THE IMPACT OF COVID-19 ON CONTRACEPTIVE SUPPLIES THROUGH PRIVATE SECTOR PHARMACIES

Analysis of Data from Brazil, Côte d'Ivoire and the Philippines

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MOMENTUM A Global Partnership for Health and Resilience

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ABBREVIATIONS

ACTS	Accuracy and Timeliness Statistics
AIMAS	Agence Ivoirienne de Marketing Social
ARIMA	Auto-regressive Integrated Moving Average
BCP	Bayesian Analysis of Change Point Problems
COCs	Combined Oral Contraceptive Pills
COVID-19	Coronavirus Disease 2019
CYP	Couple-Years of Protection
ECPs	Emergency Contraceptive Pills
FP	Family Planning
MAPE	Mean Absolute Percentage Error
mCPR	Modern Contraceptive Prevalence Rate
OCPs	Oral Contraceptive Pills
POPs	Progestin Only Pills
PSI	Population Services International
R	A language and environment for statistical computing
sMAPE	Symmetric Mean Absolute Percentage Error
SMO	Social Marketing Organization
UNFPA	United Nations Family Planning Association
USAID	United States Agency for International Development
WHO	World Health Organization

INTRODUCTION

BOX 1. KEY MESSAGES

- The private sector plays a key role in delivering family planning (FP) services in many countries, and to date, the impact of COVID-19 on private sector FP services has been relatively unknown.
- The approach used by MOMENTUM in this analysis provides a snapshot of how global shocks like COVID-19 affect local sales of contraceptives in the private sector by using retail pharmacy data collected by IQVIA.
- Our results found limited impacts, showing that COVID-19 did not have a significant or lasting effect on retail pharmacy sales of contraceptives, and suggesting that the private sector FP markets in the three countries studied demonstrated a measure of resilience.
- With data like this, stewards of mixed health systems may be able to better understand how private sector actors may be leveraged and mobilized for future health emergencies.

Early in the COVID-19 pandemic there were concerns of potential disruptions to continuity of family planning (FP) services given restrictions in movement, overloaded health care systems, and fear of contracting COVID-19 while accessing services (Weinberger, Hayes, White & Skibiak, 2020). Prior analysis of the impact of the COVID-19 pandemic in 2020 on (primarily public sector) FP services in low- and middle-income countries suggests at most a limited, short-term impact, with some countries reporting little or no impact with modern Contraceptive Prevalence Rates (mCPR) continuing to rise (UNFPA, 2021; Backhaus, 2022). The impact of the pandemic on the supply of modern contraceptives through the private sector in low- and middle-income countries is less well understood, as studies have tended to draw on public sector data or data from particular institutions (Polis, et al., 2022).

In addition, private sector impacts may be distinct from those seen in the public sector. Most women sourcing their methods from the private sector are using methods that require no or little direct interaction with a healthcare provider (Weinberger, et al., 2021). These methods are referred to as "self-care" methods, defined by the WHO as "the ability of individuals, families and communities to promote health, prevent disease, maintain health, and cope with illness and disability with or without the support of a healthcare provider" (WHO, 2019). Previous work theorized that the private sector was likely to be *less* severely disrupted by COVID-19 than the public sector due to a larger presence of self-care methods, and that private sector use may even increase if women shifted to self-care methods when clinical services were disrupted (Weinberger, Hayes, White, & Skibiak, 2020). By contrast, others have suggested the private sector may be *more* impacted due to economic shifts impacting the ability of users to pay out-of-pocket. For example, one paper estimated impact in Latin America by studying the impact of macroeconomic fluctuations on private sector sales and extrapolating accordingly (United Nations Population Fund, 2020).

Some analysis has been conducted on the impact of COVID-19 on private sector contraceptive markets. A paper analyzing data from across the public and private sectors in Brazil for 2019 and 2020 suggested that, in Brazil, sales across the public and private sectors of injectable contraceptives and Emergency Contraceptive Pills (ECPs) increased for a short period of time at the beginning of the pandemic period. Sales of oral contraceptives, the dominant method, remained unchanged, and sales of levonorgestrel-intrauterine devices and etonogestrel implants initially declined but then rose again (Charles, Munezero, Bahamondes, & Pacagnella, 2022). A cross-country analysis of contraceptive retail data found minimal declines in contraceptive utilization during the first quarter of the COVID-19 pandemic relative to the previous year's

quarter (Qato, Shooshtari, Guadamuz, Ferguson & Harrison, 2022). Surveys conducted by the USAID-funded Research for Scalable Solutions (R4S) project in Malawi, Nepal, Niger, and Uganda asked modern contraceptive users the source of supply for their method before the COVID-19 pandemic and during the pandemic period. The private sector maintained a similar market share across all four countries (R4S, 2022).

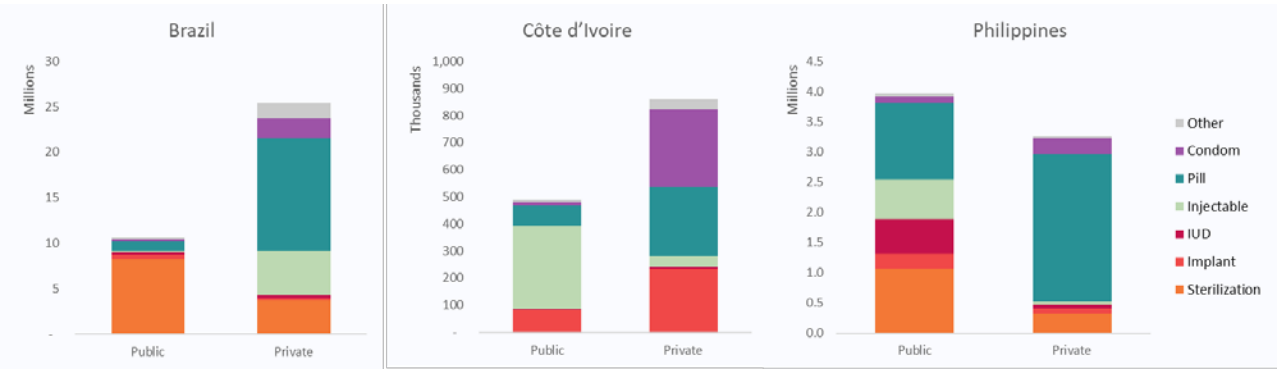
The analysis presented in this paper contributes to furthering our understanding of what, if any, impact COVID-19 may have had on private sector contraceptive markets. However, as countries grapple with improving their emergency health system preparedness in the wake of COVID-19, it will be important to understand more about how the private health sector weathered the effects and how it may be mobilized in future emergencies (Tessema GA, 2021). This analysis was conducted for the USAID-funded MOMENTUM Private Healthcare Delivery (MOMENTUM) project, which harnesses the potential of the private sector to expand access to and use of high-quality, evidence-based maternal/neonatal/child health, voluntary FP and reproductive health services. The project collaborates with governments, local organizations, communities, and private providers in all their forms—including private clinics, faith-based clinics, pharmacies, and drug shops—to generate market-based solutions that drive scale in service delivery and long-term sustainability of health coverage and outcomes.

In this work, MOMENTUM leverages IQVIA's retail pharmacy audits, which capture monthly data on volumes of pharmaceuticals sold in select markets, including contraceptives. These data are uniquely positioned to provide detailed time trends of private sector sales volumes and have been leveraged in the past to detect FP market changes, including the impact of a nursing strike in Kenya (Stephens & Alam, 2021a), and disruptions to both public and private sector supplies following the end of the 2017 public sector contract in South Africa (Stephens & Alam, 2021b). However, the methodology used for this analysis differs from this previous work.

For this analysis, we examine the supply of modern contraceptives through retail pharmacies in three countries. We re-examine the trends in Brazil (an upper-middle-income and USAID Population and Reproductive Health [PRH] graduated country) using a longer time series and different statistical approach than that used in the above-mentioned paper. We review sales of modern contraceptives through private sector pharmacies in Côte d'Ivoire (a lower-middle-income and a USAID PRH-assisted country) and the Philippines (a lower-middle-income and USAID PRH priority country). These countries were selected based on availability of IQVIA data and potential to see COVID-19 impacts across a range of different settings, such as pandemic severity and response, level of contraceptive use, size of the private sector market, and financing models. Over the course of the entire pandemic, Brazil reported a total of 174,000 COVID-19 cases per million, as compared to only 3,000 in Cote d'Ivoire and 36,000 in Philippines (Our World in Data, n.d.). We also reviewed the Oxford COVID-19 Government Response Tracker's Stringency Index, a composite measure of nine of the response metrics measured from 0 (none) to 100 (most), which scores countries on the strictness of their government's COVID-19 lockdown requirements such as closures for school, workplaces, etc. From March 15, 2020, through the end of 2021, the Index averaged 65 in Brazil, 33 in Cote d'Ivoire, and 75 in the Philippines (Oxford, n.d.).

In two of these countries (see Figure 1), the majority of women source modern contraceptives from the private sector (defined as any of pharmacies, other private sector retail outlets, clinics and/or hospitals), and in the third (the Philippines), the private sector supplies just under half (45%). Private sector users in Brazil and the Philippines most commonly rely on oral contraceptive pills (OCPs), while private sector use in Côte d'Ivoire is more evenly split across condoms, OCPs, and implants (Weinberger, et al., 2021).

FIGURE 1. CONTRACEPTIVE USE BY METHOD AND SECTOR, 2019



Source: Reproductive Health Supplies Coalition LEAP; note that pill includes both COCs and POPs while ECPs are included in "other"

This analysis focuses on a subset of the private contraceptive market in these countries, namely methods distributed through private sector pharmacies for which data are available under license from IQVIA. This includes the following methods: Combined Oral Contraceptives (COCs), Progestin-Only Pills (POPs), injectables and ECPs.[1] While other methods, including longer-acting methods, may be available in these markets through other FP providers, the analysis does not include them. Subsequently, its findings are not reflective of the entire private FP market in these countries.

For this analysis, we aimed to determine if there was a significant change in supplies through private sector pharmacies during the COVID-19 pandemic (approximately March 2020 onwards). The pandemic presents several challenges to identifying potential distribution to supplies. The pandemic has lasted for a protracted period, and we do not know when or how many disruptions to supplies may have occurred over this period. Effects may, moreover, be inconsistent over time or affect different methods at different times, and while we have some theories about the association between the pandemic and private sector contraceptive sales, we do not fully understand the causal mechanisms.

Given these challenges, we used an approach that relies on two complementary methodologies. We first employed a method that can identify potential breakpoints in the data and then used a conventional forecasting technique to determine the significance of identified changes. However, this approach had two limitations. First, some of our data did not meet the assumptions required to run breakpoint analysis. Second, breakpoint analysis detected disruptions independent of any assumptions about how or when COVID-19 may have affected supplies, and so changes can be difficult to associate with the pandemic. We therefore included a second analytical approach based on comparing forecasted and actual values across pandemic waves. If significant changes could be found that coincided with different waves of the pandemic, this argues that COVID-19 may have been the driver of the change in volumes. However, the absence of any such association does not disprove the hypothesis that COVID-19 was the driver of any changes detected, as there are other impacts that could not be measured in this study – such as changes in disposable income or disruptions to the global supply chain.

The overall methodology used for this analysis offers benefits over existing studies in providing insights into potential private sector market disruptions. It relies on IQVIA's proprietary data on sales (volumes) made to private sector retail outlets by pharmaceutical wholesalers. While Charles et al (2022) utilized similar data,

[1] No ECP sales data is available in the Philippines.

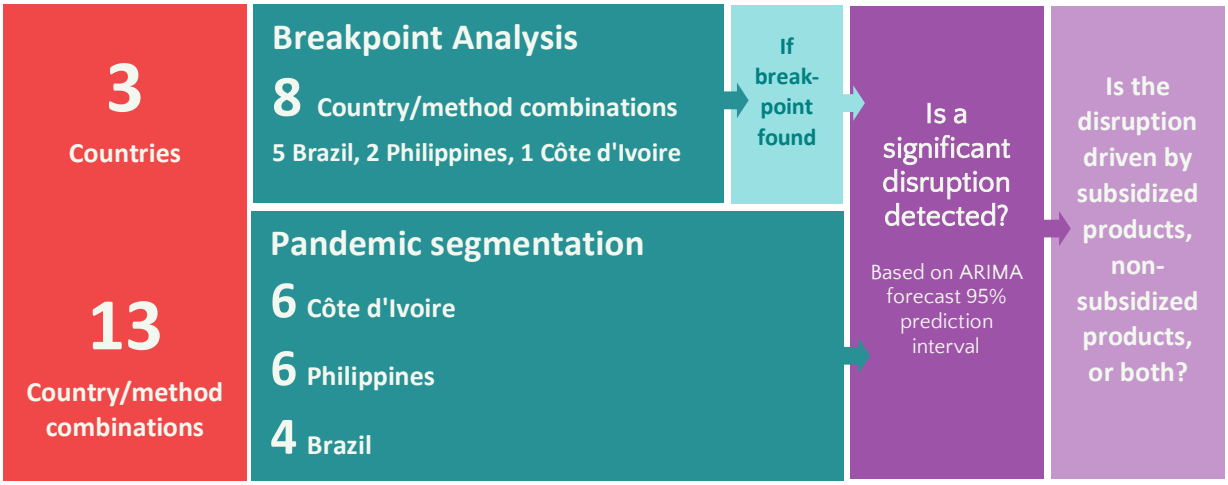
this analysis uses a longer time series and different statistical approaches that are more suited to detect statistically significant changes. Further, as sales data is regularly collected by IQVIA, this type of analysis can be done without large-scale new data collection efforts, such as the R4s consumer surveys (R4S, 2022), and therefore can provide relatively timely and cost-effective detection of market disruptions.

MOMENTUM's collaboration with IQVIA, and the analysis produced, provides lessons on leveraging private sector sales data and commercial partnerships to better understand the private FP market. Further, the methodology used holds promise in detecting disruptions (or lack thereof) to supplies in the private FP market, either from COVID-19 or other disruptions that share similar characteristics (protracted, multiple and inconsistent disruptions).

METHODOLOGY

A summary of the methodology can be seen in Figure 2 below. The data sources and statistical approaches used are described in more detail below, as well as in Annex 1.

FIGURE 2. VISUAL SUMMARY OF METHODOLOGY



DATA SOURCES

SALES VOLUMES

The primary input data used in this analysis were sales (volumes) made to private sector retail outlets by pharmaceutical wholesalers. Proprietary (not publicly available) data collected by IQVIA on a routine basis and aggregated to the month were used. IQVIA conducted the analysis of this data as part of an agreement for this project and, due to the proprietary nature of the data, only relative changes to volumes but not actual volume data are shown in this report. The reliability of these data as a reasonable approximation of market activity is believed to be high (ACTS, 2021; Personal Communication).

Data are collected at brand level but were grouped by FP method (e.g., all brands of COCs were grouped together) for this analysis. Brands were also identified that are offered at a subsidized price either under a formal government scheme, as in Brazil (Ministério da Saúde, 2021), or through social marketing or not-for-profit organizations in the Philippines and Côte d'Ivoire.[2] Separate analyses were carried out on subsidized and non-subsidized product volumes in the event that significant disruptions were found in total sales. In Brazil no analysis was carried out on the non-subsidized form of the 3-monthly injection as sales of this method were small and contained multiple zero sales, making forecasts unrealistic.

Analysis of potential disruption was conducted on sales volumes. In total, 13 different country/method combinations were included in the analysis (Table 1). These sales volumes were also converted into Couple-Years of Protection (CYP) in order to assess relative market share of different methods using standard conversion factors (USAID, n.d.).

TABLE 1. SUMMARY OF COUNTRY/METHOD COMBINATIONS INCLUDED

	Methods Included in Analysis	
Brazil†	1-monthly injectable 3-monthly injectable ECPs	COCs POPs
Philippines†	1-monthly injectable 3-monthly injectable	COCs POPs
Côte d'Ivoire‡	3-monthly injectable ECPs	COCs POPs

Note: no ECP sales data is available in the Philippines

† Analyses based on IQVIA MIDAS® Monthly Data January 2018-April 2022. Copyright IQVIA. All rights reserved

‡ Analyses based on IQVIA's FWA National Retail Audit for Côte d'Ivoire, January 2018-April 2022 Copyright IQVIA. All rights reserved

This analysis used data from January 2018 to April 2022. January 2018 was chosen as the start date in part because a Temporary Restraining Order restricting the sale and distribution of contraceptives impacted sales of contraceptives in the Philippines between June 2016 and November 2017 (Crisostomo, 2017). April 2022 was the latest data available from IQVIA at the time the analysis was conducted.

COVID-19 INDICATORS

If the pandemic affected sales of contraceptives, that effect may be related to various factors: the progression of the pandemic; government restrictions on normal activities; or how those restrictions affected the ability of people to access contraceptives. A range of different indicators related to COVID-19 were therefore considered for inclusion in the analysis (see Box 1).

The progression of the pandemic can be assessed through the number of COVID-19 cases and deaths in each country, which are published in a number of places (Our World in Data, n.d.). However, it appears likely that the number of cases as recorded is likely an under-estimate, in part due to policies affecting who should be tested, and in part to the availability of suitable tests at different times during the pandemic. Deaths may

[2] Brands linked to DKT in the Philippines include Depotrust (3-monthly injectable), Lady (COC), Trust (COC) and Daphne (POP), brands linked to DKT in Côte d'Ivoire include: Sayana Press (3-monthly injectable), and PostPill (ECP). For Côte d'Ivoire this also captured brands distributed by Agence Ivoirienne de Marketing Social (AIMAS).

therefore be a more reliable guide to the progress of the pandemic than cases, although deaths attributable to COVID-19 may also be an under- or over-estimate.

As noted in the Introduction, the potential impact of government restrictions is reflected in the Oxford COVID-19 Government Response Tracker's Stringency Index (Oxford, n.d.) a composite measure based on policies including school closures, workplace closures, and travel bans that rates Government responses on a scale from 0-100. Data is available for 187 countries worldwide. The Oxford Stringency Index derives a score relating to the number of restrictions on daily or working activities imposed by the government. The index however reflects only government policies and not how well these were enforced. The index may therefore over-estimate the impact of those restrictions on daily life. There is moreover nothing in the index that relates directly to the closure of private sector health facilities or pharmacies, and thus changes in the index may not be relevant to whether users were still able to access such outlets.

BOX 2. INDICATORS CONSIDERED TO CAPTURE COVID-19 IMPACT ON PRIVATE SECTOR CONTRACEPTIVE USE

Area	Indicator(s)
Progression of the pandemic	Number of cases or the number of deaths
Government restrictions on activities	Oxford COVID-19 Government Response Tracker's Stringency Index
Changes in ability to go out and collect contraceptives from private sector outlets	Google Mobility data on "pharmacies and grocers"

The impact of the pandemic or the associated government restrictions on how people move about and access services may be able to be ascertained from the Google Community Mobility Index (Google, n.d.). Google Mobility data has been collected for some time, but during the pandemic, the Google Community Mobility Index was made freely available. The Google Community Mobility Index tracks change over time in the number of visits to different types of locations; daily changes are benchmarked against the median number of visits for the same weekday (e.g., Monday) over the period of January 3 – February 6, 2020. The Google Community Mobility Index is based on tracking among people who are signed into their Google Account and have Location History and Location Reporting enabled. The default settings for mobile phones are set to "off," meaning that users who turn them on are doing so deliberately in order to share location data, so this dataset may not be representative, especially in settings with more limited smartphone use.

Google publishes the Mobility Index based on particular types of locations, for example parks, workplaces, retail and recreation. There is a grouping of grocery and pharmacy locations that was considered for this work, which includes: grocery markets, food warehouses, farmers markets, specialty food shops, drug stores, and pharmacies. However, it is impossible to disentangle pharmacy visits from other types of visits within this grouping, meaning that if changes at pharmacy level were not as profound or even similar to those in grocery stores, these differences would be masked. Google moreover advises caution in comparing locations across timeframes longer than 6 months. The Google Community Mobility Index may therefore not be appropriate for this analysis.

Based on the strengths and limitations of each data source it was determined that for the purposes of this analysis, data on the number of COVID-19 deaths was the more reliable and appropriate data to use.

STATISTICAL METHODS

The analytical plan was driven by the following key considerations:

(i) Previous work suggests that disruptions to product supplies may have been short-lived, with volumes not only recovering to, but rising above, previous levels so as to replenish supplies. Tools or tests that compare total predicted versus total actual sales aggregated over relatively long time periods may miss short-term disruptions.

(ii) The point at which supplies of products were disrupted is unknown, and there remained a risk that during the analysis, periods of disruption could be merged with periods of stability, so under-estimating the extent of change.

(iii) The dataset used in this study includes data from the beginning of the pandemic to April 2022, a period of 25 months. Forecasting for 25 months in the future is challenging, and differences between actual and predicted values occurring towards the end of the period are likely to be less "robust" than those detected earlier.

For all these reasons we sought first to define points at which disruption may have been more or less likely in order to avoid combining periods of disruption with periods of no disruption, and also to potentially shorten the forecast period. We defined these points of potential disruption using two different methods: (1) breakpoint analysis, and (2) examination of the progress of the pandemic, as described by the number of deaths attributed to COVID-19.

Breakpoint analysis looks to identify the point(s) at which sales in one period differ from the next. Breakpoint analysis has the advantage of being independent of any assumptions about how or when COVID-19 may have affected supplies. However, being independent of those assumptions, it can then be difficult to associate the changepoint identified with the different waves of the pandemic. Further, some of our data did not meet the assumptions required to run this statistical test, e.g., normal distribution and independence.

We therefore chose to add a second approach in order to identify disruptions that may be more directly linked to the progress of the pandemic, and that was suitable to apply to more of our dataset. We used the data on deaths attributable to COVID-19 to divide the pandemic period into periods or "segments" of at least 3 months in length (but segments varied in length).

Finally, potential points of disruption identified either by breakpoint analysis or by examination of pandemic periods served as cut-off points to generate forecasts. Forecasts were then compared to actual sales data to assess if changes were statistically significant, based on if the sum of actual sales for the period fell outside of the 95% prediction interval of the forecast. Forecasts were developed using Auto-regressive Integrated Moving Average (ARIMA) models, a standard and commonly used forecasting model (Kotu & Deshpande, 2019). More details on each of the analytical approaches can be found in Annex 1.

RESULTS SUMMARY

Overall, few changes during the period of COVID-19 were identified across the three countries. Most notably, no significant changes in COCs, the most commonly supplied method through private pharmacies in all three countries, were detected.

In **Côte d'Ivoire**, both subsidized and non-subsidized ECP volumes declined at the beginning of the pandemic period, although this may have been due to a change in behavior rather than a disruption to supply. Two changes to volumes of the 3-monthly injectables were identified; however, one change represented an increase and the other a decrease. Taken together this appears unlikely to represent disruption.

In the **Philippines,** one disruption to the volumes of the 1-monthly injectable was detected but given the low volumes of this method and the absence of any disruption to other contraceptive methods, this is unlikely to represent a meaningful change to supplies of modern contraceptives.

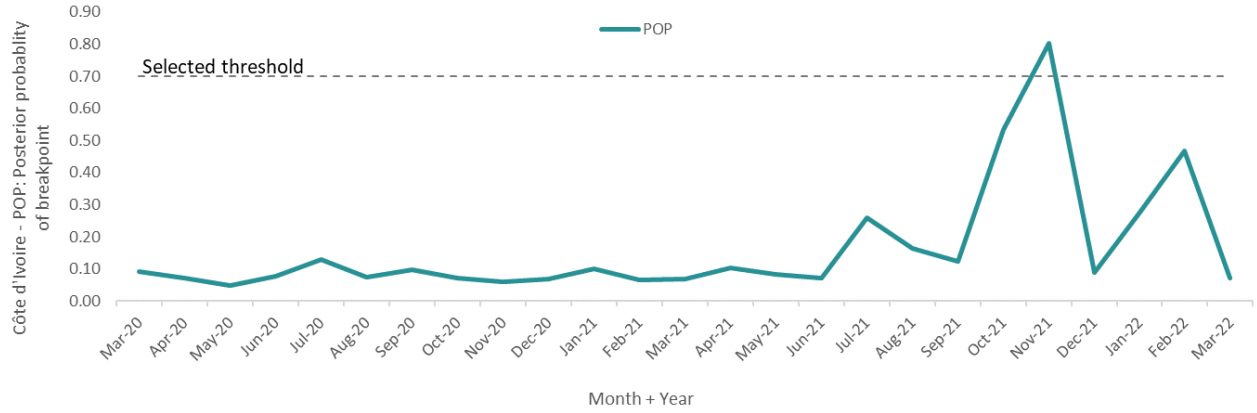
A significant change to volumes of POPs was detected in **Brazil**, but in this case a significant decline in sales in one month was followed by a significant increase in the next, suggesting that if there was disruption it was of a short duration. No other significant changes to volumes were detected in Brazil.

More detailed results from the two analyses are presented below.

BREAKPOINT ANALYSIS

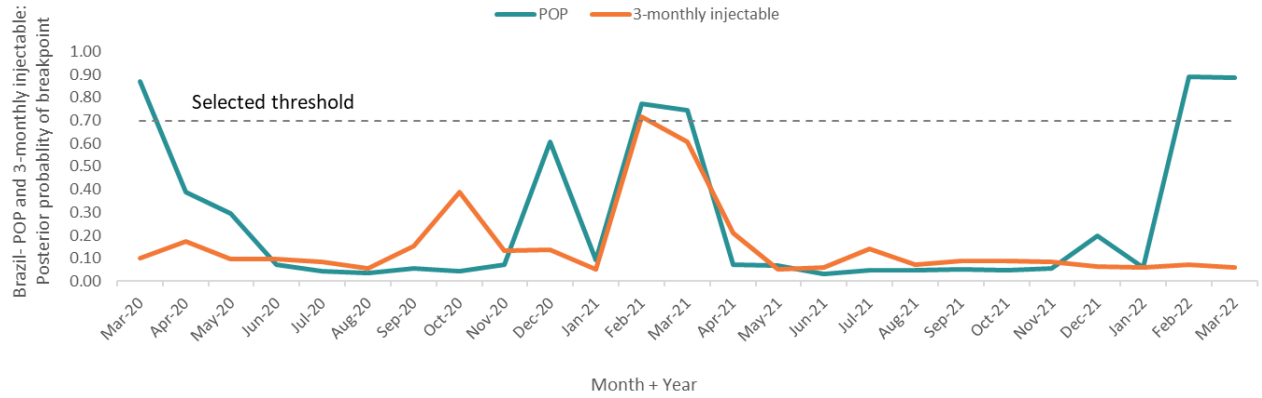
As noted earlier, breakpoint analysis could be carried out on 8 country-method combinations. Breakpoint analysis identified breakpoints in volumes sold during the pandemic period for POPs in Côte d'Ivoire, POPs in Brazil (multiple breakpoints), and for the 3-monthly injectable in Brazil. These breakpoints can be seen in Figure 3 and Figure 4 below, where a point on the graph exceeds the selected probability threshold (dotted line). No breakpoints were identified for the other contraceptive methods analyzed in Brazil, and no breakpoints were identified for either of the two contraceptive methods examined in the Philippines (data not shown).

FIGURE 3. BREAKPOINTS IDENTIFIED IN CÔTE D'IVOIRE‡



‡ Analysis of IQVIA's FWA National Retail audit for Côte d'Ivoire, January 2018-April 2022. Copyright IQVIA. All rights reserved.

FIGURE 4. BREAKPOINTS IDENTIFIED IN BRAZIL†



†Analysis of IQVIA MIDAS Monthly data for Brazil, January 2018-April 2022. Copyright IQVIA. All rights reserved.

Forecasts were then developed using ARIMA models based on the breakpoints identified in Côte d'Ivoire and Brazil to determine if changes in sales volumes were significant, defined as when the sum of actual volumes fell outside the sum of the 95% prediction intervals.

The breakpoint identified in the volumes of POPs in Côte d'Ivoire was not found to be significant, meaning actual sales volumes were not statistically different from forecasted volumes. In addition, POPs constituted less than 1% of total CYP delivered through private sector pharmacies in 2019 (based on analysis of IQVIA's FWA National Retail Audit for Côte d'Ivoire, January 2018-April 2022), and more recent data (data to June 2022) suggests that POP volumes seem subject to large fluctuations.

Similarly, the breakpoint identified for the 3-monthly injectable in Brazil (from February 2021) was also not found to be significant, indicating that volumes of the 3-monthly injectable did not seem to show a meaningful change during this time.

Finally, multiple forecasts were developed corresponding to the multiple POP breakpoints identified in Brazil. Two breakpoints, just one month apart, February 2020 and March 2020, were found to be significant. However, in this case the significant decline in sales in February was followed by a significant increase in March 2020, suggesting that if there was disruption it was short in duration. The other two POP breakpoints (March 2021 and March 2022) were not found to be significant. A summary of the results from the breakpoint analysis is shown in the Table 2 below.

TABLE 2. SUMMARY OF BREAKPOINT ANALYSIS RESULTS

	1-Monthly Injectable	3-Monthly Injectable	ECPs	COCs	POPs
Brazil†	✖	? February 2021 breakpoint (not confirmed by forecast)	✖	✖	Multiple Breakpoints§ (Feb & Mar 2020 confirmed by forecast)
Philippines†	**N/A**	✖	**No sales**	**N/A**	✖
Côte d'Ivoire‡	**No sales**	**N/A**	**N/A**	**N/A**	? November 2021 breakpoint (not confirmed by forecast)

✖ = No breakpoint identified; = Breakpoint identified showing increase; ? = Breakpoint identified showing decrease; No sales = Product not available; N/A = Breakpoint not possible as data could not be transformed to meet test requirements

§February 2020, March 2020, February 2021, March 2021, February 2022, March 2022; † Analyses based on IQVIA MIDAS Monthly Data January 2018-April 2022. Copyright IQVIA. All rights reserved; ‡ Analyses based on IQVIA's FWA National Retail Audit for Côte d'Ivoire, January 2018-April 2022 Copyright IQVIA. All rights reserved.

PANDEMIC SEGMENTATION

As noted above, using changes in the number of deaths attributed to the pandemic, the period from March 2020 to April 2022 was divided into several "phases" or "segments." A total of 71 forecasts were generated using ARIMA models (one for each for segment and country/method combination). A significant "disruption" was identified if the sum of actual volumes was lower or higher than the sum of the 95% prediction intervals.

As can be seen from Table 3, very few disruptions were detected using this approach: none in Brazil, just one in the Philippines (1-monthly injection), and three in Côte d'Ivoire (two for 3-monthly injections and ECPs). Notably, for COCs, which make up the largest share of private sector retail outlet CYPs in each country (as per IQVIA MIDAS Monthly sales data and the FWA National Retail audit for Côte d'Ivoire, 2020), no disruptions were detected in any phase. More details on country results can be found below.

TABLE 3 SUMMARY OF ARIMA MODEL RESULTS

	Phase/ Segment	1-monthly injection	3-monthly injection	ECPs	COCs	POPs
Brazil†	Phase 1	✖	✖	✖	✖	✖
	Phase 2	✖	✖	✖	✖	✖
	Phase 3	✖	✖	✖	✖	✖
Philippines†	Phase 1	✖	✖	-	✖	✖
	Phase 2	?	✖	-	✖	✖
	Phase 3	✖	✖	-	✖	✖
	Phase 4	✖	✖	-	✖	✖
	Phase 5	✖	✖	-	✖	✖
Côte d'Ivoire‡	Phase 1	-	?	?	✖	✖
	Phase 2	-	✖	✖	✖	✖
	Phase 3	-	?	✖	✖	✖
	Phase 4	-	✖	✖	✖	✖
	Phase 5	-	✖	✖	✖	✖
	Phase 6	-	✖	✖	✖	✖

? Significant difference in sales (actual above forecasted); ? Significant difference in sales (actual below forecasted)

✖ No significant difference between actual and forecasted sales

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‡ Analyses based on IQVIA's FWA National Retail Audit for Côte d'Ivoire, January 2018-April 2022 Copyright IQVIA. All rights reserved.

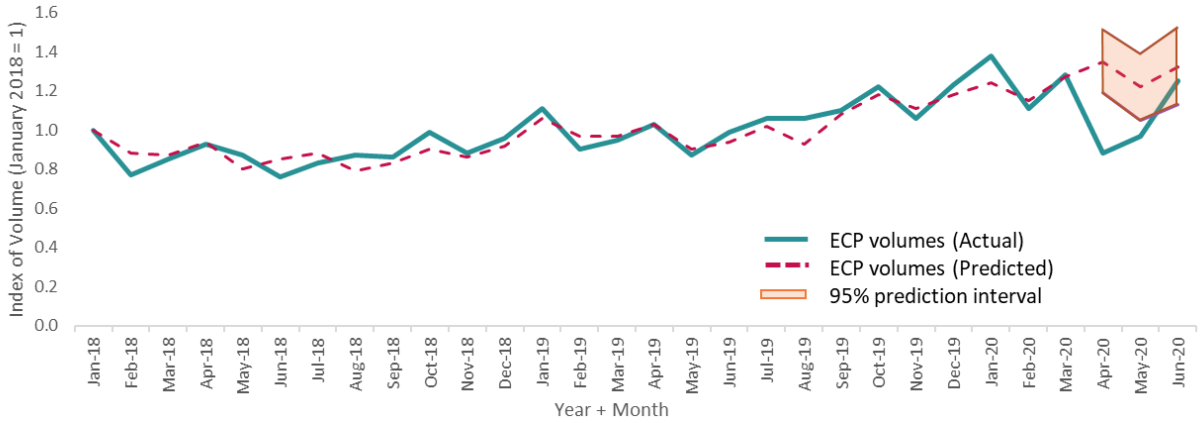
PHILIPPINES: The disruption seen in 1-monthly injectable volumes in the Philippines occurred in the period October 2020 to February 2021. In this instance, actual volumes were significantly greater than forecasted volumes both overall and for four of the five months in this segment. However, given that 1-monthly injectables constituted <1% of total CYPs delivered through the private sector retail outlets prior to the

pandemic (IQVIA MIDAS Monthly data,2019), and that no other products were affected at this time, it is unlikely that this represents a meaningful change to contraceptive supply.

CÔTE D'IVOIRE: The 3-monthly injectable saw a significant increase in the first phase (April – June 2020), and a significant decrease in the third phase (November 2020 to March 2021). Sales of the 3-monthly injectable in Côte d'Ivoire are dominated by sales of the social marketing organization (SMO) product. The increase early in the pandemic period may reflect efforts by the SMO to push product into the supply chain for fear of shortfalls elsewhere. That volumes declined to previous levels in a later period as deaths from COVID-19 increased once more suggests that any impact on supplies was temporary.

The decline in ECP volumes in Côte d'Ivoire occurred in the first phase (April – June 2020). For context, ECPs contributed approximately one fifth of total CYPs delivered through the private sector retail outlets in 2019 (based on IQVIA's FWA National Retail audit for Côte d'Ivoire). Actual volumes in this first phase were significantly lower than the forecast for two out of the three months (see Figure 5). In total, actual volumes were more than 20% below forecasted volumes for this period. A significant decline was found for both SMO and non-subsidized ECPs. This decline would appear to be a genuine market disruption. However, given that no other method was similarly impacted, it may suggest that supplies of ECPs were not disrupted, but rather that consumer behavior may have changed, reducing the demand for ECPs.

FIGURE 5. ECP VOLUMES IN CÔTE D'IVOIRE: FORECAST PERIOD APRIL – JUNE 2020 (PHASE 1)‡



‡Analysis of IQVIA's FWA National Retail audit for Cote d'Ivoire, January 2018- June 2020. Copyright IQVIA. All rights reserved.

BRAZIL: No disruptions were identified in Brazil. However, it is interesting to note that in the third segment COC volumes showed an uncharacteristic decline relative to the forecast. Over the period from May 2021 to February 2022, volumes of COCs were approximately 9% below the forecast whereas in phases one and two, the difference between actuals and forecasts was less than 1%. As can be seen from Figure 6, however, this difference failed to reach statistical significance in many months, and indeed for the period as a whole, no significant difference could be detected.

FIGURE 6. COC VOLUMES, BRAZIL: FORECAST PERIOD MAY 2021 – FEBRUARY 2022†

†Analysis of IQVIA MIDAS Monthly data for Brazil, January 2018-February 2022. Copyright IQVIA. All rights reserved

LIMITATIONS

The main input data used for this analysis is sales of contraceptives from wholesalers to private retail outlets, and not actual sales to clients. An assumption is made that retailers adjust their purchasing to match changes in client demand, but it is possible that results are not fully reflective of changes in volumes sold to clients. Also, because this analysis relied on data captured at retail outlets alone and not in other clinical settings where longer-acting methods may be available, the findings do not apply to the entirety of the private FP products and services market in these countries.

In addition, there are limitations inherent to the methodologies used for analysis. Breakpoint analysis could only be conducted on 8 of the 13 country-method combinations and identified breakpoints cannot be directly associated with COVID-19. The pandemic segmentation analysis attempted to link disruptions directly to COVID-19; it assumed that disruptions would occur shortly after a change in the numbers of deaths from COVID-19 was detected. In reality, the effect may have been delayed, in which case our forecasts may have inadvertently combined periods of disruption with periods of stability. Further, our pandemic segmentation approach was based on country level changes to the pandemic. There may be changes to supplies that are influenced by changes outside the country, such as export bans or factory shutdowns.

Finally, while this analysis was able to identify disruptions, it was unable to identify the cause of a change in volumes (e.g., changes in behavior, government restrictions, supply chain disruptions).

CONCLUSION

This analysis sought to assess the impact of the COVID-19 pandemic on private sector supplies of modern contraceptives in three countries: Brazil, Côte d'Ivoire and the Philippines. While there have been several studies using different methods to assess the impact of COVID-19 on contraceptive access, our methodology differs by applying modeling approaches to private sector sales data to detect where and when private FP market disruptions may have occurred. As noted earlier, assessing the impact of COVID-19 presents unique methodological challenges. The pandemic period has been protracted, and the frequency and duration of disruptions are likely to be inconsistent over time. Given these challenges, this analysis employed two methodological approaches to detect potential disruptions – breakpoint analysis and pandemic segmentation. For both, forecast models were developed to allow for testing the significance of any

identified disruptions. While this approach still has limitations, as described above, it represents a useful way to understand COVID-19's impact on private FP markets given available data.

The analysis revealed a lack of meaningful changes, except for ECPs in Côte d'Ivoire. While this may appear to be a 'null' result, we interpret this to mean that COVID-19 did not have a significant or lasting impact on contraceptive supply through pharmacies in these three very different private FP markets during the analyzed time period, at least at the selected level of probability analyzed (95%). Further, we did not find any evidence of increased use of the private sector or increased use of self-care methods through these outlets (e.g., actual volumes did not exceed predicted levels), which had been hypothesized as a potential outcome of pandemic disruptions to clinical services.

In particular, the lack of meaningful disruptions in Brazil found in this analysis contrasts with the results of Charles et al (2022), where an increase in sales of injectable contraceptives was observed in the period February-May 2020 and for ECPs in the period June-July 2020. However, the earlier paper defined a disruption as simply a 5% difference between the sales in the month in 2019 with sales in the same month in 2020, and it also included both public and private sector sales (Charles, Munezero, Bahamondes, & Pacagnella, 2022). This highlights the importance of the selected methodology when drawing conclusions about market-level impacts.

Early in the pandemic there were initial fears that COVID-19 could have profound impacts on contraceptive markets, including leading to stockouts, reducing access to contraception, and changing where and how often women seek services and what methods they use (Weinberger, Hayes, White, & Skibiak, 2020). For the three countries analyzed, we did not find changes in private sector sales of contraceptives that suggest that any of these impacts came to fruition. The lack of meaningful declines shows that the private markets in these three countries were resilient and able to continue to supply contraceptives throughout the pandemic period. The lack of meaningful increases, across methods and particularly for the self-care methods included in the analysis, suggests that FP users may not have had to adjust their source of supply or method as was hypothesized. While the three analyzed countries represent very different private FP markets, the results from this study may not be generalizable to other contexts.

Methodologies like the ones presented in this work can provide a more detailed snapshot of how global shocks like COVID-19 affect local sales of contraceptives in the private sector. These approaches should also be coupled with both quantitative and qualitative studies that allow for a more nuanced understanding of the individual experience of women and barriers that may have been faced beyond what can be found in analysis of sales data. Armed with this information, stewards of mixed health systems may be able to better consider how private sector access points may be leveraged and mobilized in future emergency preparedness planning.

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ANNEX 1: METHODOLOGICAL DETAILS

BREAKPOINT ANALYSIS

There are several different breakpoint detection methods. Literature does not suggest that any one of these methods is always superior to another. In this activity we chose to use the statistical package called "bcp" (BCP) in R, a language and environment for statistical computing. BCP uses a Bayesian approach to detect changes in mean between different parts or segments of a time series.

A breakpoint identifies an instance where sales in one period differ significantly from sales in the next period.

BCP was selected because it does not require the user to make any assumptions about the number of potential breakpoints in the time series or to determine the size of the "penalty" added into the calculations for any one additional breakpoint.

At the same time the output from the BCP model allows the way in which the number and location of each breakpoint is determined to be made transparent. BCP calculates the probability of a change having happened at any particular point in time, the so-called "Posterior Probability of a Change." These represent the proportion of iterations resulting in a change point at each position in the time series. Any time point with a posterior probability of a change greater than 0.7 is regarded by some as being a potential "real" changepoint.[3]

BCP does, however, require that the time series does not suffer from serial correlation and follows a normal distribution.[4] Data relating to the sales of each method were thus checked for serial correlation and normality, using the Ljung-Box[4] and Shapiro-Wilk[5] tests respectively. Time series that were found likely to be non-normal or serially correlated were subjected to transformation by taking the log or cube and tested again. Despite these efforts, however, data for some contraceptive methods could not be transformed to meet the tests of normality and lack of serial correlation, as shown in the table below. This means that whilst breakpoint analysis could be carried out for all methods in Brazil, it was possible only to conduct breakpoint analysis for two of the methods in the Philippines, and only one method in Côte d'Ivoire.

TABLE A1. TIME SERIES MEETING TESTS FOR NORMALITY AND SERIAL CORRELATION

	1-Monthly Injectable	3-Monthly Injectable	ECPs	COCs	POPs
Brazil†	✓§	✓§	✓	✓	✓§
Philippines†	✗	✓§	N/A	✗	✓§
Côte d'Ivoire‡	N/A	✗	✗	✗	✓§

✓ Tests on time series suggest that data are normally distributed but not serially correlated

✗ Tests on time series, suggest that data are not normally distributed and/or serially correlated

§ Data subjected to transformation meet tests of normality and lack of serial correlation

N/A No sale

† Analyses based on IQVIA MIDAS Monthly Data January 2018-April 2022. Copyright IQVIA. All rights reserved

‡ Analyses based on IQVIA's National Retail audit for Côte d'Ivoire, January 2018-April 2022. Copyright IQVIA. All rights reserved

[3] Comparison of changepoint methods. https://www.marinedatascience.co/blog/2019/09/28/comparison-of-change-point-detection-methods/

[4] Forecasting: Principles and Practice (2nd ed). Hyndman RJ and Athanasopoulos G. Chapter 9. https://otexts.com/fpp2/dynamic.html

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PANDEMIC SEGMENTATION

We identified periods more likely to have suffered disruption by dividing each time series into segments, based on when deaths attributed to COVID-19 peaked.

Figures A1-A3 show the peaks identified in each of three countries included in this study. In Côte d'Ivoire, for example (see Figure A2), we see that the first segment runs from March 2020 to June 2020 and the second from July 2020 to October 2020. In these cases, the first forecast would use data from January 2018 to March 2020 and forecast through to the end of June, and the second forecast would use data from January 2018 to June 2020 and forecast through to the end of October 2020.

Using the approaches outlined above, the following number of segments were found in each country:

- Côte d'Ivoire: 6 segments
- Philippines: 6 segments
- Brazil: 4 segments

Breaking the pandemic period up into smaller segments in this way allows for relatively short-term forecasts, and significant deviations in volumes can be directly related to changes in the progress of the pandemic.

FIGURE A1. COVID-19 DEATHS: BRAZIL

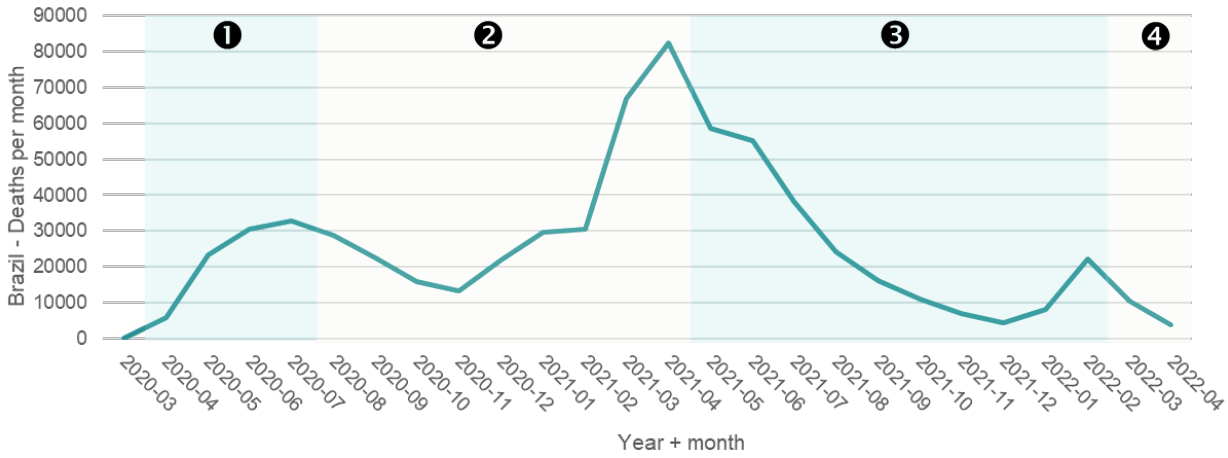

FIGURE A2. COVID-19 DEATHS: CÔTE D'IVOIRE

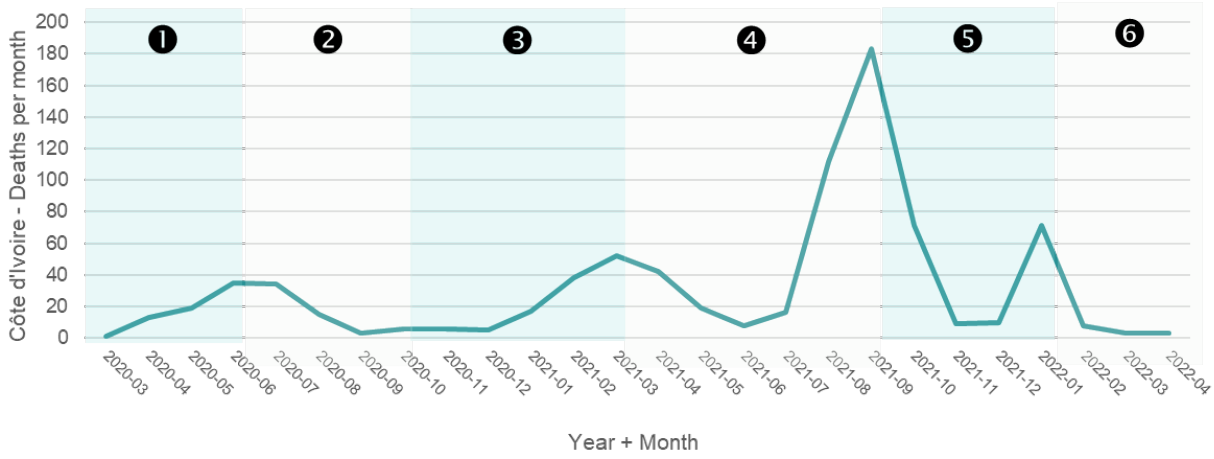

FIGURE A3. COVID-19 DEATHS: THE PHILIPPINES

FORECASTING WITH ARIMA

As noted above, the breakpoints identified by either BCP or the segments found through study of the changing rate of deaths were used to define the cut-off points for forecasts generated by ARIMA models. The ARIMA models forecast what is expected to happen based on previous trends, and these forecasts were then compared to the actual sales volumes.

ARIMA models combine two common models used in forecasting – an Autoregressive Model and a Moving Average model:

- Autoregressive models ("AR") use previous time periods as input to regression equations to predict the value of the next time period, with the model determining how many previous time periods are used in the regression equation.
- Moving Average models ("MA") assume the next observation in the next time period is the mean of past observations, with the number of past observations being varied to achieve the best result.
- The "I" in ARIMA stands for "integrated" and means that an ARIMA model also looks at the differences in the non-seasonal or "stationary" observations at each time point.

ARIMA models will vary according to the number of previous time periods entered into the regression equations, the number of past observations used to calculate the mean, and the extent of differencing to produce the stationary data. The ARIMA model where the Mean Absolute Percentage Error (MAPE) (or Symmetric Mean Absolute Percentage Error (sMAPE) where MAPE could not be calculated owing to zero sales in a month) is closest to zero is generally the one that is selected.

To produce accurate forecasts with robust prediction intervals, however, ARIMA models require not only that the time series is (or is transformed through differencing) to be "stationary" but that the residuals (i.e. what is left over after the most appropriate model has been fitted to the data) do not suffer from serial correlation and are normally distributed. Therefore, each of these requirements were checked for each ARIMA model created. Stationarity was checked using the Kwiatkowski-Phillips-Schmidt-Shin ("KPSS") test, serial correlation by the Auto Correlation Function, and normality through visual inspection of the residual plot. The ARIMA model with the lowest MAPE (or sMAPE) and which met all of the above criteria was the one selected. Table A2 shows the dates of the pandemic waves by country, and which met the criteria to be included.

TABLE A2. STATIONARITY TESTS CARRIED OUT ON TIME SERIES

					Time series passing stationarity test (p>0.01)				
	Pandemic Phase†	Data period	Forecast period	Forecast months	1-Monthly Injectable	3-Monthly Injectable	ECPs	OCPs	POPs
Brazil†	1	Jan18-Mar20	Apr 20 - July 20	4	✓	✓	✓	✓	✓
	2	Jan18-Jul20	Aug 20 - Apr 21	9	✓	✓	✓	✓	✓*
	3	Jan18-Apr21	May 21 - Feb 22	10	✓	✓	✓	✓	✓*
	4	Jan18-Feb22	Mar 22 - Apr 22	2	Too short				
Philippines†	1	Jan18-Apr20	May 21 - Sep 21	5	✓	✓	-	✓	✓
	2	Jan18-Sept20	Oct 20 - Feb 21	5	✓	✓	-	✓	✓
	3	Jan18-Feb21	Mar 21 - Aug 21	6	✓	✓	-	✓	✓
	4	Jan18-Aug21	Sep 21 - Nov 21	3	✓	✓	-	✓	✓
	5	Jan18-Nov21	Dec 21 - Mar 22	4	✓	✓	-	✓	✓
	6	Jan18-Mar22	Apr 22	1	Too short				
Côte d'Ivoire‡	1	Jan18-Mar20	Apr 20 - Jun 20	3	-	✓	✓*	✓	✓
	2	Jan18-Jun20	Jul 20 - Sep 20	4	-	✓*	✓*	✓*	✓
	3	Jan18-Oct20	Nov 20 - Mar 21	5	-	✓*	✓*	✓*	✓
	4	Jan18-Mar21	Apr 21 - Sep 21	6	-	✓*	✓*	✓*	✓
	5	Jan18-Sept21	Oct 21 - Jan 22	4	-	✓*	✓*	✓*	✓
	6	Jan18-Jan22	Feb 22 - Apr22	3	-	✓*	✓*	✓*	✓

† As defined by changes in deaths attributed to COVID-19; – No sales detected; * First-order differencing applied to time series

ARIMA models produce a forecast and prediction intervals around each point in the forecast. In this study we chose to generate a 95% prediction interval, an interval that indicates that 95 times out of 100, the actual data would fall within that interval.

For each period defined through breakpoint analysis or pandemic wave, the sum of each of the lower and upper prediction interval was compared to the sum of the actual volumes for the same period. If the sum of actual volumes was above or below the sum of the higher or lower prediction intervals respectively, this was highlighted as a disruption. Where a disruption was identified we used the same method to determine if the change was driven by changes in volumes of either the subsidized or non-subsidized form, or both.

All ARIMA models and tests were carried out using R.