



Effect of the COVID-19 pandemic on women's, maternal and child health services in Tshwane District, South Africa

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Background

The COVID-19 pandemic severely impacted healthcare service delivery globally. The aim of this study was to assess effects of the COVID-19 pandemic on the uptake of routine healthcare services related to maternal, newborn, child, and women's health (MNCWH) in Tshwane District, an urban locality in Gauteng Province, South Africa.

Methods

As part of the observational Tshwane Maternal-Child COVID-19 study, routine data sources, including the District Health Information System and other district-based datasets, were studied from April 2019 to March 2022, to describe the impact of the first four COVID-19 waves in Tshwane District. The year pre-pandemic was used as a baseline. Data included MNCWH data elements/indicators, child health data elements/indicators, and COVID-19 surveillance data. Data analysis included descriptive statistics, together with visual analysis of trends over time. Statistical investigation included testing of differences between data from the pre-pandemic year (as baseline) and data from the following two pandemic years (2020/2021 and 2021/2022), as per the National Department of Health's financial years (from April to March of the following year).

Results

Multiple MNCWH health elements/indicators showed major decreases during the COVID-19 pandemic period, with preventive services rendered at primary healthcare and community level more severely affected than facility-based clinical services. The most significant decreases were recorded during the first pandemic year, most notably during the first strict lockdown period, with partial or complete recovery in the second pandemic year, while selected indicators saw large impacts during the actual COVID-19 waves.

Conclusions

The COVID-19 pandemic severely impacted the ability of women and children to access healthcare services in this large urban district in South Africa. Health system strengthening measures and adequate planning for future emergency situations are crucial to mitigate the negative impact on maternal and child health, as South Africa strives to move towards reaching its Sustainable Development Goals.

Introduction

The first case of SARS-CoV-2 infection was reported in Wuhan, China, in December 2019. The ensuing pandemic affected most countries severely, with the burden of COVID-19 disease and accompanying lockdown regulations impacting on the provision of routine and essential health services. South Africa was no exception, given its pre-existing quadruple burden of diseases, including HIV and tuberculosis; non-communicable diseases (mainly hypertension and diabetes); suboptimal maternal and child health; and violence/injury.¹

Providing continuity of healthcare services in an already stretched healthcare system is challenging, particularly during a pandemic. South Africa reorganised its healthcare services by increasing medical and laboratory capacity and building field hospitals – all in anticipation of a rapid increase in number of adult COVID-19 cases. Additionally, the country implemented a level-5 lockdown in March 2020, which prohibited non-essential economic activity, limited movement of people outside their homes, and restricted availability of transport for commuters. Four distinct COVID-19 waves ensued between March 2020 and March 2022, leading to the enforcement of several levels of lockdown restrictions. Despite public-health interventions to curb the spread of SARS-CoV-2, routine and emergency healthcare services needed to continue to avoid collateral morbidity and mortality, resulting in major strains on the healthcare system.

International research has highlighted widespread and significant impacts of the COVID-19 pandemic on the provision and utilisation of healthcare services, especially those related to maternal, newborn, child and women's health (MNCWH).² In attempting to understand the impact on the healthcare system it is insufficient to rely solely on hospital-based studies, as disease burden may shift within the context of severely constrained pandemic environments. The Tshwane Health District has the same geographical boundaries as that of the Tshwane metropolitan municipality. It is a largely urban district in the Gauteng Province of South Africa with a population of 3 552 452 people, and a total surface area of 6 345 km², making it the third-largest municipality in the world by surface area.³ Primary health care (PHC) facilities in Tshwane District provided continuous services during the pandemic as reported in district management meetings and personal communications with clinicians, with occasional short-term closures due to COVID-19-related prevention activities.

The research aim was to gain a better understanding of the effect of the COVID-19 pandemic on the uptake of routine MNCWH services in Tshwane District, rendered mainly at PHC facilities and district hospitals (public-sec-

tor facilities), as well as at community level and at schools/crèches.

Methods

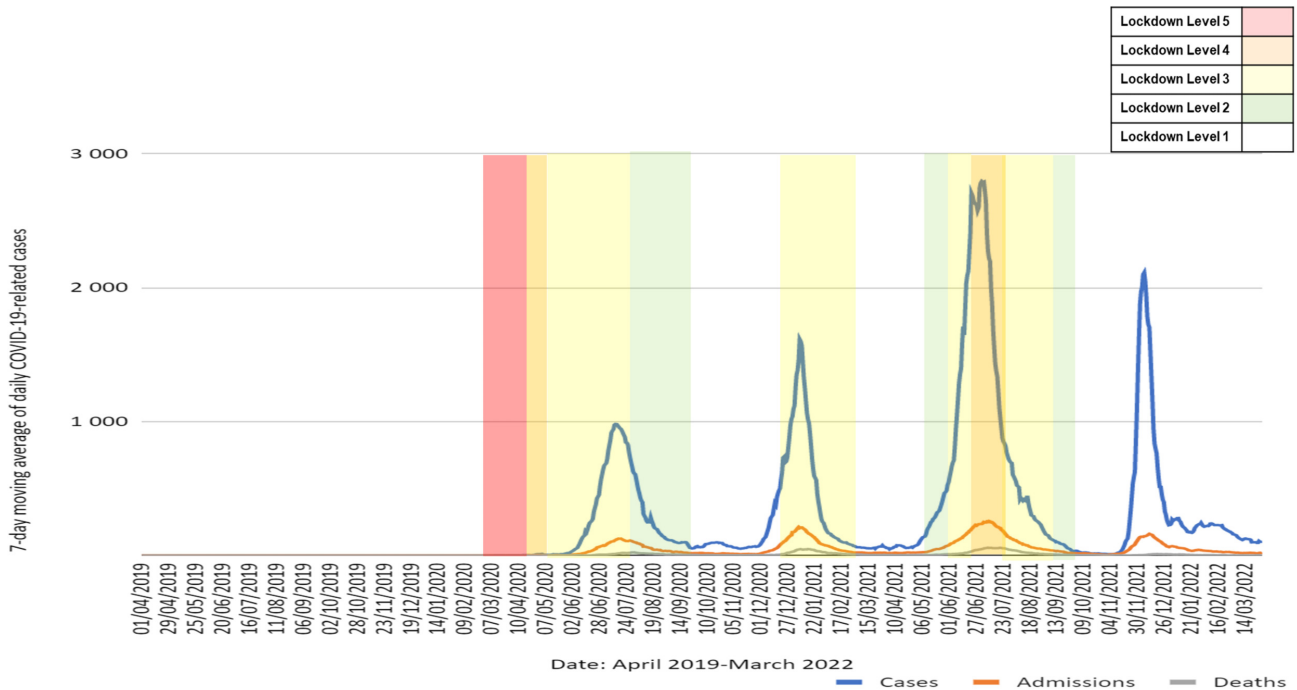
As part of the observational Tshwane Maternal-Child COVID-19 study, routine data sources, including the District Health Information System (DHIS) and other district-based datasets, were analysed from April 2019 to March 2022, to describe the impact of the COVID-19 pandemic over the first four epidemic waves in Tshwane District.¹ The year pre-pandemic was used as baseline. Data elements and indicators included those relating to MNCWH (including reproductive health, termination of pregnancies, cervical cancer screening, clinical forensic medical services, obstetric care, and early infant HIV diagnosis), child health (including immunisations, Vitamin A, deworming, and school health), and COVID-19 surveillance (including cases, hospitalisations and deaths). Only a selection of data elements was included in this analysis due to the large number available; the current focus was on clinical and preventive services provided at public health facilities at different levels of care, together with services provided at schools and community level, in order to study the impact of the COVID-19 pandemic on broader maternal-child health service provision within these different contexts and settings. In-depth analysis of clinical care provided mostly at hospital level, and maternal-child outcomes (including morbidity and mortality rates), were not the focus of this particular study.

Data analysis included descriptive statistics, together with visual analysis of trends over time. Statistical investigation included testing of differences between data from the pre-pandemic year, as baseline, compared with results from the following two pandemic years (2020/2021 and 2021/2022), as per the National Department of Health's financial years (from April to March of the following year). Shapiro Wilk's test was used to determine if data were normally distributed, followed by inferential tests, including the independent t-test as well as the non-parametric alternative, the Mann-Whitney U test, to compare the pre-pandemic baseline results with those obtained in the two pandemic years. Additional investigations included paired comparisons, including the paired t-test and Wilcoxon signed-rank test, comparing the months of the baseline group with those from the pandemic years (2020/2021 and 2021/2022) to investigate changes over these periods. Significance tests were performed at 5% level of significance, and the analysis was performed using the statistical program R.⁴

Research permissions were obtained from the Ethics committees of the University of Pretoria and Sefako Mak-

¹ The Tshwane Maternal-Child COVID-19 Study was established to study the burden and impact of the COVID-19 pandemic on maternal and child health in the Tshwane District, South Africa. It was registered under the reference number 822/2020 with the Ethics Committee of the Faculty of Health Sciences, University of Pretoria, South Africa.

Figure 1. Number of recorded COVID-19-related cases, hospital admissions and deaths in Tshwane District from pandemic start to March 2022 with corresponding timelines of COVID-19 lockdown levels



Source. Tshwane District COVID-19 line lists, Tshwane District Health Services, Gauteng Province Description of lockdown levels in South Africa: (1) 'Lockdown Level 1': Low risk of COVID-19 spread with high health system readiness; with precautions and health guidelines in place, but normal activity resumed; (2) 'Lockdown Level 2': Moderate risk of COVID-19 spread with high health system readiness; with physical distancing and restrictions in place on leisure and social activities to prevent virus resurgence; (3) 'Lockdown Level 3': Moderate risk of COVID-19 spread with moderate health system readiness; with restrictions in place on many activities, including at workplaces and socially, to address a high risk of transmission; (4) 'Lockdown Level 4': Moderate to a high risk of COVID-19 spread with low to moderate health system readiness; with extreme precautions in place to limit community transmission and outbreaks, while allowing some activity to resume; and (5) 'Lockdown Level 5': High risk of COVID-19 spread with a low health system readiness; with drastic measures in place to contain spread of the virus and save lives.

gatho Health Sciences University together with relevant provincial and district approvals.

Key findings

The Tshwane District COVID-19 pandemic followed a similar pattern to the rest of South Africa, with four distinct waves occurring between April 2020 and March 2022 (Figure 1).

Women's health and reproductive services

Family planning

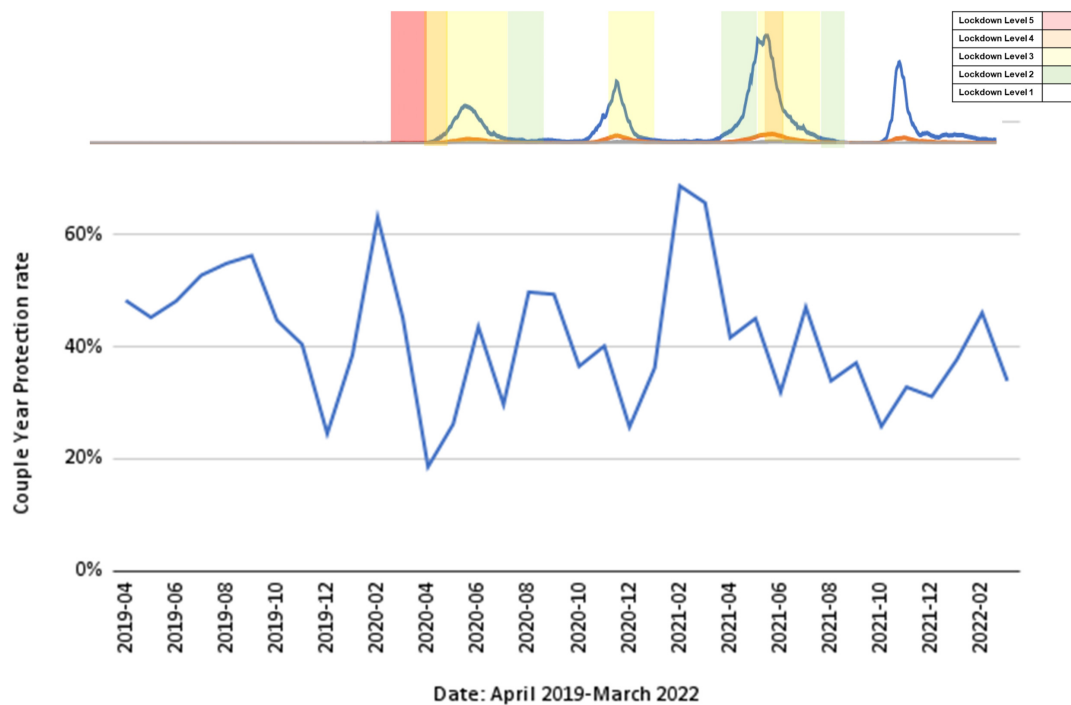
Utilisation of modern contraceptive methods to prevent unplanned pregnancies was measured using the composite indicator couple-year protection rate (CYPR). The year-on-year average CYPR was lower in 2020/2021 (40.8%) and 2021/2022 (37.0%), than in the pre-pandemic year when it was 46.8% ($p=0.04$; pre-pandemic versus pandemic period). The CYPR showed an annual decrease over the December summer vacation period. There was an additional sharp decrease in April 2020 to 18.6%, which corresponded with the first strict COVID-19 lockdown in South Africa (Figure 2).

Termination of pregnancy services

Termination of pregnancy (TOP) services in Tshwane District were mostly maintained despite an initial drop at the start of the pandemic and lockdown regulations; they increased again from March 2021 onwards (Figure 3). The average number of total TOPs was 508/month (pre-pandemic), 494/month (2020-2021), and 628/month (2021-2022) ($p=0.1236$ for total TOPs 2021-2022 versus pre-pandemic).

During the study period, Jubilee District Hospital, situated in Tshwane Sub-district 2, was the only site providing both first- and second-trimester TOP services in the entire sub-district and district respectively, and an important contributor to the district's overall TOP numbers. Before September 2020, the hospital's TOP clinic had two allocated clinicians, with only one trained to perform procedures. A new staff member was appointed in October 2020, with more staff added in 2022, increasing the capacity and therefore leading to a subsequent rise in the number of procedures performed and increasing the district's overall TOP numbers (Figure 4). The TOP clinic register, a DHIS source document, showed that the average age of the women utilising the clinic's service, and average gestation at time of TOP, which stabilised around

Figure 2. Couple-year protection rate for Tshwane District from April 2019 to March 2022, with corresponding timelines of COVID-19 waves and lockdown levels



Source. District Health Information System and COVID-19 line list, Tshwane District Health Services, Gauteng Province, as per financial years of the South African Department of Health (April to March the following year)

10 weeks' gestation, were both not much affected by the pandemic or the local increase in service capacity.

Cervical cancer screening

There was a marked decrease in the monthly number of cervical cancer screenings, from an average of 5455 samples/month (pre-pandemic), to 3453/month (2020-2021), and with a nadir of 2147 in July 2020 (Figure 5). There was a corresponding decrease in detection of high-grade precancerous cases from 3609 cases/year (2019-2020), to 2020 cases/year (2020-2021), and 2041 cases/year (2021-2022).

This DHIS indicator changed in April 2020, from the number of cervical cancer screenings done in women above 30 years of age, to also include the number of cervical cancer screenings done for women living with HIV above 20 years of age. A discrepancy was noted when comparing the number of cervical cancer screenings captured on the DHIS and corresponding sample numbers received by the National Health Laboratory Service (NHLS), especially during the period from April 2020 to June 2020, which coincided with the strictest lockdown period (Figure 5).

Forensic clinical services

The seven dedicated Clinical Forensic Medical Centres in Tshwane District manage survivors of crime (particularly sexual assault, domestic violence and child abuse), supporting judicial processes through evidence collec-

tion and provision of expert witnesses. The monthly total client numbers and subgroups of adult females and children seen for clinical consultations showed a sharp decline, from an average of 230/month (pre-pandemic) to 94 during April 2020, corresponding with the strict lockdown at the start of the pandemic, with subsequent stabilisation afterwards to pre-pandemic numbers (Figure 6).

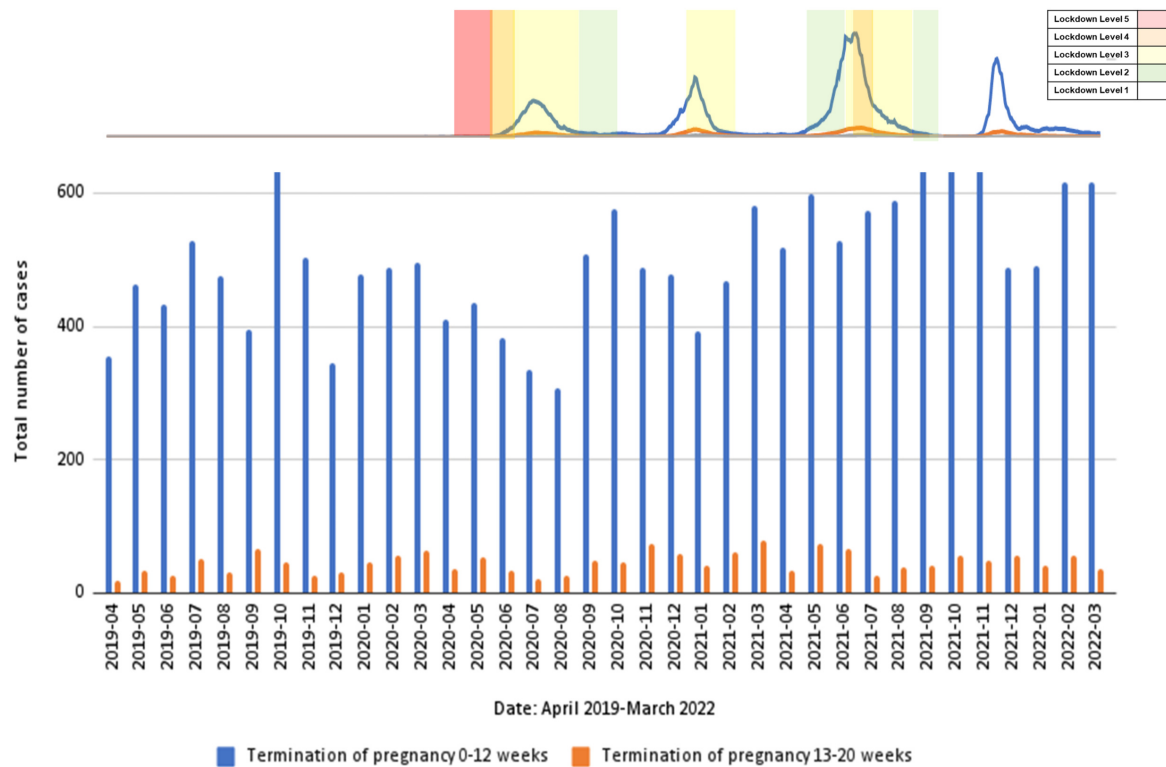
Maternal and neonatal health

Antenatal care

Antenatal care provision was mostly maintained throughout the study period, despite some monthly variations, for instance in April 2020 (the first month of strict lockdown) (Figure 7). Overall, there were slight reductions in monthly numbers of first antenatal visits over the three-year period, with averages of 5090/month (pre-pandemic), 4875/month (2020-2021), and 4754/month (2021-2022) ($p=0.261$ for total first antenatal visits 2021-2022 versus pre-pandemic).

It is further appreciable that the majority of pregnant women in Tshwane District booked for antenatal care before 20 weeks' gestation (pre-pandemic average of 64.7%), and this was maintained throughout the pandemic period, with a slight decrease to 62.0% in 2020-2021, but with a subsequent increase to 66.4% in 2021-2022.

Figure 3. Monthly numbers of terminations of pregnancies in Tshwane District from April 2019 to March 2022, grouped by pregnancy weeks (first 12 weeks; 13-20 weeks of pregnancy), with corresponding timelines of COVID-19 waves and lockdown levels



Source: District Health Information System and COVID-19 line list, Tshwane District Health Services, Gauteng Province

Deliveries and stillbirths

The average monthly number of in-facility deliveries was 4786/month (pre-pandemic), 4962/month (2020-2021), and 4719/month (2021-2022), showing a reduction at the end of the study period (average of 4554/month in the last six months) (Figure 8). The stillbirth numbers fluctuated, with average numbers of 98/month (pre-pandemic), 109/month (2020-2021), and 98/month (2021-2022), with two spikes noticeable in the first pandemic year – the first occurred just after the first COVID-19 wave, and the second more sustained peak stretched from the second to the third COVID-19 waves ($p=0.045$; 2020-2021 versus pre-pandemic).

Teenage pregnancies

The 'delivery in 10 to 19 years in-facility rate' indicator is used to monitor the percentage of in-facility deliveries in young women under 20 years of age. This indicator showed an increasing trend over the study period (Figure 9), with average monthly percentages increasing from 8.0% (pre-pandemic), to 8.7% (2020-2021), to 9.4% (2021-2022) ($p=0.05$ for pre-pandemic versus 2020-2021; $p=0.03$ for 2020-2021 versus 2021-2022).

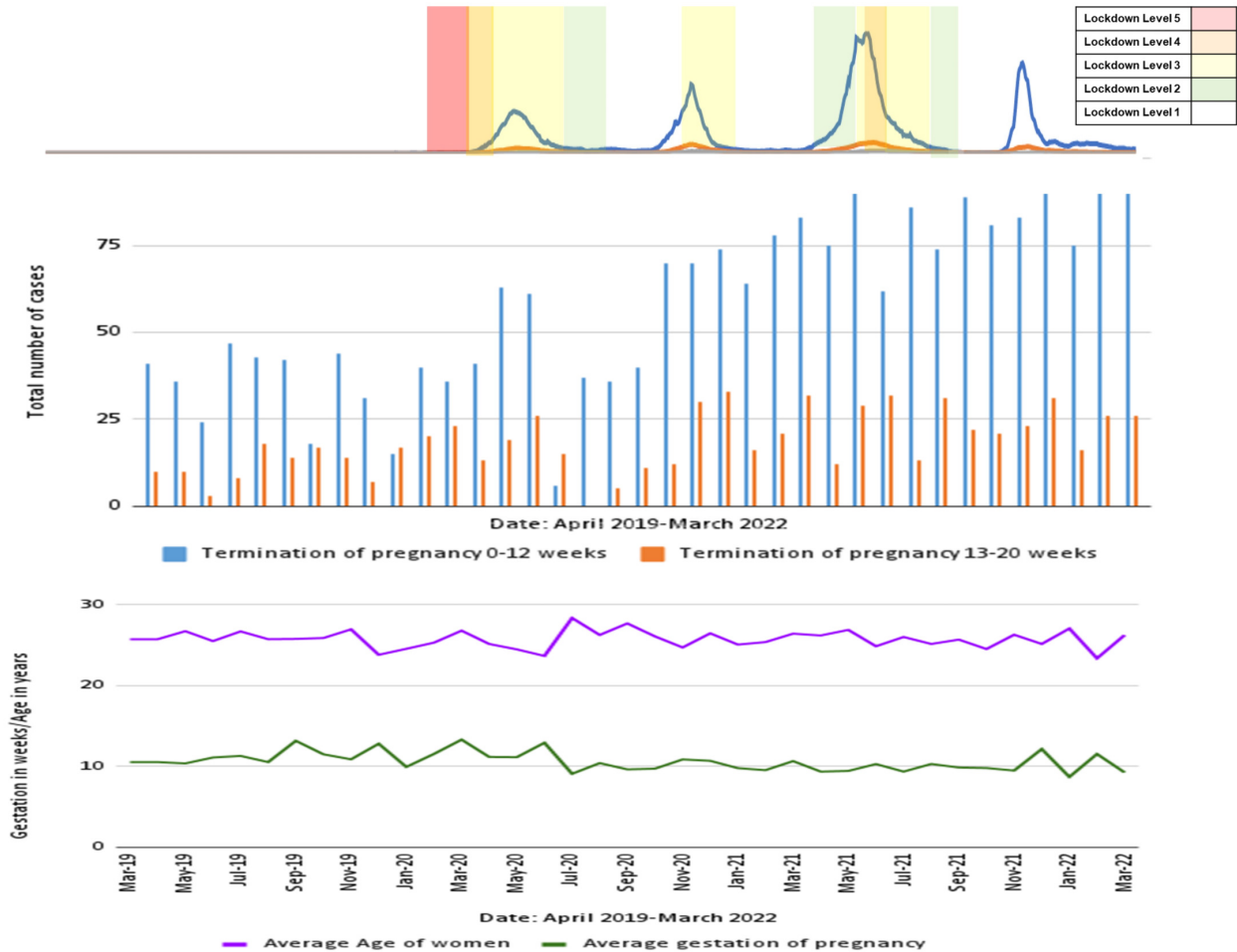
Babies born prior to their mothers' arrival at a health facility

The number of babies born before arrival (BBA) at a health facility gradually increased from 146/month (pre-pandemic), to 177/month (2020-2021), and 191/month (2021-2022) ($p<0.001$ for pre-pandemic versus 2021-2022) (Figure 10). This timing of the increase corresponded to restrictions on personal movement during the lockdown periods, with no trend reversal seen with easing of lockdown regulations. There was a marked peak in BBA numbers in July 2021 ($n=236$), just after the third and largest COVID-19 wave in the district.

HIV programme

As a gauge for the robustness of the HIV programme to maintain MNCWH service coverage during the pandemic, the number of infant birth HIV Polymerase Chain Reaction (PCR) Reaction tests was compared with number of live births to HIV-positive women, as recorded in the DHIS (Figure 11). Data showed that the early infant diagnosis programme was well maintained, in terms of infant birth testing. There was a decrease in number of recorded live births to women living with HIV in the last year of study, leading to a corresponding decrease in number of infant birth PCR tests.

Figure 4. Terminations of pregnancies done at Jubilee District Hospital, situated in Tshwane Subdistrict 2, from April 2019 to March 2022, with corresponding timelines of COVID-19 waves and lockdown levels (top); numbers of terminations per month as grouped by pregnancy weeks (first 12 weeks; 13-20 weeks of pregnancy) (middle); and average gestation and age of clients (bottom)



Source: Jubilee District Hospital termination of pregnancy register, Subdistrict 2, Tshwane District Health Services (For three months of the study period, namely March 2019, April 2019 and August 2019, the source document data were untraceable, with use of extrapolated averages.)

Child health

Deworming and Vitamin A supplementation

Administration of both Vitamin A supplementation and deworming medication is mainly conducted at PHC facilities and at community level (including administration by community health workers). Both of these preventive health services were reduced by more than 50% during the level-5 lockdown compared with the pre-COVID-19 period, with subsequent improvement in the former as the lockdown restrictions eased (Vitamin A: $p=0.002$; deworming: $p=0.0005$; pre-pandemic versus pandemic period) (Figure 12).

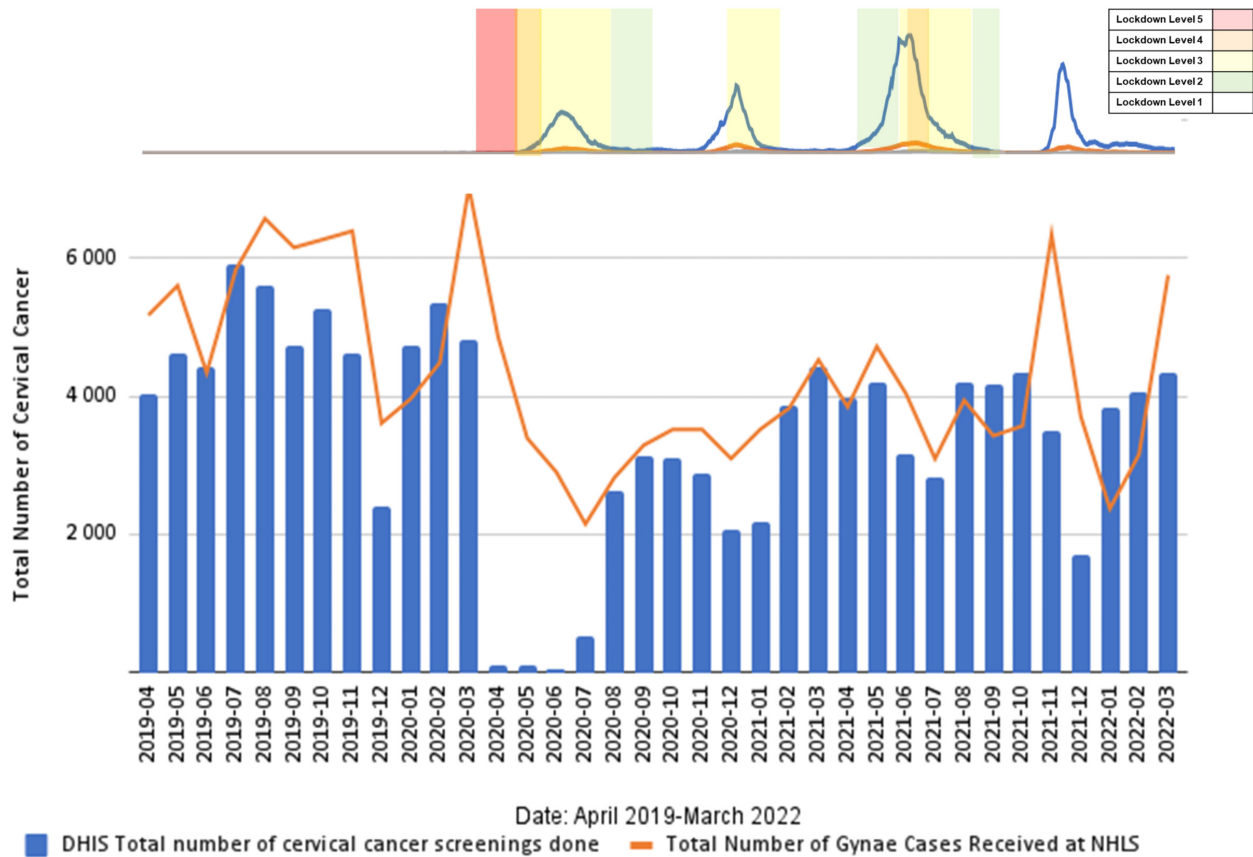
Childhood immunisations

The well-established childhood immunisation programme includes multiple vaccinations given at various

time points, with the most intensive phase being the first year of life (nine different vaccines, 13 administrations, and seven time points). It is mostly a facility-based health programme, monitored by various data elements and indicators on the DHIS. The measles vaccination (given at six and 12 months of age) is an important coverage marker due to the risk of outbreaks of this highly contagious infection when herd immunity decreases. Another important coverage marker is the data element 'immunised fully under 1 year', defined as a child who has completed his/her primary course of immunisation before the age of one year.

Figure 13 shows the effect of the pandemic on these indicators. The figure also shows a yearly decline during each December, including the pre-pandemic period, corresponding to the holiday period. However, the start of lockdown in April 2020 shows a similar sharp decline, with the measles first dose coverage plummeting to

Figure 5. Monthly numbers of cervical cancer screenings done in Tshwane District from April 2019 to March 2022, with corresponding timelines of COVID-19 waves and lockdown levels



Source: District Health Information System, COVID-19 line list and National Health Laboratory Services district report, Tshwane District Health Services

62.8%, but there is evidence of catch-up as the yearly averages moved from 86.2% (pre-pandemic), to 87.8% (2020-2021), and to 90.6% (2021-2022). Additionally, there is evidence of increases in the fully immunised group at the end of the study period (average of 92.7% from January to March 2022) ($p < 0.001$ for 2020-2021 versus 2021-2022)

School health: Screening of learners

The Integrated School Health Programme (ISHP) provides a comprehensive screening programme (including vision, speech and hearing, anthropometry, locomotor system, oral health, communicable and non-communicable diseases, mental health and psychosocial risk) for all Grades 1 and 8 and other at-risk learners, undertaken by 23 dedicated teams in Tshwane District during school terms. The screenings are done on site, and screening periods are limited to public school terms. Figure 14 shows the severe ISHP disruption for multiple months in 2020 and 2021 due to COVID-19-related school closures from 18/03/2020, with partial school re-openings from 08/06/2020 and renewed closures from 27/07/2020 to 03/08/2020, with phased reopening thereafter.

Human papillomavirus (HPV) immunisation

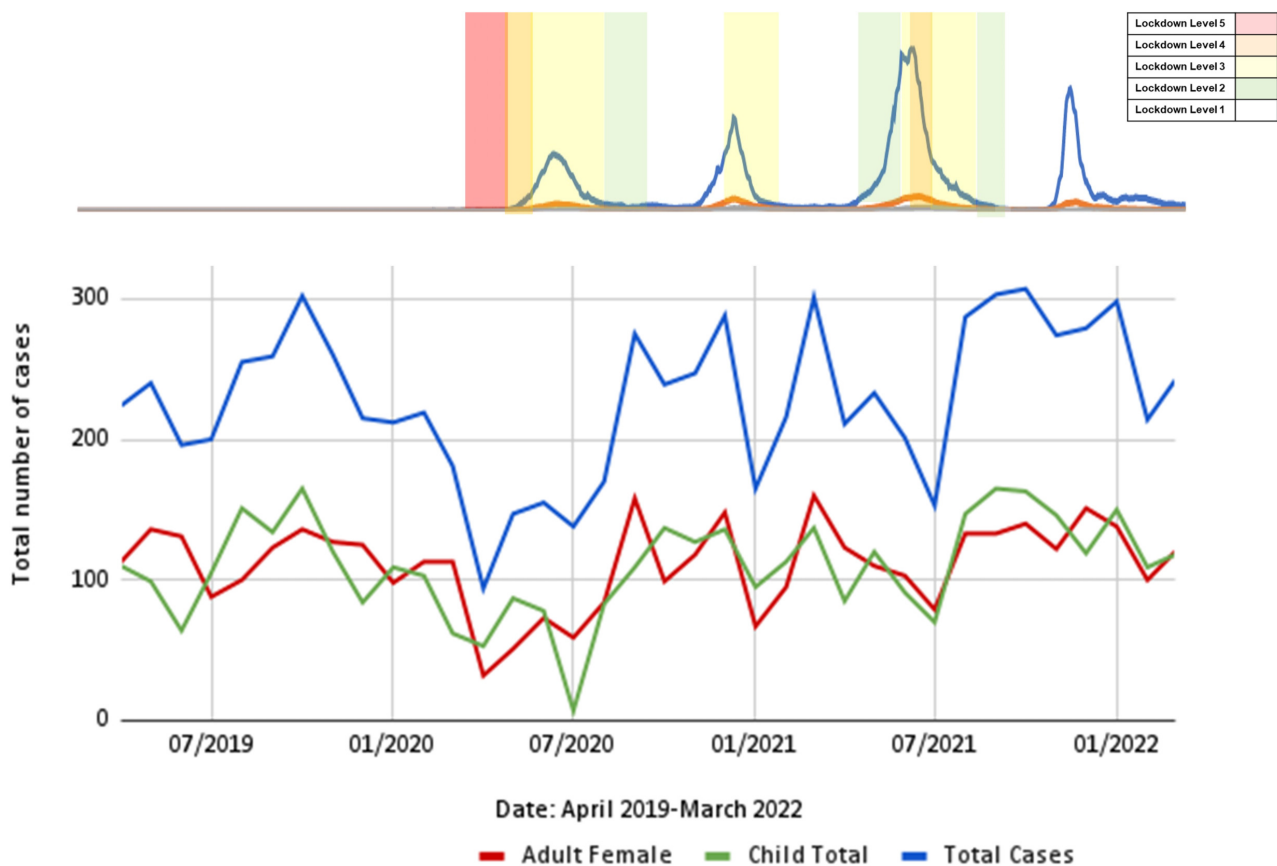
The HPV immunisation campaign is a national school-based vaccination campaign implemented through the ISHP in all public schools. Female learners in grades 4 or 5, aged 9 years and older, are given two doses at six-month intervals, in two campaigns (February/March and August/September). Table 1 shows the relevant data for Tshwane District for 2019-2022.

Review of overall trends for the selected indicators show that most routine MNCWH services were disrupted during the COVID-19 pandemic period, with more severe impacts on preventive services at PHC and community level than on facility-based clinical services (Table 2). The most significant decrease was experienced during the first pandemic year, most notably during the first strict lockdown period, with partial or complete recovery in the second pandemic year.

Discussion

South Africa has seen improved maternal and child health outcomes in the past decade, linked to improved effectiveness and access to large-scale health pro-

Figure 6. Monthly numbers of clinical consultations at Clinical Forensic Medical Centres in Tshwane District from April 2019 to March 2022, with data shown for total cases as well as adult female and child cases, with corresponding timelines of COVID-19 waves and lockdown levels



Source. Clinical Forensic Services register and COVID-19 line list, Tshwane District Health Services

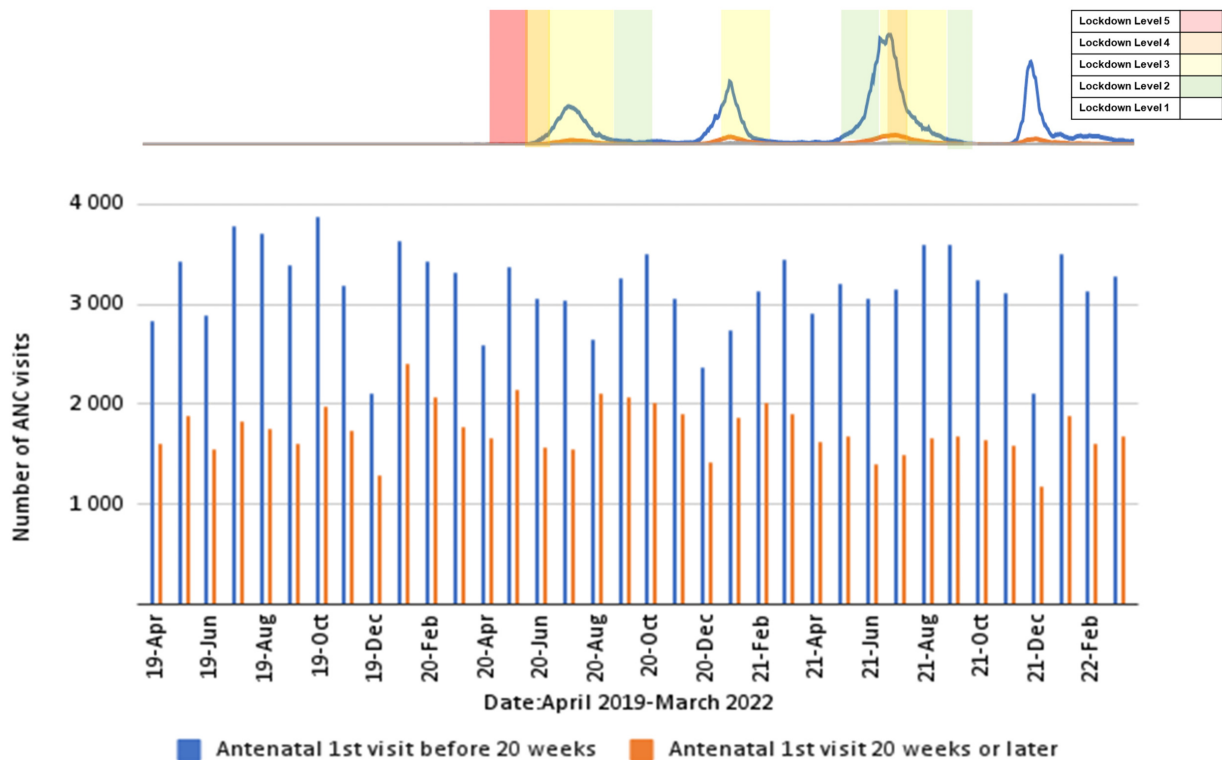
grammes, mostly anchored in PHC services at district level.⁵ These routine services are accessible to all citizens and mostly free of charge through the public health system. The data presented in this chapter largely exclude curative hospital-based services and services rendered within the private sector.

The COVID-19 pandemic was a major disruptive force, not only due to risk of morbidity and mortality because of infection with this novel pathogen, but also because of the lockdown regulations designed to curb its spread.⁶ During the initial strict lockdown period, movement of the entire population was severely restricted outside of their homes.⁷ Although PHC facilities in Tshwane District remained open and mostly functional, apart from short-term closures for COVID-19 prevention activities, uptake of many MNCWH services showed a sharp decline during the initial strict level-5 lockdown, despite very few COVID-19 cases at that stage. Preventive health services were most severely affected, particularly services rendered at community level and at schools/crèches. This decreased utilisation at the onset of the pandemic, with subsequent second-year recovery, is consistent with findings of other African and Indian studies.⁸⁻¹⁰ Con-

tributing factors included movement restrictions, reduced access to transportation, pandemic-related economic challenges, reduced health-system capacity, and delayed care-seeking behaviours due to fear of infection and misconceptions about transmission. Clients were more likely to avoid or delay routine or preventive services than to delay acute and emergency medical care. This was in line with reports by Czeisler et al.¹¹ that one-third of adult American respondents delayed or avoided routine medical care during June 2020.

Utilisation of family-planning services decreased markedly, as indicated by the significant decrease in CYPR. However, whereas this decrease reversed in the second pandemic year in the rest of the Gauteng¹² it did not do so in Tshwane District, where it decreased further. The national shortage of injectable medroxyprogesterone prior to and during the pandemic period also affected Tshwane District and may have contributed to some extent to the low CYPR. The cervical cancer screening programme was also significantly impacted, especially during the initial strict lockdown period, possibly because it was not deemed to be immediately life-threatening if temporarily postponed. The discrepancy in cervi-

Figure 7. Monthly numbers of antenatal care (ANC) first visits done in Tshwane District from April 2019 to March 2022, as grouped by first visits done before 20 weeks and on/after 20 weeks gestation, with corresponding timelines of COVID-19 waves and lockdown levels



Source. Clinical Forensic Services register and COVID-19 line list, Tshwane District Health Services

cal cancer screening data from the DHIS and the NHL, particularly during level-5 lockdown, can likely be attributed to data-quality issues, including incomplete facility-level capturing, similar to reports from other sites during the pandemic.^{2,13} The decreased cervical cancer screening led to reduction in early detection of high-grade precancerous lesions, raising concerns about long-term impacts of the missed screening opportunities during the pandemic.

Additionally, the HPV immunisation campaign was significantly affected by COVID-19-related school closures, with the pandemic onset coinciding with a planned change-over in age group of vaccine-eligible girls in 2020, leading to very low HPV numbers in the first pandemic year. On resumption in 2021, the service showed the ability to adapt, despite the erratic school calendar caused by the pandemic's lockdown restrictions, but long-term concerns remain regarding missed HPV vaccinations during this period. Adolescents engaging in risky sexual behaviour are at high risk for HPV infection and more than 90% of HPV-associated cancers are preventable through vaccination.¹⁴

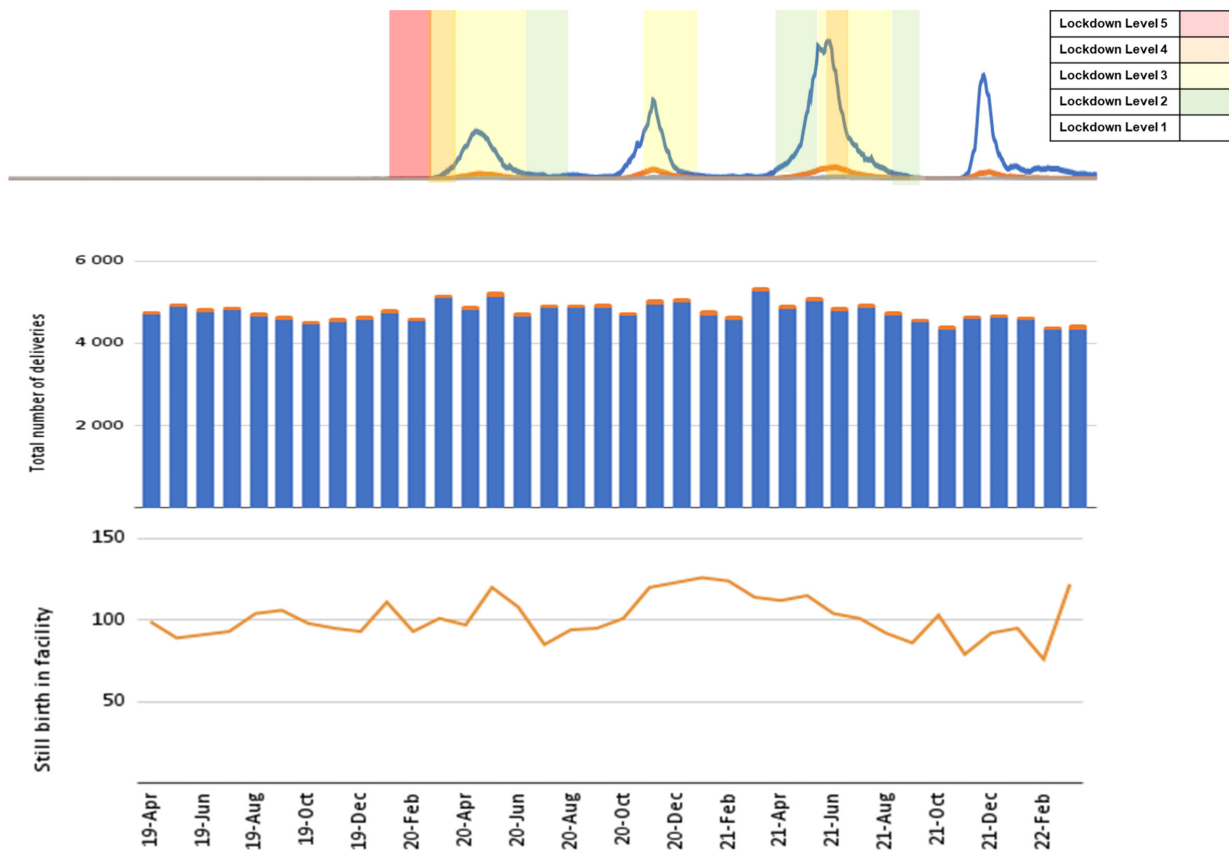
The inability of community health workers to conduct their usual home visits during the lockdown period to administer routine health interventions is illustrated by significant reductions in Vitamin A and deworming adminis-

tration. Health screening of learners at schools was also severely disrupted by COVID-19 restrictions, with schools closed for most of 2020, and partial or rotational return of learners still prevalent in 2021. Children who missed preventive healthcare opportunities are at risk of never catching up on these, except if catch-up activities are subsequently prioritised within the health system.

One well-established preventive health programme that showed resilience in Tshwane District was the childhood immunisation programme, despite the programme being known to easily take strain during crisis situations.¹⁵ Data in this study showed immediate large decreases at the start of the pandemic, but then marked increases in both measles and fully immunised (under-1-year) indicators during the second pandemic year, to levels higher than pre-pandemic coverage. Importantly though, despite such successes, a significant number of children who missed vaccinations during the acute crisis period may still not have had catch-up doses, leading to population-level reductions in herd immunity and risks of vaccine-preventable disease outbreaks, as illustrated in the current country-wide measles outbreak.¹⁶

In September 2019, the high pre-existing level of gender-based violence was declared a national crisis by the South African government. Global research showed an increase in domestic violence during the COVID-19 lock-

Figure 8. Monthly numbers of deliveries, live births and stillbirths in health facilities in Tshwane District from April 2019 to March 2022, with corresponding timelines of COVID-19 waves and lockdown levels



Source: District Health Information System and COVID-19 line list, Tshwane District Health Services

down period, with increased numbers of gender-based violence cases reported in the first seven days of strict level-5 lockdown in South Africa.¹⁷ However, limited local research has been done on the impact of lockdown restrictions on women's and children's experiences of domestic violence, including intimate partner violence and child abuse. Research done by Mahlangu et al.¹⁸ in Gauteng, South Africa, reported that women experienced increased levels of emotional abuse and reported higher levels of paternal physical abuse towards their children, but notably few women reported experiencing physical violence at home. In the present study, the number of clients reporting sexual abuse at the forensic clinical services decreased markedly during the strict lockdown periods. Possible explanations include movement restrictions, night-time curfews, limited social events, and the lockdown-related alcohol ban, potentially decreasing the risk of sexual assault. But the restrictions could also have prevented clients from accessing services and reporting abuse, with children and victims of domestic violence being particularly vulnerable groups.

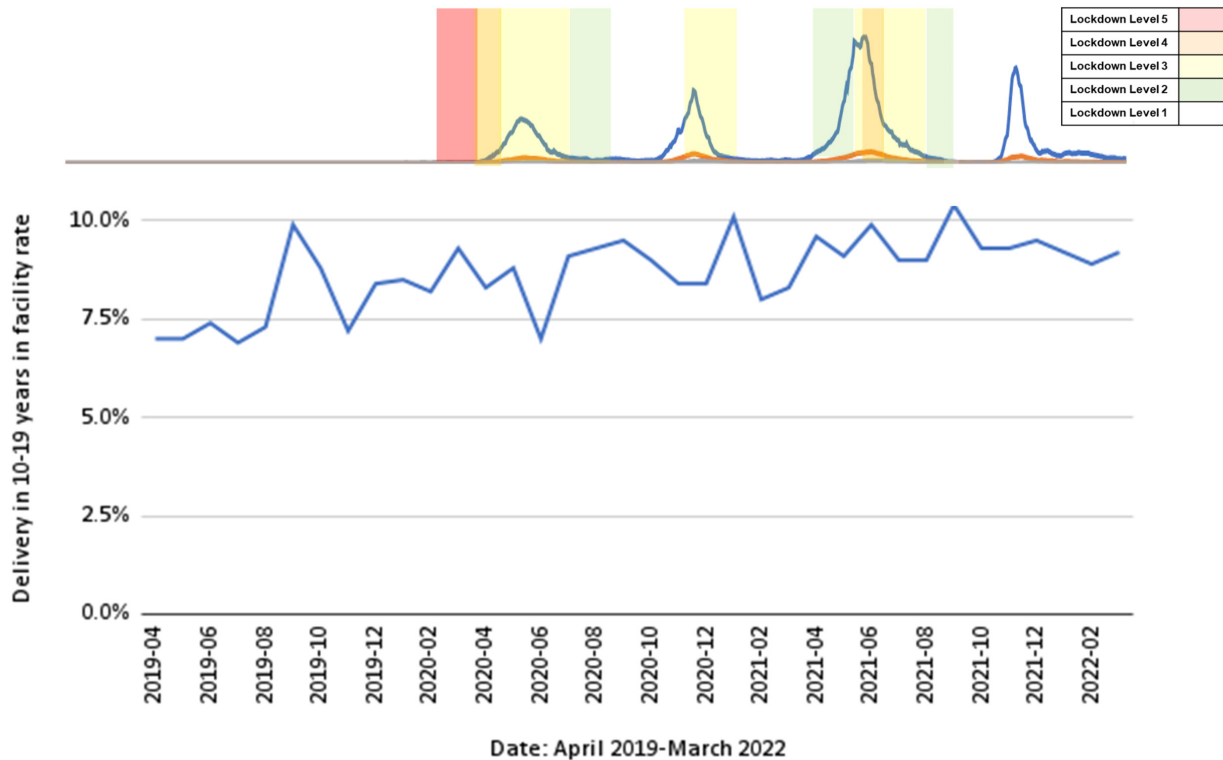
The significantly improved TOP access in Tshwane District over the study period shows that health-service disruption can be mitigated and even counteracted by planned resource allocation, even when faced with a cri-

sis of the magnitude of the COVID-19 pandemic, with its associated lockdown measures. Gauteng was the only South African province that did not report a decrease in the number of TOPs during the pandemic.¹⁹

The increased number of teenage deliveries and the number of babies born outside of health facilities recorded during the study period in Tshwane District is of concern, with trends continuing into the second year. Several factors, including transport issues and precipitous labour, could have led to women giving birth before arrival at a health facility, but preference for home deliveries reportedly also increased, particularly among refugee women.^{20,21} Nationally, the teenage in-facility deliveries rate increased during the pandemic, although overall teenage pregnancy rates are difficult to calculate because of inaccurate reporting of pregnancies ending in miscarriages or terminations. Pandemic-related school closures and disruption of access to family-planning services, together with previously identified predictors of teenage pregnancies such as lack of parental support and economic challenges, possibly put teenagers in Tshwane District at compounded risk of unplanned pregnancies.¹⁹

In the present study, MNCWH services that were linked to clinical care provision were less disrupted than

Figure 9. Percentage of in-facility deliveries in teenage girls (aged 10 to 19 years) in Tshwane District from April 2019 to March 2022, with corresponding timelines of COVID-19 waves and lockdown levels



Source: District Health Information System and COVID-19 line list, Tshwane District Health Services

preventive services. Despite early concerns regarding the risk of contracting COVID-19 during visits to health facilities, utilisation of antenatal services in Tshwane District was generally well maintained throughout the pandemic. This also extended to in-facility components of large-scale health programmes, such as infant HIV PCR testing. Research from Johannesburg, South Africa, on infant HIV diagnosis during the pandemic utilising NHLS data similarly found minimal disruption to HIV testing for children under two years of age.²²

Stillbirth numbers increased significantly during the first pandemic year, in line with international research done by Khalil and colleagues.²³ However, unlike many other indicators studied in this research, the noticeable spikes coincided with the first and second COVID-19 waves, rather than with lockdown periods. It is unclear whether this was due to maternal SARS-CoV-2 infection, or the additional strain on healthcare resources during times of increased infections and admissions.²⁴

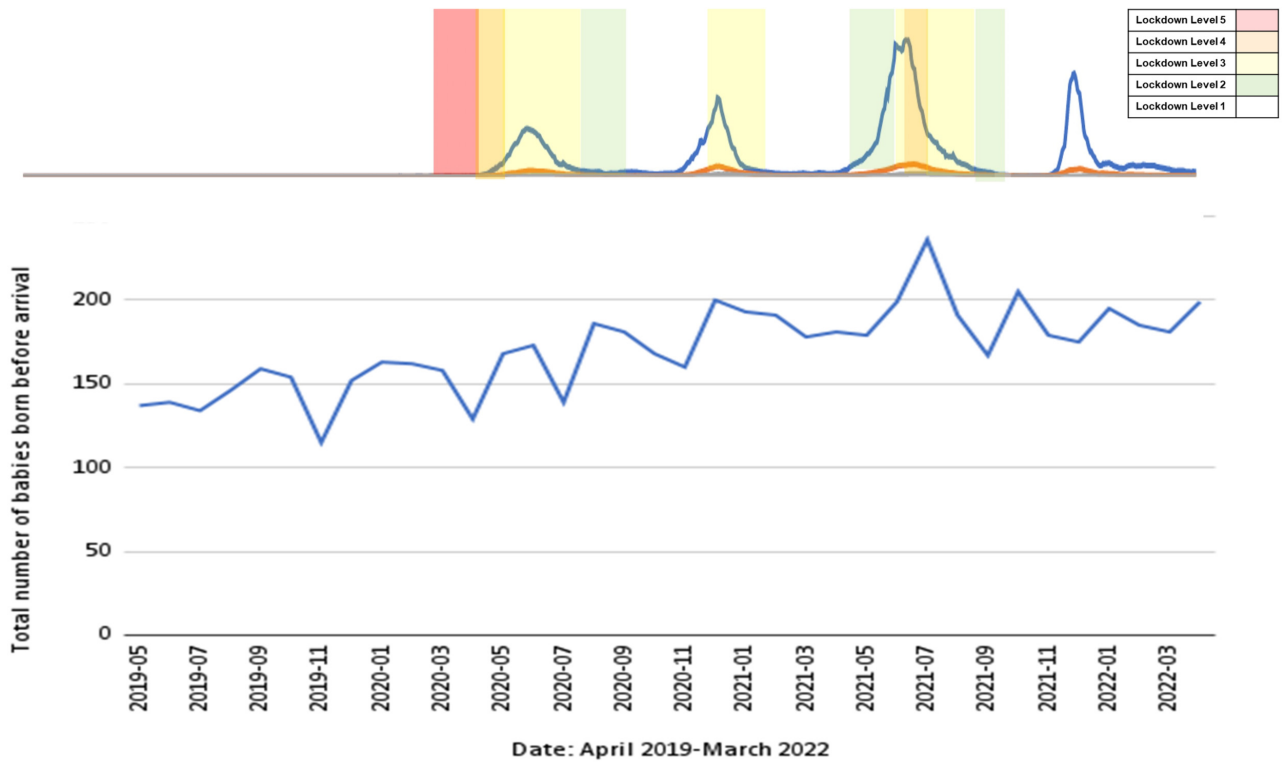
The strengths of this study include the use of district-wide data from several sources from one of the country's large health districts, with many of the researchers, as staff members of the Tshwane District Health Services, having intimate knowledge of the health-service provision in the district. Limitations include the use of routine data sets with all the inherent difficulties in terms of completeness and correctness, particularly during a time of crisis impacting health workers and administrative staff,

although data cleaning was done as far as possible. Local geographical variations may have been obscured by the presented aggregate district-level data. Furthermore, there was a lack of private-sector data with regard to routine data sets, excluding the COVID-19 surveillance data. Quantitative data alone are not sufficient to fully unpack the reasons for particular health-seeking behaviour. In addition, the COVID-19 pandemic and the associated lockdown measures led to changes in both internal and external migration patterns influencing health-service needs in terms of access in specific geographical areas, which was not measurable as part of this research.

Conclusions and Recommendations

The COVID-19 pandemic has been a major challenge to health services globally. The research presented in this chapter indicates its impact on the ability of women and children to access various routine healthcare services in a large peri-urban district in South Africa. Future-proofing the health system for major disruptive events, such as pandemics, needs to include planning of service delivery and client access to service-delivery points at all levels of care, including at community level. While curative services may need to be prioritised in the acute phase, it is crucial that the likely duration of an emergency situation

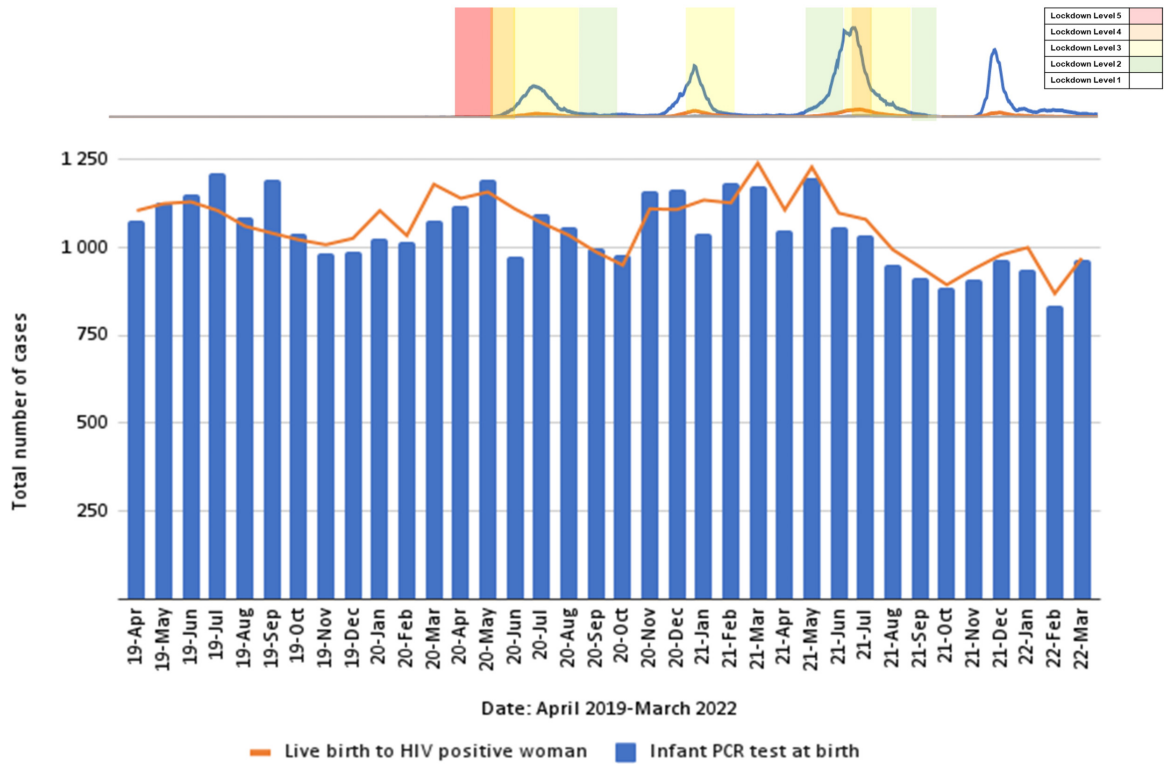
Figure 10. Monthly numbers of babies born before arrival to a health facility in Tshwane District, from April 2019 to March 2022, also showing corresponding timelines of COVID-19 waves and lockdown levels



Source. District Health Information System and COVID-19 line list, Tshwane District Health Services

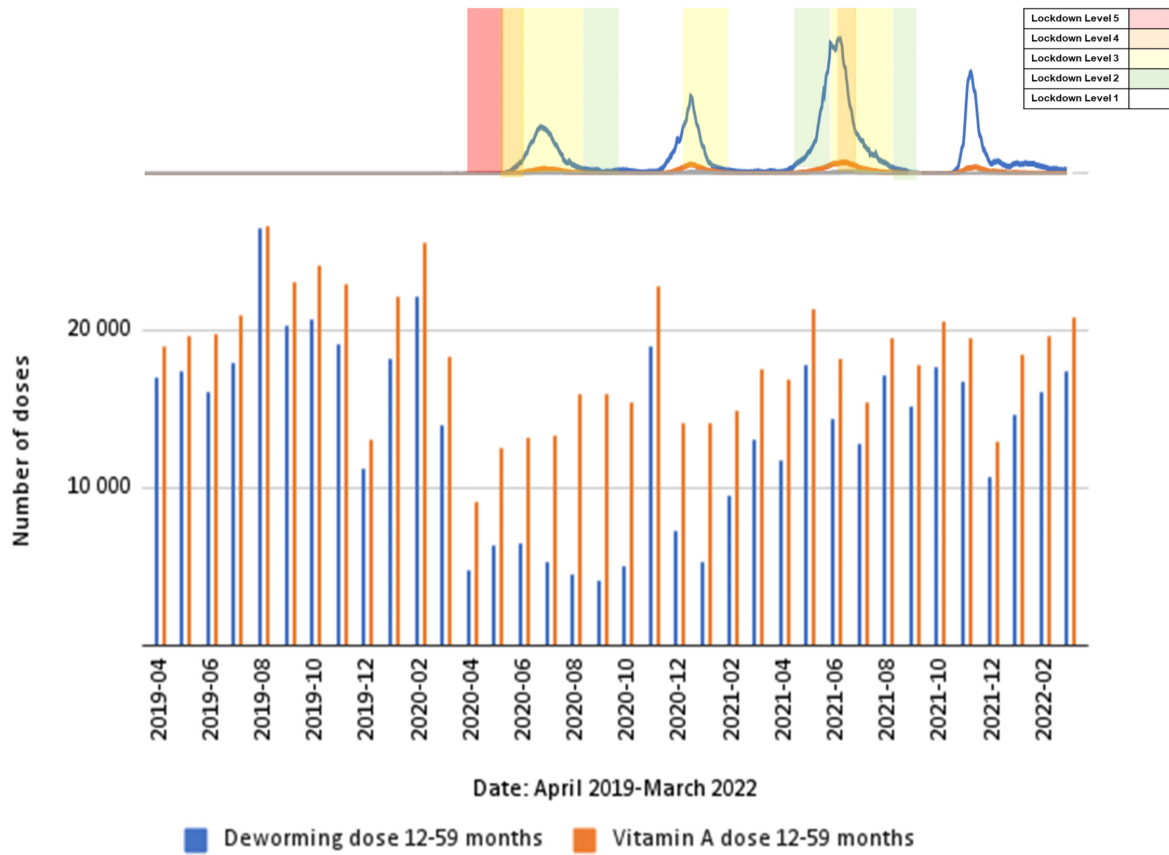
be regularly reassessed, with delivery of preventive services also prioritised, despite the emergency situation. Measures that need to be strengthened include use of innovative digital health solutions to assist with health education, and where possible, appointment reminders and use of telemedicine for routine consultations.

Figure 11. Monthly numbers of births to HIV-positive women and infant birth HIV PCR tests done in Tshwane District from April 2019 to March 2022, with corresponding timelines of COVID-19 waves and lockdown levels



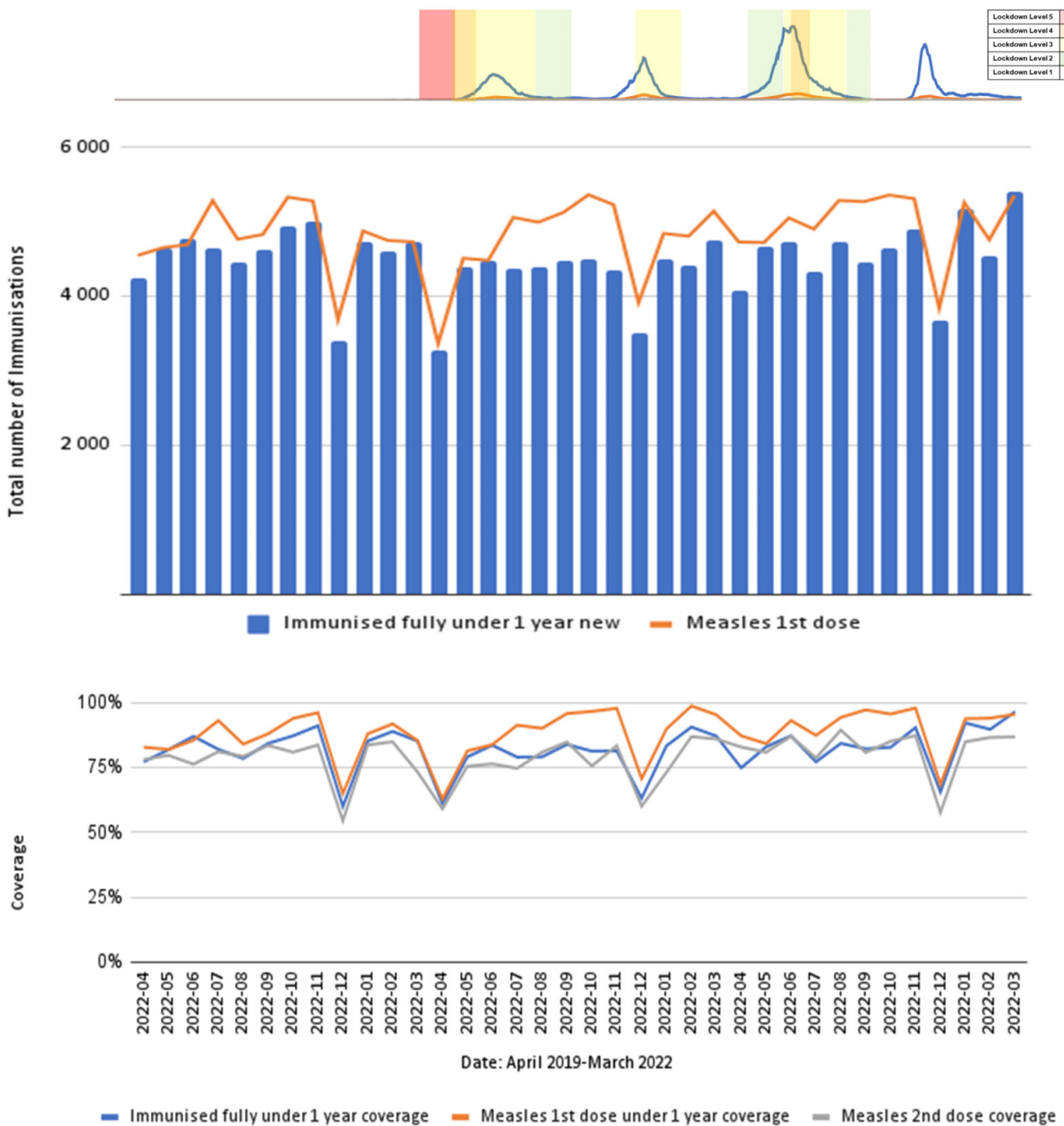
Source: District Health Information System and COVID-19 line list, Tshwane District Health Services

Figure 12. Monthly numbers of deworming and Vitamin A doses administered in Tshwane District from April 2019 to March 2022, with corresponding timelines of COVID-19 waves and lockdown levels



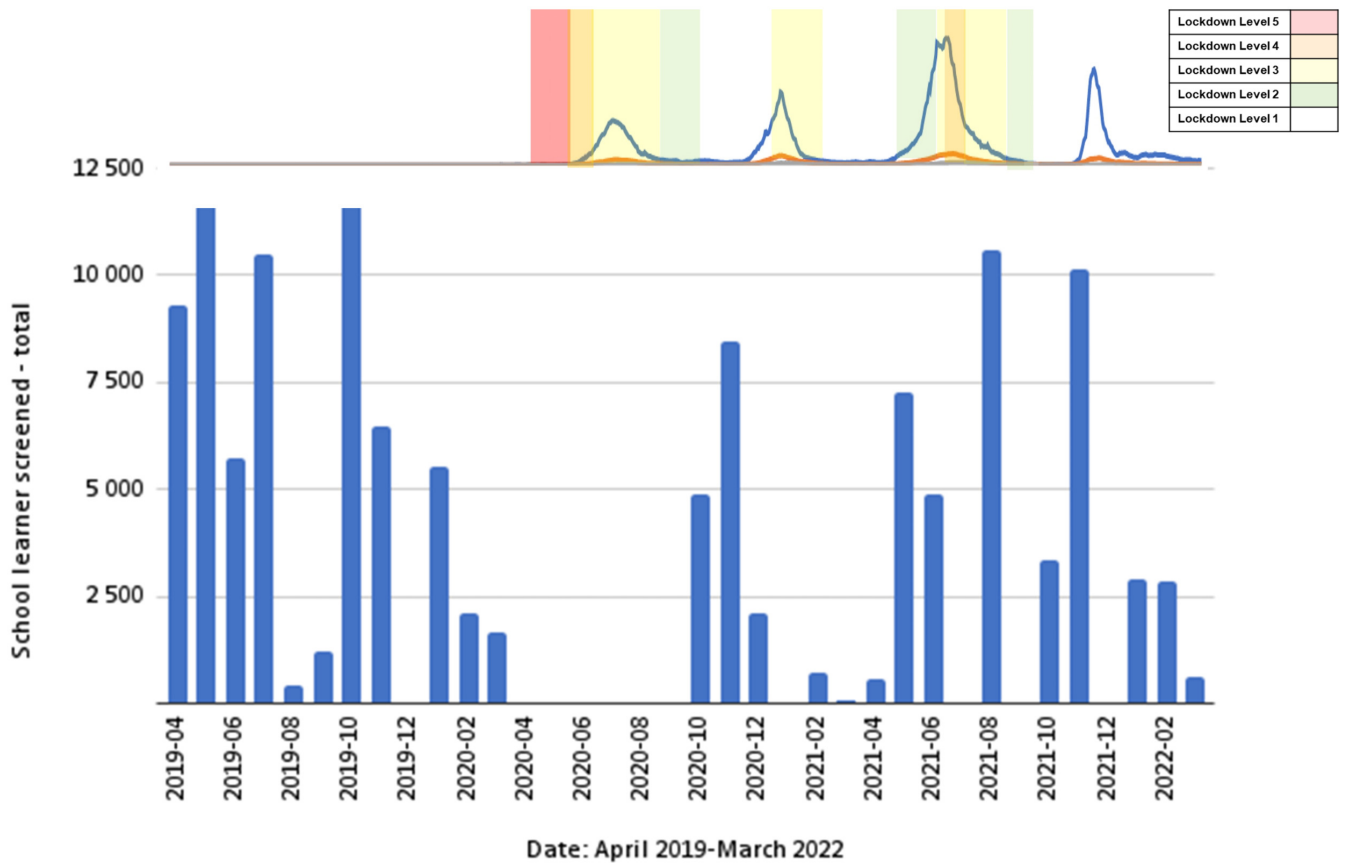
Source: District Health Information System and COVID-19 line list, Tshwane District Health Services

Figure 13. Monthly immunisation doses and coverage rates for Tshwane District from April 2019 to March 2022, as illustrated by number of children fully immunised under 1 year and measles first and second doses, with corresponding timelines of COVID-19 waves and lockdown levels



Source. District Health Information System and COVID-19 line list, Tshwane District Health Services

Figure 14. Monthly numbers of learners screened in Tshwane District from April 2019 to March 2022, with corresponding timelines of COVID-19 waves and lockdown levels



Source. Integrated School Health Programme data and COVID-19 line list, Tshwane District Health Services

Table 1. Consolidated data from HPV campaigns for girls at schools in Tshwane District, 2019-2022

Year	HPV campaign	Campaign coverage	Comments
2019	HPV-1 (February-March)	68% (15 056 targeted learners vaccinated)	Includes catch-up doses (HPV-1 of 2018 = 918; HPV-2 of 2017 = 637; HPV-2 of 2018 = 2 851).
	HPV-2 (August-September)	99% (15 710 targeted learners vaccinated)	Includes catch-up doses (HPV-1 of 2019 = 3 644; HPV-2 of 2018 = 2 691).
2020	HPV-1 (February-March)	114% (1 259 targeted Grade 4 learners vaccinated; 6% of additional girls who were new in school)	Target numbers very low because of transitioning year in which the target group moved from Grade 4 to Grade 5, as many learners were underage in Grade 4 leading to targets not being reached. No catch-up doses were given during this campaign.
	HPV-2 (August-September)	None	Campaign was suspended due to COVID-19-related school closures. Learners not vaccinated were to be rolled over to next year.
2021	HPV-1 (February-April)	81% (18 287 targeted learners vaccinated)	Overall learners vaccinated = 21 828, including catch-up doses (HPV-2 of 2020 & 2019 = 541).
	HPV-2 (August-September)	96% (18 024 targeted learners vaccinated)	Overall learners vaccinated = 19 811; including catch-up doses (HPV-1 of 2021 = 1 570; HPV-2 of 2019 & 2020 = 217).
2022	HPV-1	89% (20 515 targeted learners vaccinated)	Overall learners vaccinated = 20 515; no catch-ups were done, as all outstanding learners planned to be vaccinated during subsequent round.

Source: Integrated School Health Programme data, Tshwane District Health Services.

Table 2. Summary of selected MNCWH indicators and their performance in Tshwane District, 2019-2022

Grouping	Indicator/measurement	Preventive service or clinical care*	Main service delivery platform	Performance over study period**
Women's health and reproductive services	Family planning (couple-year protection rate)	Preventive	Health facilities at all levels; mainly PHC facilities	Decreased during 2020/2021; further decrease during 2021/2022.
	Termination of pregnancy (number)	Clinical	Hospital-level (mostly outpatient service)	Decreased during 2020/2021; with increase in 2021/2022 to higher than pre-pandemic levels.
	Cervical cancer screening (number)	Preventive	Health facilities at all levels; mainly PHC facilities	Decreased markedly during 2020/2021, with recovery in 2021/2022, but not reaching pre-pandemic levels.
Forensic clinical services	Clinical consultations (number)	Clinical	Dedicated sites at health facilities (outpatient service)	Marked decrease during each lockdown period, with severe reduction during 1st strict lockdown period, but otherwise services were maintained.
Maternal and neonatal health	Antenatal care (ANC first visits; ANC first visits <20 weeks) (number)	Preventive & clinical	Health facilities at all levels	ANC visits mostly maintained throughout, despite some monthly variations, with overall slight reductions in monthly first ANC visit numbers. Percentage of early bookings (first ANC visit <20 weeks) remained unchanged.
	In-facility deliveries (number)	Clinical	Health facilities at all levels	Slight increase during 2020/2021; decrease to below pre-pandemic levels during 2021/2022.
	Stillbirths (in-facility) (number)	Clinical	Health facilities at all levels	Stillbirth numbers increased in 2020/2021, with two peaks (after COVID-19 wave 1 & second sustained peak during COVID-19 waves 2&3). Stillbirth numbers in 2021/2022 returned to pre-pandemic levels.
	Teenage pregnancies (Delivery in 10 to 19 years in-facility rate)	Preventive & clinical	Health facilities at all levels	Increased percentage in 2020/2021, with further increase in 2021/2022.
	Born before arrival (number)	Preventive & clinical	Outside of health facilities	Increased number in 2020/2021, with further increase in 2021/2022, with largest peak in July 2021 after COVID-19 wave 3.
	HIV programme: Infant birth HIV PCR (number)	Preventive & clinical	Health facilities at all levels	Infant birth PCR compared with live births to HIV-positive women well maintained throughout entire period.
Child health	Vitamin A dose (age 12-59 months) (number)	Preventive	PHC facilities, community-level, including crèches	Large reduction in 2020/2021 (>50%), especially during level-5 lockdown. Recovery in 2021/2022, but not to pre-pandemic levels.
	Deworming dose (age 12-59 months) (number)	Preventive	PHC facilities, community-level, including crèches	Large reduction in 2020/2021 (>50%), especially during level-5 lockdown. Recovery in 2021/2022, but not to pre-pandemic levels.

Grouping	Indicator/measurement	Preventive service or clinical care*	Main service delivery platform	Performance over study period**
	EPI: Measles first dose (number & coverage)	Preventive	PHC facilities	Sharp decline during 2022/2021 at start of strict lockdown (April 2020), with subsequent catch-up; percentage in 2021/2022 higher than pre-pandemic levels.
	EPI: Fully immunised under 1 year (number & coverage)	Preventive	PHC facilities	Maintained overall, except for sharp declines linked to COVID-19 waves and lockdown levels.
School health	Health screening of learners (number)	Preventive	Schools	Large reductions in 2020/2021, with minimal or no screening in some months. Recovery in 2021/2022, with fewer months with low activities.
	HPV vaccination (number)	Preventive	Schools	Complex pattern due to campaign-based delivery, with confluence of two major impacting factors, namely COVID-19-related school closures and HPV target age adjustment.

PHC = primary health care; ANC = antenatal care; EPI = Expanded Programme on Immunization.

*Preventive services include measures taken for the purpose of disease prevention. Clinical care includes activities involving or relating to the direct medical treatment or testing of patients.

**Colour coding: Red = mostly negative impact; Yellow = complex impact; Green = services largely maintained.

Abbreviations

Abbreviation	Description
ANC	antenatal care
BBA	born before arrival
COVID-19	coronavirus disease of 2019
CYPR	couple-year protection rate
DHIS	District Health Information System
EPI	Expanded Programme on Immunization
HIV	human immunodeficiency virus
HPV	human papillomavirus
ISHP	Integrated School Health Programme
MNCWH	maternal, newborn, child and women's health
NHLS	National Health Laboratory Service
PCR	polymerase chain reaction
PHC	primary health care
SARS-CoV-2	severe acute respiratory syndrome coronavirus 2
TOP	termination of pregnancy



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References

1. Pillay-van Wyk V, Msemburi W, Laubscher R, et al. Mortality trends and differentials in South Africa from 1997 to 2012: second National Burden of Disease Study. *Lancet Glob Health*. 2016;4(9):e642-e653. doi:10.1016/s2214-109x(16)30113-9
2. Amouzou A, Maïga A, Faye CM, et al. Health service utilisation during the COVID-19 pandemic in sub-Saharan Africa in 2020: A multicountry empirical assessment with a focus on maternal, newborn and child health services. *BMJ Glob Health*. 2022;7(5):e008069. doi:10.1136/bmjgh-2021-008069
3. Statistics South Africa. *Mid-Year Population Estimates 2022*. StatsSA; 2022. <http://www.statssa.gov.za,info@statssa.gov.za>
4. R Project for Statistical Computing. R: A language and environment for statistical computing. Published 2021. <https://www.R-project.org/>
5. Bhardwaj S, Pattinson R, Kauchali S, et al. Implementation of strategies to improve programme effectiveness lead to an improvement in maternal and child health outcomes in South Africa. *S Afr Med J*. 2018;108(3):44-49. doi:10.7196/samj.2017.v108i3b.12812
6. Pillay Y, Pienaar S, Barron P, Zondi T. Impact of COVID-19 on routine primary healthcare services in South Africa. *S Afr Med J*. 2021;111(8):714-719. doi:10.7196/samj.2021.v111i8.15786
7. South African Government. Regulations and Guidelines - Coronavirus COVID-19. <http://www.gov.za/covid-19/resources/regulations-and-guidelines-coronavirus-covid-19>
8. Bolarinwa OA, Ahinkorah BO, Seidu AA, et al. Mapping evidence of impacts of COVID-19 outbreak on sexual and reproductive health: A scoping review. *Healthcare*. 2021;9(4):436. doi:10.3390/healthcare9040436
9. Kumar S, Singh AK, Jain PK, et al. Impact of COVID-19 pandemic on maternal and child health services in Uttar Pradesh, India. *J Family Med Prim Care*. 2021;10(1):509. doi:10.4103/jfmpc.jfmpc_155_0_20
10. Adelekan B, Goldson E, Abubakar Z, et al. Effect of COVID-19 pandemic on provision of sexual and reproductive health services in primary health facilities in Nigeria: a cross-sectional study. *Reprod Health*. 2021;18(1):166. doi:10.1186/s12978-021-01217-5
11. Czeisler MÉ, Marynak K, Clarke KEN, et al. Delay or avoidance of medical care because of COVID-19-related concerns – United States, June 2020. *Morb Mortal Wkly Rep*. 2020;69(36):1250-1257. doi:10.15585/mmwr.mm6936a4
12. Pillay Y, Museriri H, Barron P, Zondi T. Recovering from COVID lockdowns: Routine public sector PHC services in South Africa, 2019 - 2021. *S Afr Med J*. 2023;113(1):17-23. doi:10.7196/samj.2022.v113i1.16619
13. Pattinson R, Fawcus S, Gebhardt S, Soma-Pillay P, Niit R, Moodley J. The impact of COVID-19 on use of maternal and reproductive health services and maternal and perinatal mortality. In: Govender K, George G, Padarath A, Moeti T, eds. *South African Health Review 2021*. Health Systems Trust; 2021.
14. Olusanya OA, Bednarczyk RA, Davis RL, Shaban-Nejad A. Addressing parental vaccine hesitancy and other barriers to childhood/adolescent vaccination uptake during the Coronavirus (COVID-19) pandemic. *Front Immunol*. 2021;12:663074. doi:10.3389/fimmu.2021.663074
15. Shet A, Carr K, Danovaro-Holliday MC, et al. Impact of the SARS-CoV-2 pandemic on routine immunisation services: evidence of disruption and recovery from 170 countries and territories. *Lancet Glob Health*. 2022;10(2):e186-e194. doi:10.1016/s2214-109x(21)00512-x
16. National Institute for Communicable Diseases. *South African Measles Outbreak, Interim Situation Report 12 May 2023*. NICD; 2023. <https://www.nicd.ac.za/wp-content/uploads/2023/05/South-African-measles-outbreak-12-May-2023.pdf>
17. Uzobo E, Ayinmoro AD. Trapped Between Two Pandemics: Domestic Violence Cases Under COVID-19 Pandemic Lockdown: A Scoping Review. *Community Health Equity Res Policy*. 2023;43(3):319-328. doi:10.1177/0272684x211022121
18. Mahlangu P, Gibbs A, Shai N, Machisa M, Nunze N, Sikweyiya Y. Impact of COVID-19 lockdown and link to women and children's experiences of violence in the home in South Africa. *BMC Public Health*. 2022;22(1):1029. doi:10.1186/s12889-022-13422-3

19. Barron P, Subedar H, Letsoko M, Makua M, Pillay Y. Teenage births and pregnancies in South Africa, 2017 - 2021 – a reflection of a troubled country: analysis of public sector data. *S Afr Med J*. 2022;112(4):252-258. doi:10.7196/samj.2022.v112i4.16327
20. Wanyoike PK, Mutua FM. Factors associated with born before arrival and birth outcome among postnatal women attending Irchagadera Hospital, Garissa County, Kenya. *Int Arch Public Health Community Med*. 2020;4(4). doi:10.23937/2643-4512/1710051
21. Lusambili AM, Martini M, Abdirahman F, et al. "We have a lot of home deliveries" A qualitative study on the impact of COVID-19 on access to and utilization of reproductive, maternal, newborn and child health care among refugee women in urban Eastleigh, Kenya. *J Migr Health*. 2020;1-2:100025. doi:10.1016/j.jmh.2020.100025
22. Mnyani CN, Smit A, Sherman GG. Infant HIV testing amid the COVID-19 pandemic and evolving PMTCT Guidelines in Johannesburg, South Africa. *Trop Med Infect Dis*. 2022;7(10):302. doi:10.3390/tropicalmed7100302
23. Khalil A, Blakeway H, Samara A, O'Brien P. COVID-19 and stillbirth: direct vs indirect effect of the pandemic. *Ultrasound Obstet Gynecol*. 2022;59(3):288-295. doi:10.1002/uog.24846
24. Calvert C, Brockway M, Zoega H, et al. Changes in preterm birth and stillbirth during COVID-19 lockdowns in 26 countries. *Nat Hum Behav*. 2023;7(4):529-544. doi:10.1038/s41562-023-01522-y