/28159028/.

Hale, T., Angrist, N., Goldszmidt, R. et al. A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker). Nat Hum Behav 5, 529–538 (2021). https://doi.org/10.1038/s41562-021-01079-8

Hogan, A.B., Jewell, B.L., Sherrard-Smith, E., Vesga, J.F., Watson, O.J., Whittaker, C., et al. (2020). Potential impact of the COVID-19 pandemic on HIV, tuberculosis, and malaria in low-income and middle-income countries: a modelling study. *Lancet Global Health, vol. 8, issue 9, pp. e1132-e1141. Available at* https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(20)30288-6/fulltext.

Kumari, V., Mehta, K., and Choudhary, R. (2020). COVID-19 outbreak and decreased hospitalisation of pregnant women in labour. *Lancet Global Health, vol., 8, issue 9, pp. e1116-e1117. Available at* https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(20)30319-3/fulltext.

Moynihan, R., Sanders, S., Michaleff, Z.A., Scott, A.M., Clark, J., To, E.J., et al. (2021). Impact of COVID-19 pandemic on utilisation of healthcare services: a systematic review. *BMJ Open, vol. 11, issue 3, p. e045343. Available at* https://bmjopen.bmj.com/content/11/3/e045343.

Parpia, A.S., Ndeffo-Mbah, M.L., Wenzel, N.S., and Galvani, A.P. (2016). Effects of Response to 2014-2015 Ebola Outbreak on Deaths from Malaria, HIV/AIDS, and Tuberculosis, West Africa. *Emerging Infectious Disease, vol. 22, issue 3, pp. 433-441. Available at* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4766886/.

Pattinson, P., Fawcus, S., Gebhardt, S., Niit, R., Soma-Pillay, P., and Moodley, J. (2021). The impact of COVID-19 on pregnancy in 2020 compared with 2019: interim fact sheet 2021. Available at https://www.samrc.ac.za/sites/default/files/attachments/2021-03-31/SA%20report_Covid-19_2020%20pregnancy%20vs%202019_Provinces_Service%20use_Pattison%20etal_Mar21.pdf.

Quaglio, G., Cavallin, F., Nsubuga, J.B., Lochoro, P., Maziku, D., Tsegaye, A., et al. (2022). The impact of the COVID-19 pandemic on health service use in sub-Saharan Africa. *Public Health Action, vol. 12, issue 1, pp. 34-39. Available at* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8908870/.

Rao, S.P.N., Minckas, N., Medvedev, M.M., Gathara, D., Prashantha, Y.N., Seifu Estifanos, A., et al. (2021). Small and sick newborn care during the COVID-19 pandemic: global survey and thematic analysis of healthcare providers' voices and experiences. *BMJ Global Health, vol. 6, issue 3, p. e004347. Available at* https://gh.bmj.com/content/6/3/e004347.

Roberton, T., Carter, E.D., Chou, V.B., Stegmuller, A.R., Jackson, B.D., Tam, Y., et al. (2020). 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 Global Health, vol. 8, issue 7, pp. e901-e908. Available at* https://www.thelancet.com/journals/langlo/article/PIIS2214-109X(20)30229-1/fulltext.

Salyer, S.J., Maeda, J., Sembuche, S., Kebede, Y., Tshangela, A., Moussif, M., et al. (2021). The first and second waves of the COVID-19 pandemic in Africa: a cross-sectional study. *The Lancet, vol. 397, issue 10281, pp.1265-1275. Available at* https://doi.org/10.1016/S0140-6736(21)00632-2.

Semaan, A., Audet, C., Huysmans, E., Afolabi, B., Assarag, B., Banke-Thomas, A., et al. (2020). Voices from the frontline: findings from a thematic analysis of a rapid online global survey of maternal and newborn health professionals facing the COVID-19 pandemic. *BMJ Global Health, vol. 5, issue 6. Available at* https://gh.bmj.com/content/5/6/e002967.

Shikuku DN, Nyaoke IK, Nyaga LN, 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 Dec;25(6):76-87. doi: 10.29063/ajrh2021/v25i6.9. PMID: 37585823.

Siedner, M.J., Kraemer, J.D., Meyer, M.J., Harling, G., Mngomezulu, T., Gabela. P., et al. (2020). Access to primary healthcare during lockdown measures for COVID-19 in rural South Africa: an interrupted time series analysis. *BMJ Open, vol. 10, issue 10, p. e043763. Available at* https://bmjopen.bmj.com/content/10/10/e043763.

Tessema, G.A., Kinfu, Y., Dachew, B.A., Tesema, A.G., Assefa, Y., Alene, K.A., et al. (2021). The COVID-19 pandemic and healthcare systems in Africa: a scoping review of preparedness, impact and response. *BMJ Global Health, vol. 6, issue 12, p. e007179. Available at* https://gh.bmj.com/content/6/12/e007179.

Townsend, R., Chmielewska, B., Barratt, I., Kalafat, E., van der Meulen, J., Gurol-Urganci, I., et al. (2021). Global changes in maternity care provision during the COVID-19 pandemic: A systematic review and meta-analysis. *EClinicalMedicine, vol. 37, 100947. Available at* https://pubmed.ncbi.nlm.nih.gov/34195576/.

Wagner, A.K., Soumerai, S.B., Zhang, F., and Ross-Degnan, D. (2002). Segmented regression analysis of interrupted time series studies in medication use research. *Journal of Clinical Pharmacy and Therapeutics, vol. 27, issue 4, pp. 299-309. Available at* https://pubmed.ncbi.nlm.nih.gov/12174032/.

World Health Organization. (2019). Analysis and Use of Health Facility Data: Guidance for RMNCAH programme managers. Geneva, Switzerland; World Health Organization. 2019. Available at https://cdn.who.int/media/docs/default-source/documents/ddi/facilityanalysisguidance-rmncah.pdf?sfvrsn=2055e453_2&download=true.


GOU

Appendix 1: Defining the start of the COVID-19 period for time series analysis

SUPPLEMENTARY TABLE 1

Identifying the start of the COVID-19 period for interrupted time series analysis

Country	First COVID-19 case (2020)	Lockdown stringency (2020)*			Start of COVID-19 period in analysis (2020)
		>=50	>=60	>=70	
Namibia	13th March	18th March	27th March	17th April	April
South Africa	5th March	19th March	27th March	27th March	April
Zambia	18th March	9th April	15th April	3rd May	April
Zimbabwe	20th March	5th March	27th March	30th March	April

*https://ourworldindata.org/grapher/COVID-stringency-index

Appendix 2:
Data availability and quality

SUPPLEMENTARY TABLE 2

Availability of Health Management Information Systems indicators for analysis for each country (data had to be available for May-July 2019 and May-July 2020 to be classified as included)

	Comoros	DRC	Eswatini	Ethiopia	Lesotho	Madagascar	Mauritius	Mozambique	Namibia	South Africa	Tanzania	Uganda	Zambia	Zimbabwe
HEALTH-CARE UTILIZATION														
Number of outpatient visits	Red	Green	Green	Green	Green	Green	Green	Green	Yellow	Green	Yellow	Green	Green	Green
Number of inpatient visits	Red	Green	Green	Green	Green	Red	Green	Green	Green	Red	Yellow	Green	Green	Green
Number of outpatient attendances/consultations for children <5 years for any cause	Red	Red	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	Green	Green
FAMILY PLANNING														
Number of clients who accept oral contraceptives at the facility and community	Green	Green	Green	Yellow	Red	Yellow	Green	Green	Green	Green	Green	Green	Green	Green
Number of clients who accept injectable contraceptives at the facility and community	Green	Green	Green	Yellow	Green	Yellow	Green	Green	Green	Green	Green	Green	Green	Green
ABORTION														
Number of women presenting to facility with abortion related complications	Red	Green	Green	Green	Red	Green	Green	Green	Green	Red	Red	Green	Green	Green
ACCESS TO MATERNAL AND NEONATAL CARE														
Number of ANC 4 visits/ contacts provided by any trained provider	Green	Green	Green	Green	Green	Green	Red	Green	Green	Red	Green	Green	Green	Green
Number of pregnant women attending antenatal clinics who were tested for HIV during pregnancy	Green	Green	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	Green	Green

	Comoros	DRC	Eswatini	Ethiopia	Lesotho	Madagascar	Mauritius	Mozambique	Namibia	South Africa	Tanzania	Uganda	Zambia	Zimbabwe
Number of pregnant women living with HIV who received antiretroviral medicines to reduce the risk of MTCT	Not available	Available	Available	Available	Available	Available	Not available	Available	Available	Available	Not available	Excluded	Available	Available
Number of HIV exposed infants who receive a virological test for HIV within two months of birth	Not available *	Available	Available	Available	Available	Not available	Not available	Available	Available	Not available	Not available	Excluded	Available	Not available
Number of caesarean sections	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available
NUMBER OF BIRTHS														
Number of facility births	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available
Number of home births	Not available *	Available	Available	Not available	Available	Not available	Not available *	Available	Available	Available	Available	Not available	Available	Available
Number of live births	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available
MATERNAL AND BIRTH OUTCOMES														
Number of maternal deaths	Not available *	Available	Not available *	Available	Not available *	Not available *	Not available *	Available	Not available *	Available	Available	Available	Available	Available
Number of stillbirths	Available	Available	Available	Available	Available	Not available	Not available *	Available	Available	Available	Available	Available	Available	Available
Number of live births that weigh less than 2500g	Not available *	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available
Number of newborn deaths	Not available *	Not available	Not available *	Available	Not available *	Not available	Not available *	Available	Available	Available	Available	Not available	Available	Available
CHILD HEALTH OUTCOMES														
Number of deaths to children (Under 5)	Not available	Available	Not available *	Not available	Not available *	Not available	Not available *	Available	Available	Available	Available	Not available	Available	Excluded
Number of pneumonia cases (Under 5)	Not available	Available	Available	Available	Available	Available	Not available *	Available	Available	Available	Excluded	Available	Excluded	Available
Number of diarrhoea cases (Under 5)	Not available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available	Excluded	Available	Excluded
Number of malaria cases (Under 5)	Not available	Available	Not available *	Available	Not available	Available	Not available	Available	Available	Not available	Available	Excluded	Available	Available

*Data available but mean monthly numbers between May and July are less than 20 in at least one of the study years so not included for analysis

Data available for analysis	Data excluded due to differential reporting between data collection phases	Data not available (or sample size too small)

SUPPLEMENTARY TABLE 3

Outliers identified

Country	Indicator	Time point
Lesotho	Number of outpatient visits	Apr-19
Madagascar	Number of outpatient visits	Aug-20
Madagascar	Number of women presenting to facility with abortion-related complications	Jul-19
Madagascar	Number of neonatal deaths	Sep-19
Malawi	Number of caesareans	Sep-19
Mozambique	Number of clients accepting oral contraceptives	May-21
Mozambique	Number of live births	Feb 2019 & March 2021
Mozambique	Number of neonatal deaths	Mar-19
Mozambique	Number of malaria cases (Under 5)	Jan-21
Namibia	Number of clients accepting oral contraceptives	Oct-19
Namibia	Number of HIV exposed infants who received a virological test for HIV within two months of birth	Mar-21
Namibia	Number of pneumonia cases (Under 5)	Jun-20
Uganda	Number of live births	Dec-19
Uganda	Number of babies <2500g at birth	Oct-20
Zimbabwe	Number of women presenting to facility with abortion-related complications	Feb-21
Zimbabwe	Number of live births	Aug-19
Zimbabwe	Number of outpatient attendances/Consultations for children <5 years for any cause	Aug-19

Appendix 3: COVID-19 and health utilization

SUPPLEMENTARY TABLE 4

Relative change in the mean monthly number of outpatient visits in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/ Country	Mean monthly number of outpatient visits	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	4346349	1	-
May-July 2020	4654397	1.07 (1.05-1.10)	<0.001
Eswatini			
May-July 2019	121168	1	-
May-July 2020	78008	0.64 (0.55-0.76)	<0.001
Ethiopia			
May-July 2019	8149810	1	-
May-July 2020	8147343	1.00 (0.94-1.07)	0.99
Lesotho			
May-July 2019	96001	1	-
May-July 2020	48641	0.51 (0.42-0.62)	<0.001
May-July 2021	62526	0.65 (0.54-0.78)	<0.001
Madagascar			
May-July 2019	968034	1	-
May-July 2020	1016762	1.05 (0.91-1.21)	0.50
Mauritius			
May-July 2019	298728	1	-
May-July 2020	204221	0.68 (0.48-0.98)	0.04

Time period/ Country	Mean monthly number of outpatient visits	Relative change (95% confidence interval)	p-value
May-July 2021	225145	0.75 (0.52-1.08)	0.13
Mozambique			
May-July 2019	3872545	1	-
May-July 2020	2692923	0.70 (0.49-0.99)	0.04
May-July 2021	2852681	0.74 (0.52-1.04)	0.09
South Africa			
May-July 2019	1899294	1	-
May-July 2020	1286346	0.68 (0.64-0.72)	<0.001
May-July 2021	1450462	0.76 (0.72-0.81)	<0.001
Uganda			
May-July 2019	4207528	1	-
May-July 2020	3762513	0.89 (0.76-1.06)	0.19
May-July 2021	4016422	0.95 (0.81-1.13)	0.59
Zambia			
May-July 2019	1756115	1	-
May-July 2020	1603297	0.91 (0.78-1.07)	0.25
Zimbabwe			
May-July 2019	443226	1	-
May-July 2020	199560	0.45 (0.39-0.51)	<0.001

SUPPLEMENTARY TABLE 5

Relative change in the mean monthly number of outpatient visits for children <5 years old in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of outpatient visits for children <5 years	Relative change (95% confidence interval)	p-value
Eswatini			
May-July 2019	18997	1	-
May-July 2020	13258	0.70 (0.61-0.79)	<0.001
Ethiopia			
May-July 2019	1839309	1	-
May-July 2020	2126530	1.16 (1.04-1.28)	0.006
Lesotho			
May-July 2019	14051	1	-
May-July 2020	4845	0.34 (0.25-0.47)	<0.001
May-July 2021	9739	0.69 (0.51-0.95)	0.03
Madagascar			
May-July 2019	295524	1	-
May-July 2020	306781	1.04 (0.92-1.18)	0.57
Mozambique			
May-July 2019	1012984	1	-
May-July 2020	379416	0.37 (0.21-0.68)	0.002
May-July 2021	695043	0.69 (0.38-1.25)	0.22
Namibia			
May-July 2019	77244	1	-
May-July 2020	49396	0.64 (0.52-0.79)	<0.001
May-July 2021	57671	0.75 (0.61-0.92)	0.006
South Africa			
May-July 2019	1736083	1	-
May-July 2020	1168349	0.67 (0.63-0.72)	<0.001
May-July 2021	1383822	0.80 (0.75-0.85)	<0.001

Time period/Country	Mean monthly number of outpatient visits for children <5 years	Relative change (95% confidence interval)	p-value
Tanzania			
May-July 2019	2050815	1	-
May-July 2020	1741491	0.85 (0.73-0.99)	0.03
Uganda			
May-July 2019	832270	1	-
May-July 2020	14372	0.02 (0.02-0.02)	<0.001
May-July 2021	15918	0.02 (0.02-0.02)	<0.001
Zambia			
May-July 2019	537280	1	-
May-July 2020	477897	0.89 (0.80-0.99)	0.03
May-July 2021	542476	1.01 (0.91-1.12)	0.86
Zimbabwe			
May-July 2019	73763	1	-
May-July 2020	35425	0.48 (0.39-0.60)	<0.001
May-July 2021	24865	0.34 (0.27-0.42)	<0.001

SUPPLEMENTARY TABLE 6

Relative change in the mean monthly number of inpatient visits in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of inpatient visits	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	201618	1	-
May-July 2020	206886	1.03 (0.98-1.08)	0.30
Eswatini			
May-July 2019	5246	1	-
May-July 2020	3201	0.61 (0.57-0.66)	<0.001
Ethiopia			
May-July 2019	111150	1	-
May-July 2020	99333	0.89 (0.82-0.98)	0.01
Lesotho			
May-July 2019	1723	1	-
May-July 2020	1213	0.70 (0.50-1.00)	0.05
May-July 2021	1598	0.93 (0.66-1.31)	0.67
Mauritius			
May-July 2019	16317	1	-
May-July 2020	13777	0.84 (0.74-0.96)	0.009
May-July 2021	12434	0.76 (0.67-0.86)	<0.001
Mozambique			
May-July 2019	205399	1	-
May-July 2020	138693	0.68 (0.62-0.73)	<0.001
May-July 2021	151812	0.74 (0.68-0.80)	<0.001
Namibia			
May-July 2019	19908	1	-
May-July 2020	18780	0.94 (0.82-1.08)	0.41
May-July 2021	18506	0.93 (0.81-1.07)	0.31

Time period/Country	Mean monthly number of inpatient visits	Relative change (95% confidence interval)	p-value
Uganda			
May-July 2019	281997	1	-
May-July 2020	232184	0.82 (0.75-0.90)	<0.001
May-July 2021	243697	0.86 (0.79-0.94)	0.001
Zambia			
May-July 2019	45511	1	-
May-July 2020	45573	1.00 (0.81-1.24)	0.99
May-July 2021	47346	1.04 (0.84-1.29)	0.72
Zimbabwe			
May-July 2019	50929	1	-
May-July 2020	30426	0.60 (0.52-0.68)	<0.001
May-July 2021	34298	0.67 (0.59-0.77)	<0.001

Appendix 4: COVID-19 and family planning

SUPPLEMENTARY TABLE 7

Relative change in the mean monthly number of clients who accept oral contraceptives in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of clients who accept oral contraceptives	Relative change (95% confidence interval)	p-value
Comoros			
May-July 2019	402	1	-
May-July 2020	562	1.40 (0.58-3.39)	0.46
DRC			
May-July 2019	9841	1	-
May-July 2020	14295	1.45 (1.29-1.63)	<0.001
Eswatini			
May-July 2019	10481	1	-
May-July 2020	6420	0.61 (0.56-0.67)	<0.001
Mauritius			
May-July 2019	4355	1	-
May-July 2020	3701	0.85 (0.83-0.87)	<0.001
May-July 2021	3540	0.81 (0.79-0.84)	<0.001
Mozambique			
May-July 2019	100303	1	-
May-July 2020	53045	0.53 (0.18-1.55)	0.25
May-July 2021	385171	3.84 (1.31-11.27)	0.01

Time period/Country	Mean monthly number of clients who accept oral contraceptives	Relative change (95% confidence interval)	p-value
Namibia			
May-July 2019	843	1	-
May-July 2020	235	0.28 (0.11-0.67)	0.005
May-July 2021	1249	1.48 (0.61-3.58)	0.38
South Africa			
May-July 2019	313808	1	-
May-July 2020	279759	0.89 (0.80-1.00)	0.05
May-July 2021	340299	1.08 (0.97-1.21)	0.16
Tanzania			
May-July 2019	40203	1	-
May-July 2020	58680	1.46 (1.34-1.58)	<0.001
Uganda			
May-July 2019	42457	1	-
May-July 2020	41249	0.97 (0.58-1.63)	0.91
May-July 2021	18895	0.45 (0.27-0.74)	0.002
Zambia			
May-July 2019	134148	1	-
May-July 2020	115344	0.86 (0.80-0.92)	<0.001
May-July 2021	45238	0.34 (0.32-0.36)	<0.001
Zimbabwe			
May-July 2019	172937	1	-
May-July 2020	209992	1.21 (1.16-1.27)	<0.001
May-July 2021	154931	0.90 (0.86-0.94)	<0.001

SUPPLEMENTARY TABLE 8

Relative change in the mean monthly number of clients who accept injectable contraceptives in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of clients who accept injectable contraceptives	Relative change (95% confidence interval)	p-value
Comoros			
May-July 2019	1014	1	-
May-July 2020	1133	1.12 (0.99-1.26)	0.07
DRC			
May-July 2019	81052	1	-
May-July 2020	112069	1.38 (1.28-1.50)	<0.001
Eswatini			
May-July 2019	22281	1	-
May-July 2020	12068	0.54 (0.45-0.65)	<0.001
Lesotho			
May-July 2019	15084	1	-
May-July 2020	7535	0.50 (0.33-0.76)	0.001
May-July 2021	13297	0.88 (0.58-1.34)	0.55
Mauritius			
May-July 2019	3458	1	-
May-July 2020	3222	0.93 (0.91-0.96)	<0.001
May-July 2021	3166	0.92 (0.89-0.94)	<0.001
Mozambique			
May-July 2019	116260	1	-
May-July 2020	116260	1.00 (0.90-1.11)	0.99
May-July 2021	98178	0.84 (0.76-0.94)	0.001
Namibia			
May-July 2019	2064	1	-
May-July 2020	3394	1.64 (1.40-1.93)	<0.001
May-July 2021	3551	1.72 (1.47-2.02)	<0.001

Time period/Country	Mean monthly number of clients who accept injectable contraceptives	Relative change (95% confidence interval)	p-value
South Africa			
May-July 2019	716502	1	-
May-July 2020	657994	0.92 (0.84-1.00)	0.05
May-July 2021	669935	0.94 (0.86-1.02)	0.13
Tanzania			
May-July 2019	179593	1	-
May-July 2020	160903	0.90 (0.82-0.98)	0.02
Uganda			
May-July 2019	105919	1	-
May-July 2020	164531	1.55 (1.33-1.82)	<0.001
May-July 2021	175915	1.66 (1.42-1.94)	<0.001
Zambia			
May-July 2019	184153	1	-
May-July 2020	161473	0.88 (0.79-0.98)	0.02
May-July 2021	167725	0.91 (0.82-1.01)	0.09
Zimbabwe			
May-July 2019	67264	1	-
May-July 2020	56675	0.84 (0.79-0.90)	<0.001
May-July 2021	69637	1.04 (0.97-1.11)	0.30

Appendix 5: COVID-19 and abortion-related complications

SUPPLEMENTARY TABLE 9

Relative change in the mean monthly number of women presenting to facilities with abortion-related complications in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of women presenting to facilities with abortion-related complications	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	2825	1	-
May-July 2020	3317	1.17 (1.11-1.24)	<0.001
Eswatini			
May-July 2019	31	1	-
May-July 2020	26	0.84 (0.62-1.13)	0.25
Ethiopia			
May-July 2019	7712	1	-
May-July 2020	8180	1.06 (0.98-1.14)	0.13
Madagascar			
May-July 2019	1319	1	-
May-July 2020	915	0.69 (0.38-1.27)	0.23
Mauritius			
May-July 2019	108	1	-
May-July 2020	104	0.96 (0.82-1.13)	0.63
May-July 2021	111	1.03 (0.89-1.20)	0.67
Mozambique			
May-July 2019	753	1	-

Time period/Country	Mean monthly number of women presenting to facilities with abortion-related complications	Relative change (95% confidence interval)	p-value
May-July 2020	694	0.92 (0.80-1.06)	0.26
May-July 2021	2594	3.44 (3.00-3.95)	<0.001
Namibia			
May-July 2019	265	1	-
May-July 2020	501	1.89 (1.66-2.15)	<0.001
May-July 2021	364	1.37 (1.20-1.57)	<0.001
Uganda			
May-July 2019	6136	1	-
May-July 2020	4531	0.74 (0.71-0.77)	<0.001
May-July 2021	3978	0.65 (0.62-0.68)	<0.001
Zambia			
May-July 2019	2934	1	-
May-July 2020	3450	1.18 (0.99-1.39)	0.06
May-July 2021	3747	1.28 (1.08-1.51)	0.005
Zimbabwe			
May-July 2019	2528	1	-
May-July 2020	2182	0.86 (0.82-0.91)	<0.001
May-July 2021	2339	0.93 (0.88-0.97)	0.001

Appendix 6: COVID-19 and access to maternal health care

SUPPLEMENTARY TABLE 10

Relative change in the mean monthly number of fourth antenatal care visits/contacts in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of fourth ANC visits/contacts	Relative change (95% confidence interval)	p-value
Comoros			
May-July 2019	578	1	-
May-July 2020	461	0.80 (0.58-1.10)	0.16
DRC			
May-July 2019	191104	1	-
May-July 2020	212377	1.11 (1.08-1.14)	<0.001
Eswatini			
May-July 2019	837	1	-
May-July 2020	725	0.87 (0.78-0.96)	0.005
Ethiopia			
May-July 2019	199230	1	-
May-July 2020	192995	0.97 (0.88-1.06)	0.51
Lesotho			
May-July 2019	1645	1	-
May-July 2020	1604	0.97 (0.80-1.19)	0.80
May-July 2021	2577	1.57 (1.28-1.91)	<0.001
Madagascar			
May-July 2019	30931	1	-
May-July 2020	36014	1.16 (1.09-1.24)	<0.001

Time period/Country	Mean monthly number of fourth ANC visits/contacts	Relative change (95% confidence interval)	p-value
Mozambique			
May-July 2019	75769	1	-
May-July 2020	80163	1.06 (0.98-1.14)	0.15
May-July 2021	94149	1.24 (1.15-1.34)	<0.001
Namibia			
May-July 2019	15102	1	-
May-July 2020	16682	1.10 (0.99-1.23)	0.06
May-July 2021	14527	0.96 (0.87-1.07)	0.47
Tanzania			
May-July 2019	145553	1	-
May-July 2020	171892	1.18 (1.12-1.24)	<0.001
Uganda			
May-July 2019	74685	1	-
May-July 2020	77902	1.04 (0.97-1.13)	0.28
May-July 2021	92866	1.24 (1.15-1.34)	<0.001
Zambia			
May-July 2019	48006	1	-
May-July 2020	43677	0.91 (0.38-2.19)	0.83
May-July 2021	55448	1.16 (0.48-2.79)	0.75
Zimbabwe			
May-July 2019	44546	1	-
May-July 2020	25260	0.57 (0.53-0.60)	<0.001
May-July 2021	32446	0.73 (0.69-0.77)	<0.001

SUPPLEMENTARY TABLE 11

Relative change in the mean monthly number of c-sections in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of c-sections	Relative change (95% confidence interval)	p-value
Comoros			
May-July 2019	242	1	-
May-July 2020	239	0.99 (0.85-1.15)	0.87
DRC			
May-July 2019	10780	1	-
May-July 2020	12320	1.14 (1.09-1.20)	<0.001
Eswatini			
May-July 2019	319	1	-
May-July 2020	329	1.03 (0.85-1.25)	0.75
Ethiopia			
May-July 2019	11138	1	-
May-July 2020	12405	1.11 (1.04-1.20)	0.004
Lesotho			
May-July 2019	495	1	-
May-July 2020	425	0.86 (0.66-1.12)	0.26
May-July 2021	410	0.83 (0.64-1.08)	0.16
Madagascar			
May-July 2019	2100	1	-
May-July 2020	3695	1.76 (1.17-2.64)	0.007
Mauritius			
May-July 2019	587	1	-
May-July 2020	593	1.01 (0.95-1.08)	0.74
May-July 2021	595	1.01 (0.95-1.08)	0.66
Mozambique			
May-July 2019	3573	1	-
May-July 2020	3983	1.11 (1.04-1.19)	0.001

Time period/Country	Mean monthly number of c-sections	Relative change (95% confidence interval)	p-value
Namibia			
May-July 2019	971	1	-
May-July 2020	1159	1.19 (1.05-1.35)	0.006
South Africa			
May-July 2019	23987	1	-
May-July 2020	24993	1.04 (1.01-1.07)	0.008
May-July 2021	25512	1.06 (1.03-1.10)	<0.001
Tanzania			
May-July 2019	15294	1	-
May-July 2020	14053	0.92 (0.87-0.97)	0.002
Uganda			
May-July 2019	11863	1	-
May-July 2020	12245	1.03 (0.97-1.09)	0.28
May-July 2021	13044	1.10 (1.04-1.16)	0.001
Zambia			
May-July 2019	3926	1	-
May-July 2020	4074	1.04 (0.96-1.12)	0.36
May-July 2021	3493	0.89 (0.82-0.96)	0.004
Zimbabwe			
May-July 2019	2983	1	-
May-July 2020	2184	0.73 (0.66-0.81)	<0.001
May-July 2021	2702	0.91 (0.82-1.00)	0.05

SUPPLEMENTARY TABLE 12

Relative change in the mean monthly number of pregnant women attending antenatal care who were tested for HIV in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of pregnant women attending ANC who were tested for HIV	Relative change (95% confidence interval)	p-value
Comoros			
May-July 2019	578	1	-
May-July 2020	461	0.80 (0.58-1.10)	0.16
DRC			
May-July 2019	106020	1	-
May-July 2020	120758	1.14 (1.07-1.21)	<0.001
Eswatini			
May-July 2019	2407	1	-
May-July 2020	2167	0.90 (0.82-0.99)	0.04
Ethiopia			
May-July 2019	182366	1	-
May-July 2020	176130	0.97 (0.91-1.02)	0.23
Lesotho			
May-July 2019	2579	1	-
May-July 2020	2402	0.93 (0.74-1.17)	0.55
May-July 2021	2352	0.91 (0.72-1.15)	0.43
Madagascar			
May-July 2019	25957	1	-
May-July 2020	17678	0.68 (0.56-0.83)	<0.001
Mozambique			
May-July 2019	139389	1	-
May-July 2020	132774	0.95 (0.86-1.05)	0.33
May-July 2021	141888	1.02 (0.92-1.12)	0.72
Namibia			
May-July 2019	6836	1	-

Time period/Country	Mean monthly number of pregnant women attending ANC who were tested for HIV	Relative change (95% confidence interval)	p-value
May-July 2020	7454	1.09 (0.94-1.26)	0.24
May-July 2021	6451	0.94 (0.82-1.09)	0.43
South Africa			
May-July 2019	73465	1	-
May-July 2020	73419	1.00 (0.90-1.11)	0.99
May-July 2021	70571	0.96 (0.86-1.07)	0.47
Tanzania			
May-July 2019	191773	1	-
May-July 2020	189008	0.99 (0.91-1.07)	0.74
Uganda			
May-July 2019	151856	1	-
May-July 2020	162202	1.07 (0.99-1.16)	0.10
May-July 2021	153176	1.01 (0.93-1.09)	0.83
Zambia			
May-July 2019	52899	1	-
May-July 2020	48814	0.92 (0.81-1.05)	0.21
May-July 2021	45885	0.87 (0.77-0.98)	0.03
Zimbabwe			
May-July 2019	41708	1	-
May-July 2020	41665	1.00 (0.84-1.18)	0.99
May-July 2021	41248	0.99 (0.83-1.17)	0.90

SUPPLEMENTARY TABLE 13

Relative change in the mean monthly number of pregnant women living with HIV who received antiretroviral medicines to reduce the risk of mother-to-child transmission in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of pregnant women living with HIV who received antiretroviral medicines to reduce the risk of MTCT	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	622	1	-
May-July 2020	618	0.99 (0.89-1.12)	0.91
Eswatini			
May-July 2019	704	1	-
May-July 2020	709	1.01 (0.92-1.10)	0.88
Ethiopia			
May-July 2019	494	1	-
May-July 2020	563	1.14 (0.94-1.38)	0.18
Lesotho			
May-July 2019	673	1	-
May-July 2020	609	0.90 (0.74-1.11)	0.33
May-July 2021	546	0.81 (0.66-0.99)	0.04
Madagascar			
May-July 2019	114	1	-
May-July 2020	138	1.21 (0.94-1.55)	0.13
Mozambique			
May-July 2019	9285	1	-
May-July 2020	9590	1.03 (0.95-1.13)	0.47
May-July 2021	9725	1.05 (0.96-1.14)	0.30
Namibia			
May-July 2019	1089	1	-
May-July 2020	1200	1.10 (0.98-1.24)	0.10
May-July 2021	1005	0.92 (0.82-1.04)	0.18

Time period/Country	Mean monthly number of pregnant women living with HIV who received antiretroviral medicines to reduce the risk of MTCT	Relative change (95% confidence interval)	p-value
South Africa			
May-July 2019	22791	1	-
May-July 2020	22780	1.00 (0.89-1.12)	0.99
May-July 2021	20828	0.91 (0.82-1.02)	0.12
Zambia			
May-July 2019	4264	1	-
May-July 2020	4319	1.01 (0.93-1.11)	0.77
May-July 2021	3810	0.89 (0.82-0.98)	0.01
Zimbabwe			
May-July 2019	4551	1	-
May-July 2020	4553	1.00 (0.91-1.10)	0.99

SUPPLEMENTARY TABLE 14

Relative change in the mean monthly number of HIV exposed infants who receive a virological test for HIV within two months in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of HIV exposed infants who receive a virological test for HIV within two months	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	598	1	-
May-July 2020	630	1.05 (0.99-1.12)	0.11
Eswatini			
May-July 2019	863	1	-
May-July 2020	649	0.75 (0.66-0.86)	<0.001
Ethiopia			
May-July 2019	940	1	-
May-July 2020	788	0.84 (0.63-1.12)	0.24
Lesotho			
May-July 2019	610	1	-
May-July 2020	479	0.79 (0.68-0.91)	0.001
May-July 2021	491	0.81 (0.69-0.93)	0.004
Mozambique			
May-July 2019	6187	1	-
May-July 2020	6625	1.07 (1.01-1.13)	0.02
May-July 2021	7849	1.27 (1.20-1.34)	<0.001
Namibia			
May-July 2019	884	1	-
May-July 2020	900	1.02 (0.84-1.23)	0.85
May-July 2021	772	0.87 (0.72-1.06)	0.17
Zambia			
May-July 2019	8976	1	-
May-July 2020	9551	1.06 (0.93-1.22)	0.38
May-July 2021	5463	0.61 (0.53-0.70)	<0.001


PNC BED 3
88
Welch Allyn

Appendix 7: COVID-19 and number of births

SUPPLEMENTARY TABLE 15

Relative change in the mean monthly number of facility births in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of facility births	Relative change (95% confidence interval)	p-value
Comoros			
May-July 2019	1234	1	-
May-July 2020	1390	1.13 (1.01-1.26)	0.04
DRC			
May-July 2019	291702	1	-
May-July 2020	324371	1.11 (1.05-1.17)	<0.001
Eswatini			
May-July 2019	2276	1	-
May-July 2020	2350	1.03 (0.85-1.25)	0.74
Ethiopia			
May-July 2019	172172	1	-
May-July 2020	176729	1.03 (0.96-1.10)	0.43
Lesotho			
May-July 2019	2455	1	-
May-July 2020	2385	0.97 (0.84-1.12)	0.70
May-July 2021	2291	0.93 (0.81-1.08)	0.36
Madagascar			
May-July 2019	27691	1	-
May-July 2020	31285	1.13 (1.10-1.16)	<0.001

Time period/Country	Mean monthly number of facility births	Relative change (95% confidence interval)	p-value
Mauritius			
May-July 2019	1173	1	-
May-July 2020	1248	1.06 (0.96-1.18)	0.24
May-July 2021	1178	1.00 (0.91-1.11)	0.94
Mozambique			
May-July 2019	94315	1	-
May-July 2020	94984	1.01 (0.98-1.03)	0.60
May-July 2021	104338	1.11 (1.08-1.14)	<0.001
Namibia			
May-July 2019	6643	1	-
May-July 2020	7246	1.09 (1.01-1.18)	0.03
May-July 2021	7090	1.07 (0.98-1.16)	0.11
South Africa			
May-July 2019	86174	1	-
May-July 2020	89809	1.04 (1.01-1.07)	0.002
May-July 2021	89874	1.04 (1.02-1.07)	0.002
Tanzania			
May-July 2019	148634	1	-
May-July 2020	148967	1.00 (0.97-1.03)	0.88
Uganda			
May-July 2019	99220	1	-
May-July 2020	100525	1.01 (0.97-1.06)	0.58
May-July 2021	116741	1.18 (1.12-1.23)	<0.001
Zambia			
May-July 2019	50268	1	-
May-July 2020	46609	0.93 (0.89-0.96)	<0.001
May-July 2021	44517	0.89 (0.85-0.92)	<0.001
Zimbabwe			
May-July 2019	32663	1	-
May-July 2020	30177	0.92 (0.90-0.95)	<0.001
May-July 2021	31153	0.95 (0.93-0.98)	<0.001

SUPPLEMENTARY TABLE 16

Relative change in the mean monthly number of home births in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of home births	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	18710	1	-
May-July 2020	17825	0.95 (0.93-0.97)	<0.001
Eswatini			
May-July 2019	74	1	-
May-July 2020	105	1.43 (1.16-1.75)	<0.001
Lesotho			
May-July 2019	121	1	-
May-July 2020	145	1.20 (0.83-1.72)	0.33
May-July 2021	113	0.93 (0.65-1.35)	0.71
Mozambique			
May-July 2019	1144	1	-
May-July 2020	1203	1.05 (0.90-1.23)	0.53
May-July 2021	1101	0.96 (0.82-1.13)	0.63
Namibia			
May-July 2019	186	1	-
May-July 2020	203	1.09 (0.93-1.28)	0.28
May-July 2021	227	1.22 (1.04-1.43)	0.01
South Africa			
May-July 2019	3840	1	-
May-July 2020	4051	1.05 (1.01-1.10)	0.02
May-July 2021	4591	1.20 (1.15-1.25)	<0.001
Tanzania			
May-July 2019	4016	1	-
May-July 2020	4147	1.03 (0.91-1.17)	0.61

Time period/Country	Mean monthly number of home births	Relative change (95% confidence interval)	p-value
Zambia			
May-July 2019	2973	1	-
May-July 2020	2717	0.91 (0.74-1.13)	0.40
May-July 2021	1810	0.61 (0.49-0.75)	<0.001
Zimbabwe			
May-July 2019	2423	1	-
May-July 2020	2906	1.20 (1.06-1.36)	0.004
May-July 2021	2387	0.99 (0.87-1.12)	0.81

SUPPLEMENTARY TABLE 17

Relative change in the mean monthly number of live births in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of live births	Relative change (95% confidence interval)	p-value
Comoros			
May-July 2019	1368	1	-
May-July 2020	1382	1.01 (0.90-1.13)	0.87
DRC			
May-July 2019	285616	1	-
May-July 2020	311353	1.09 (1.07-1.11)	<0.001
Eswatini			
May-July 2019	2216	1	-
May-July 2020	2290	1.03 (0.86-1.25)	0.73
Ethiopia			
May-July 2019	179517	1	-
May-July 2020	184641	1.03 (0.97-1.10)	0.39
Lesotho			
May-July 2019	2303	1	-
May-July 2020	2165	0.94 (0.83-1.07)	0.34
May-July 2021	2266	0.98 (0.87-1.12)	0.80
Madagascar			
May-July 2019	27691	1	-
May-July 2020	31285	1.13 (1.10-1.16)	<0.001
Mauritius			
May-July 2019	1163	1	-
May-July 2020	1238	1.06 (0.96-1.18)	0.24
May-July 2021	1171	1.01 (0.91-1.12)	0.89
Mozambique			
May-July 2019	95459	1	-
May-July 2020	96187	1.01 (0.44-2.31)	0.99

Time period/Country	Mean monthly number of live births	Relative change (95% confidence interval)	p-value
May-July 2021	73598	0.77 (0.34-1.76)	0.54
Namibia			
May-July 2019	6674	1	-
May-July 2020	7260	1.09 (1.03-1.15)	0.005
May-July 2021	7316	1.10 (1.03-1.16)	0.002
South Africa			
May-July 2019	84510	1	-
May-July 2020	88073	1.04 (1.01-1.07)	0.003
May-July 2021	88065	1.04 (1.01-1.07)	0.003
Tanzania			
May-July 2019	146916	1	-
May-July 2020	143611	0.98 (0.94-1.01)	0.20
Uganda			
May-July 2019	97231	1	-
May-July 2020	98562	1.01 (0.97-1.06)	0.54
May-July 2021	114913	1.18 (1.13-1.23)	<0.001
Zambia			
May-July 2019	49634	1	-
May-July 2020	45924	0.93 (0.89-0.96)	<0.001
May-July 2021	43939	0.89 (0.85-0.92)	<0.001
Zimbabwe			
May-July 2019	35086	1	-
May-July 2020	33083	0.94 (0.92-0.97)	<0.001
May-July 2021	33540	0.96 (0.93-0.98)	0.002

Appendix 8: COVID-19 and maternal outcomes

SUPPLEMENTARY TABLE 18

Relative change in the mean monthly number of maternal deaths in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of maternal deaths	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	252	1	-
May-July 2020	267	1.06 (0.96-1.17)	0.25
Ethiopia			
May-July 2019	87	1	-
May-July 2020	74	0.84 (0.61-1.16)	0.30
Mozambique			
May-July 2019	78	1	-
May-July 2020	59	0.76 (0.58-0.99)	0.04
May-July 2021	59	0.75 (0.57-0.99)	0.04
South Africa			
May-July 2019	77	1	-
May-July 2020	106	1.39 (1.07-1.80)	0.01
May-July 2021	125	1.63 (1.26-2.11)	<0.001
Tanzania			
May-July 2019	139	1	-
May-July 2020	134	0.97 (0.84-1.11)	0.65
Uganda			
May-July 2019	85	1	-

Time period/Country	Mean monthly number of maternal deaths	Relative change (95% confidence interval)	p-value
May-July 2020	107	1.26 (1.07-1.49)	0.005
Zambia			
May-July 2019	52	1	-
May-July 2020	103	1.98 (1.53-2.56)	<0.001
May-July 2021	122	2.34 (1.81-3.02)	<0.001
Zimbabwe			
May-July 2019	33	1	-
May-July 2020	39	1.17 (0.90-1.53)	0.25
May-July 2021	40	1.19 (0.91-1.55)	0.20

Appendix 9: COVID-19 and neonatal outcomes

SUPPLEMENTARY TABLE 19

Relative change in the mean monthly number of stillbirths in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of stillbirths	Relative change (95% confidence interval)	p-value
Comoros			
May-July 2019	25	1	-
May-July 2020	26	1.03 (0.67-1.56)	0.90
DRC			
May-July 2019	3555	1	-
May-July 2020	3857	1.08 (1.01-1.16)	0.02
Eswatini			
May-July 2019	60	1	-
May-July 2020	60	0.99 (0.74-1.34)	0.97
Ethiopia			
May-July 2019	2430	1	-
May-July 2020	2847	1.17 (1.03-1.34)	0.02
Lesotho			
May-July 2019	55	1	-
May-July 2020	50	0.90 (0.67-1.20)	0.47
May-July 2021	37	0.66 (0.49-0.90)	0.009
Mozambique			
May-July 2019	1215	1	-
May-July 2020	1202	0.99 (0.91-1.08)	0.82
May-July 2021	1175	0.97 (0.89-1.06)	0.46

Time period/Country	Mean monthly number of stillbirths	Relative change (95% confidence interval)	p-value
Namibia			
May-July 2019	123	1	-
May-July 2020	123	0.99 (0.83-1.19)	0.95
May-July 2021	122	0.99 (0.83-1.18)	0.91
South Africa			
May-July 2019	1664	1	-
May-July 2020	1735	1.04 (1.00-1.09)	0.05
May-July 2021	1809	1.09 (1.04-1.13)	<0.001
Tanzania			
May-July 2019	1640	1	-
May-July 2020	1438	0.88 (0.79-0.97)	0.01
Uganda			
May-July 2019	1723	1	-
May-July 2020	1682	0.98 (0.91-1.05)	0.50
May-July 2021	1837	1.07 (0.99-1.14)	0.08
Zambia			
May-July 2019	632	1	-
May-July 2020	686	1.08 (0.93-1.27)	0.31
May-July 2021	578	0.91 (0.78-1.07)	0.26
Zimbabwe			
May-July 2019	563	1	-
May-July 2020	601	1.07 (0.98-1.16)	0.12
May-July 2021	589	1.04 (0.96-1.13)	0.29

SUPPLEMENTARY TABLE 20

Relative change in the mean monthly number of live births <2500g in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of live births <2500g	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	14550	1	-
May-July 2020	15744	1.08 (0.99-1.18)	0.07
Eswatini			
May-July 2019	176	1	-
May-July 2020	125	0.71 (0.57-0.89)	0.003
Ethiopia			
May-July 2019	2633	1	-
May-July 2020	2575	0.98 (0.89-1.08)	0.66
Lesotho			
May-July 2019	332	1	-
May-July 2020	276	0.83 (0.59-1.17)	0.29
May-July 2021	265	0.80 (0.57-1.12)	0.20
Madagascar			
May-July 2019	1230	1	-
May-July 2020	1402	1.14 (1.07-1.21)	<0.001
Mauritius			
May-July 2019	207	1	-
May-July 2020	221	1.06 (0.95-1.19)	0.26
May-July 2021	209	1.01 (0.90-1.12)	0.91
Mozambique			
May-July 2019	2469	1	-
May-July 2020	2380	0.96 (0.90-1.03)	0.31
May-July 2021	2467	1.00 (0.93-1.07)	0.99
Namibia			
May-July 2019	633	1	-

Time period/Country	Mean monthly number of live births <2500g	Relative change (95% confidence interval)	p-value
May-July 2020	696	1.10 (1.03-1.17)	0.003
May-July 2021	700	1.11 (1.04-1.18)	0.001
South Africa			
May-July 2019	10881	1	-
May-July 2020	10671	0.98 (0.94-1.03)	0.41
May-July 2021	11397	1.05 (1.00-1.10)	0.05
Tanzania			
May-July 2019	6644	1	-
May-July 2020	6359	0.96 (0.87-1.05)	0.35
Uganda			
May-July 2019	5419	1	-
May-July 2020	5913	1.09 (1.05-1.13)	<0.001
May-July 2021	5985	1.10 (1.06-1.15)	<0.001
Zambia			
May-July 2019	5733	1	-
May-July 2020	5586	0.97 (0.92-1.03)	0.36
May-July 2021	4124	0.72 (0.68-0.76)	<0.001
Zimbabwe			
May-July 2019	2990	1	-
May-July 2020	2494	0.83 (0.75-0.92)	<0.001
May-July 2021	2630	0.88 (0.79-0.97)	0.01

SUPPLEMENTARY TABLE 21

Relative change in the mean monthly number of newborn deaths in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of newborn deaths	Relative change (95% confidence interval)	p-value
Ethiopia			
May-July 2019	652	1	-
May-July 2020	606	0.93 (0.74-1.16)	0.53
Mozambique			
May-July 2019	375	1	-
May-July 2020	326	0.87 (0.65-1.17)	0.36
May-July 2021	374	1.00 (0.74-1.34)	0.98
Namibia			
May-July 2019	66	1	-
May-July 2020	64	0.97 (0.75-1.26)	0.82
May-July 2021	63	0.96 (0.74-1.25)	0.76
South Africa			
May-July 2019	1009	1	-
May-July 2020	1074	1.06 (0.99-1.14)	0.08
May-July 2021	1050	1.04 (0.97-1.12)	0.25
Tanzania			
May-July 2019	409	1	-
May-July 2020	328	0.80 (0.73-0.88)	<0.001
Zambia			
May-July 2019	295	1	-
May-July 2020	291	0.99 (0.72-1.35)	0.93
May-July 2021	123	0.42 (0.30-0.58)	<0.001
Zimbabwe			
May-July 2019	715	1	-
May-July 2020	548	0.77 (0.67-0.87)	<0.001
May-July 2021	599	0.84 (0.74-0.95)	0.007

Appendix 10: COVID-19 and child outcomes

SUPPLEMENTARY TABLE 22

Relative change in the mean monthly number of deaths to children <5 years in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of deaths to children <5 years	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	3807	1	-
May-July 2020	3508	0.92 (0.84-1.01)	0.08
Mozambique			
May-July 2019	535	1	-
May-July 2020	461	0.86 (0.76-0.98)	0.02
May-July 2021	544	1.02 (0.90-1.15)	0.78
Namibia			
May-July 2019	143	1	-
May-July 2020	118	0.82 (0.70-0.97)	0.02
May-July 2021	121	0.85 (0.72-0.99)	0.04
South Africa			
May-July 2019	1424	1	-
May-July 2020	1374	0.97 (0.55-1.68)	0.90
May-July 2021	2578	1.81 (1.04-3.15)	0.04
Tanzania			
May-July 2019	864	1	-
May-July 2020	694	0.80 (0.68-0.94)	0.008
Zambia			
May-July 2019	177	1	-
May-July 2020	348	1.97 (1.60-2.43)	<0.001
May-July 2021	307	1.74 (1.41-2.15)	<0.001

SUPPLEMENTARY TABLE 23

Relative change in the mean monthly number of malaria cases in children <5 years in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of malaria cases <5 years	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	859315	1	-
May-July 2020	879438	1.02 (0.98-1.07)	0.32
Ethiopia			
May-July 2019	17078	1	-
May-July 2020	18128	1.06 (0.84-1.35)	0.62
Madagascar			
May-July 2019	23625	1	-
May-July 2020	53486	2.26 (1.69-3.03)	<0.001
Mozambique			
May-July 2019	334240	1	-
May-July 2020	274118	0.82 (0.66-1.02)	0.07
May-July 2021	275380	0.82 (0.66-1.02)	0.08
Namibia			
May-July 2019	31	1	-
May-July 2020	86	2.76 (0.74-10.30)	0.13
May-July 2021	61	1.95 (0.52-7.30)	0.32
Tanzania			
May-July 2019	265869	1	-
May-July 2020	243275	0.92 (0.85-0.99)	0.02
Zambia			
May-July 2019	133244	1	-
May-July 2020	170406	1.28 (0.76-2.16)	0.36
May-July 2021	117837	0.88 (0.52-1.50)	0.65
Zimbabwe			
May-July 2019	2327	1	-
May-July 2020	2196	0.94 (0.35-2.58)	0.91
May-July 2021	604	0.26 (0.10-0.71)	0.009

SUPPLEMENTARY TABLE 24

Relative change in the mean monthly number of pneumonia cases in children <5 years in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly number of pneumonia cases <5 years	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	303138	1	-
May-July 2020	296434	0.98 (0.96-1.00)	0.06
Eswatini			
May-July 2019	109	1	-
May-July 2020	61	0.56 (0.46-0.69)	<0.001
Ethiopia			
May-July 2019	102677	1	-
May-July 2020	98509	0.96 (0.90-1.02)	0.21
Lesotho			
May-July 2019	940	1	-
May-July 2020	154	0.16 (0.10-0.27)	<0.001
May-July 2021	363	0.39 (0.23-0.64)	<0.001
Madagascar			
May-July 2019	4851	1	-
May-July 2020	4197	0.87 (0.76-0.99)	0.03
Mozambique			
May-July 2019	69714	1	-
May-July 2020	55115	0.79 (0.73-0.86)	<0.001
May-July 2021	293741	4.21 (3.89-4.56)	<0.001
Namibia			
May-July 2019	1248	1	-
May-July 2020	1461	1.17 (0.57-2.39)	0.66
May-July 2021	794	0.64 (0.31-1.30)	0.22

Time period/Country	Mean monthly number of pneumonia cases <5 years	Relative change (95% confidence interval)	p-value
South Africa			
May-July 2019	14495	1	-
May-July 2020	3664	0.25 (0.19-0.34)	<0.001
May-July 2021	8813	0.61 (0.46-0.81)	<0.001
Uganda			
May-July 2019	45512	1	-
May-July 2020	5846	0.13 (0.10-0.17)	<0.001
May-July 2021	10229	0.22 (0.17-0.29)	<0.001
Zimbabwe			
May-July 2019	50940	1	-
May-July 2020	13111	0.26 (0.18-0.37)	<0.001
May-July 2021	29370	0.58 (0.40-0.83)	0.003

SUPPLEMENTARY TABLE 25

Relative change in the mean monthly number of diarrhoea cases in children <5 years in May-July 2020 and May-July 2021, compared to May-July 2019

Time period/Country	Mean monthly Number of diarrhoea cases <5 years	Relative change (95% confidence interval)	p-value
DRC			
May-July 2019	250181	1	-
May-July 2020	261408	1.04 (1.01-1.08)	0.006
Eswatini			
May-July 2019	2187	1	-
May-July 2020	1734	0.79 (0.59-1.06)	0.12
Ethiopia			
May-July 2019	108581	1	-
May-July 2020	121253	1.12 (1.05-1.19)	0.00034
Lesotho			
May-July 2019	548	1	-
May-July 2020	168	0.31 (0.19-0.50)	<0.001
May-July 2021	415	0.76 (0.47-1.22)	0.25
Madagascar			
May-July 2019	26139	1	-
May-July 2020	26375	1.01 (0.82-1.24)	0.93
Mauritius			
May-July 2019	1483	1	-
May-July 2020	536	0.36 (0.25-0.51)	<0.001
May-July 2021	490	0.33 (0.23-0.47)	<0.001
Mozambique			
May-July 2019	22364	1	-
May-July 2020	15073	0.67 (0.53-0.86)	0.002
May-July 2021	18360	0.82 (0.64-1.05)	0.12

Time period/Country	Mean monthly Number of diarrhoea cases <5 years	Relative change (95% confidence interval)	p-value
Namibia			
May-July 2019	17285	1	-
May-July 2020	9414	0.54 (0.47-0.63)	<0.001
May-July 2021	10183	0.59 (0.51-0.68)	<0.001
South Africa			
May-July 2019	2775	1	-
May-July 2020	843	0.30 (0.26-0.35)	<0.001
May-July 2021	2981	1.07 (0.93-1.24)	0.34
Tanzania			
May-July 2019	120102	1	
May-July 2020	89963	0.75 (0.66-0.85)	<0.001
Zambia			
May-July 2019	59831	1	-
May-July 2020	41667	0.70 (0.61-0.79)	<0.001
May-July 2021	34462	0.58 (0.51-0.65)	<0.001

2gether 4SRHR

Sweden Sverige

UNFPA

unicef

World Health Organization