AFRICAN JOURNAL OF SCIENCE, TECHNOLOGY AND SOCIAL SCIENCES

Journal website: https://journals.must.ac.ke

MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

A Publication of Meru University of Science and Technology

# The effects of COVID-19 pandemic on maternal and childhood health services in Meru County, Kenya

Gervase M. M'ibui[1*]

[1]Meru University of Science and Technology

ARTICLE INFO

KEY WORDS

*COVID- 19*

*Pandemic*

*Maternal and child Health*

*Meru*

ABSTRACT

**Background:** COVID- 19 pandemic put unprecedented burden on healthcare systems, globally. Women and children were most affected. It was thus necessary to examine its effects on Maternal and Child Health (MCH) services in Meru County Kenya, to design mitigation strategies against drawbacks to safeguard previously made gains.

**Methods:** Ethical clearance was obtained from Meru University Institutional Research Ethics and Review Committee (MIRERC). MCH Data for one year before and one year after the pandemic were analyzed using SPSS computer package and compared. Statistical tests were carried out using 2t test and descriptive and inferential statistics employed for summaries.

**Results:** No significant change occurred in the proportion of Fully Immunized Child (FIC) at $p<.05$ as $t(24) = 1.72$, $p=.098$. Nevertheless, the proportion of women with 4th antenatal care visit and adolescents 10 - 14 years pregnant at the first ANC visit, had lower and higher mean scores before and after the pandemic with significant changes at $p=.05$ of ($p=0.011$) and ($p=0.003$) respectively.

**Conclusions:** The pandemic did not affect MCH service indicators during the first year of the sickness in Meru County. However, the proportion of teenage pregnancies increased significantly, as the proportion of women with 4th antenatal care visit decreased.

## Background

The unique conditions of the 21st century, have reshaped the invasive power of disease causal agents, disrupting the balance of epidemic occurrences and disease transmission landscape unprecedentedly. Consequently, novel infectious diseases such as COVID- 19 pandemic, Ebola and other public health emergencies continue to occur.

The first confirmed case of COVID -19 infection caused by the novel coronavirus was reported in a 55-year-old individual from Hubei Province in China in November 17th, 2019 (WHO, 2020). The first confirmed case of COVID- 19 outside of China was reported in Thailand on January 14th 2020, the time when WHO technical team established human to human transmission in China (WHO, 2020).

During the same period, the first confirmed

Corresponding author: Gervase M. M'ibui Email: gmiriti@must.ac.ke

https://doi.org/10.58506/ajstss.v2i2.142

AFRICAN JOURNAL OF SCIENCE, TECHNOLOGY AND SOCIAL SCIENCES ISSN :2958-0560

https://journals.must.ac.ke © 2023 The Authors. Published by Meru University of Science and Technology

This is article is published on an open access license as under the CC BY SA 4.0 license

case of local transmission in the USA was recorded (Ghinai et al, 2020). By 21st February, nine European countries had reported 47 cases with 38 of them linked to two clusters in Germany and France and 14 having been infected in China (Spiteri et al, 2020). Clearly, the virus was circulating at the speed of the jetliners.

Within a short period, COVID- 19 spread to other parts of the World and Africa. WHO declared it a pandemic on 11th March 2020 (Lone and Ahmad, 2020). The first case of COVID-19 in Kenya was confirmed in Nairobi on the 12th March 2020. This was a Kenyan citizen who had travelled back to Nairobi from USA via London UK, on the 5th of March 2020 (Ministry of Health, Kenya).

Despite early reports showing more men dying from COVID-19, the health of women and children was generally negatively impacted through resource reallocation, missed opportunities and priorities setting. This led compromised sexual and reproductive health care services (UN, 2020). The objective of this study was to document the effects of COVID-19 pandemic on Maternal and Childhood Health services in Meru County, Kenya to recommend mitigation strategies and avoid gains made in MCH service indicators over time.

Usually, hospital visits are associated with increased chances of infection. This fear heightened during the COVID- 19 pandenic. However, WHO and Ministries of Health encouraged the public to attend health facilities for essential services including immunization because compromised maternal medical care during pregnancy and sub optical MCH services such as immunization of children could be more harmful (WHO, 2020).

The pandemic resulted in rapid increase in demand for services to health systems and governments throughout the world (WHO 2020). In addition, COVID- 19 infections were treated with fear, stigma and discrimination which discouraged the patients to go for services. The health workers including nurses and midwives, who usually ensure vaccinations, safe pregnancies and births are conducted professionally, information on contraceptives and counselling of women and young people are effectively carried out developed low morale (UNFPA, 2020).

Therefore, as countries grappled with rising numbers of COVID- 19 cases, postponement and suspension of both routine and elective health services may have resulted (WHO, 2020). That would possibly reverse gains made previously, in many low- and middle-income countries (Menendez et al, 2020).

It has previously been found that countries with high maternal mortality rate (MMR), are strongly associated with weak health systems. COVID- 19 pandemic further strained the already weak health systems, severely impacting essential health care services such as MCH clinic attendance in low- and middle-income countries (UNFPA, 2020) such scenarios may have worsed maternal and neonatal mortality rates (Bong et al, 2020).

During an outbreak of a novel infectious disease, systems focus on the cases and deaths and pay less attention to the indirect effects as in the case of Ebola in Sierra Leone (Kassa et al, 2022). It is important to assess sub optimal utilization of essential routine health services for rational reallocation of meagre resources for both the crisis and core essential health care services (Sochas et al, 2017). Elsewhere, modelling of possible scenarios of increased mortality from sub optimal performance of health systems showed negative impacts of COVID – 19 on MCH services (Chmielewska et al, 2021: Stein et al, 2020). This paper compared one-year period performance of MCH services before COVID- 19 outbreak one-year period after COVID- 19 pandemic in Meru County.

## Methodology

This was a descriptive cross-sectional comparative study between the proportions of clients accessing MCH services prior to COVID- 19 and post -COVID 19 pandemic periods. The study examined the impact of COVID -19 outbreak in Meru County on Maternal and Child Health (MCH) services in order to recommend mitigation strategies against its effects and safeguard against previously made gains in this important service.

Ethical clearance for the study was sought from Meru University of Science and Technology Institute of Research Ethics and Review Committee (MIRERC). Authority to review health records was sought and granted by the Meru County government Health Services. In addition, structured focused group discussions and key informant interviews were conducted to triangulate data from health records. Data were analyzed using SPSS computer package and a period of one year before and one year after COVID-19 pandemic were compared in the nine sub-counties. Statistical tests were carried out using 2t test and descriptive and inferential statistics employed for summaries

**Results**

The first antigen administered to new-born babies is the BCG. The vaccine is given to prevent infection with Tuberculosis (TB). It is thus mandatory at birth or soon thereafter. The study looked at the performance of this antigen one year before and one year after COVID- 19 pandemic across the nine sub-counties of Meru County. In Buuri Sub County, the performance of vaccination of children with BCG before COVID 19 (M= 25.92, SD =8.1) compared to the period after COVID- 19 (M= 37.24, SD 10.3) demonstrated better coverages after COVID-19 period. t (24) = -5.10852, p<0.001. As it came out from the Key Informants, mothers believed childhood vaccinations prevent COVID- 19 infections.

Igembe Central sub-County confirmed similar results before COVID 19 (M= 69.41, SD =6.6) compared to the period after the pandemic (M= 91.01, SD 18.7). The performance was statistically significantly better after COVID- 19, t (24) = -3.79221, p<0.001. As gathered from Key Informants, mothers in Igembe Central too, took even babies born at home for vaccinations which they believed prevented COVID- 19 illness.

However, there was no significant difference in performance in Igembe North Sub County before and after COVID; (M= 65.3, SD =9.1) compared to (M= 66.04, SD 19.1) with t (24) = -0.12153, p=.90. Igembe South Sub County had worse performance before COVID 19, (M= 148, SD =23.7) compared to the period after COVID- 19 period; (M= 169, SD 21). There was a significant difference in coverages between the two periods. t (24) = -2.17925, p=.04. In this sub county, mothers felt vaccinations were vital and protected their children from all diseases.

Nevertheless, Imenti Central had better performance before COVID 19 (M= 86.55, SD =39.7) compared to (M= 76.03, SD 9.6) after COVID- 19. That notwithstanding, there was no significant difference in performance between the two periods. t (24) = 0.96227, p=.35. Similar observations were made in North Imenti where the performance before and after COVID 19 was (M=118, SD =26.9) and (M= 105, SD 29.1) correspondingly. This demonstrated no significant difference in performance as t (24) = 1.19748, p=.24.

However, Imenti South posted different performance before and after COVID 19 (M=69, SD =5.9) and (M= 80, SD 8.3) respectively. There was a significant difference in coverages. t (24) = -3.16869, p=.001. The performance was better after COVID- 19 period. This is also one of the sub counties where Key Informants said vaccines protected children from COVID- 19.

The performance during COVID- 19 period in Tigania East was better after COVID- 19 pandemic;(M= 56.84, SD 18.8) compared to (M=41.02, SD =4.5) before COVID- 19 period. The results were significant at p<.05, t (24) = -2.73024, p=.011. Tigania West also had similar results where the performance before COVID 19 was (M=36.82, SD =8) compared to COVID- 19 period (M= 47.94, SD 9.9). t (24) = -2.97466, p=.006. In both cases, mothers believed routine vaccinations worked against COVID- 19.

Despite variations in the sub county BCG coverages, there was statistically no significant difference in overall performance of BCG coverage one year before and one year after COVID- 19 pandemic in Meru County, t (26) = -1.06640, p= .30. (see figure 1).

The proportion of under 1 year fully immunized children (FIC) before COVID- 19 (M=63.78, SD =11.2) compared to after COVID 19 period

**Figure 1:** *Comparison of BCG coverage before and after COVID- 19 Pandemic*

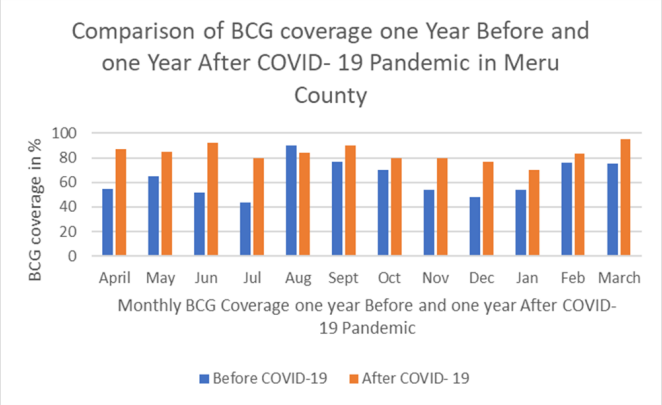



**Figure 2:** *Under 1 year Fully Immunized Children during COVID- 19*

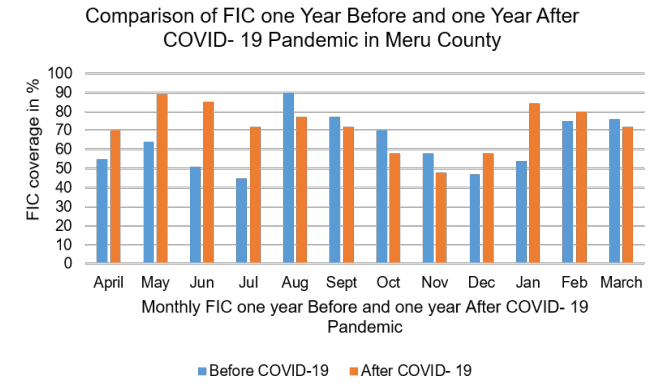
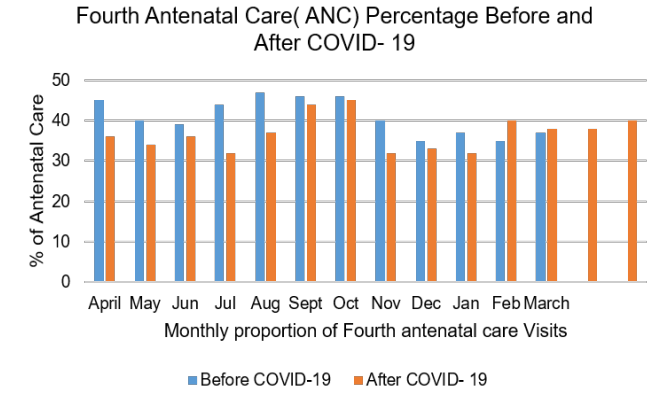



**Figure 3:** *Comparison of the Percentage of Women with Fourth Antenatal care Visit before and after COVID- 19*




(M=72.32, SD=14) demonstrated no statistically significant difference at p<.05 as t (24) = 1.72, p=.098. (figure 2)

The proportion of the 4th antenatal care visit 12 months before COVID- 19 (M=41.29, SD =3.7) compared to 14 months after COVID 19 period, (M=37.11, SD=4.28) demonstrated significantly better performance before COVID- 19, at p<.05, t

**Figure 4:** *Proportion of pregnant Adolescents (10-19) years*

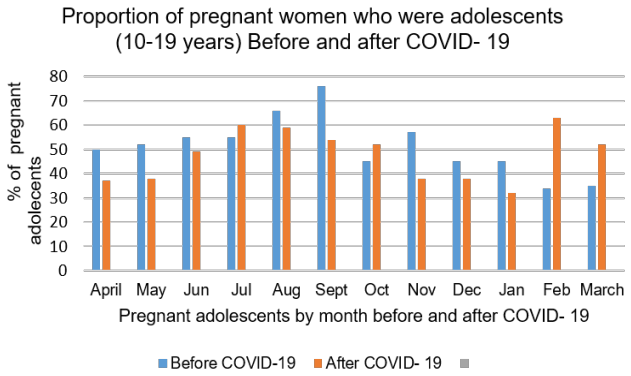
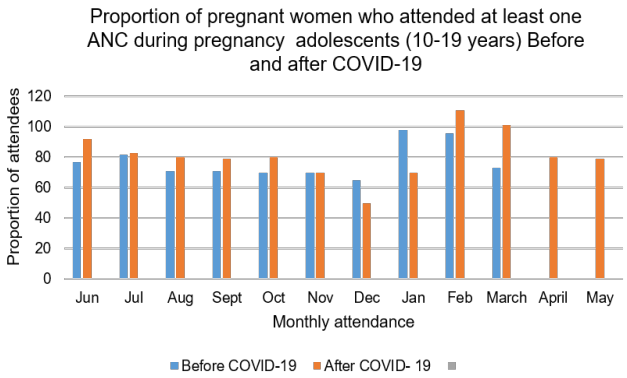



**Figure 5:** *Proportion of pregnant women who attended at least one ANC during pregnancy before and after COVID- 19 period*




(26) = 2.73, p=.011. (figure 3)

The proportion of pregnant women who were adolescents (10-19 years) one year before COVID-19 (M=49.12, SD =8.9) compared to one year after COVID 19 period (M=48.31, SD=10.09) demonstrated no significant difference at p<.05. t (24) = 0.22, p=.83 (figure 4)

The proportion of pregnant women who attended at least one ANC during Pregnancy before and after COVID- 19 period (M=77.5, SD =9.9) compared to 14 months after COVID 19 (M=81.85, SD=14.8) demonstrated no significant difference in attendance at p<.05. t (26) = -0.84, p=.41 (figure 5)

The number of women of reproductive age (WRA) who received Family Planning (FP) Commodities 12 months before COVID- 19 (M=13729, SD =1,711) compared to 14 months period of COVID- 19 pandemic (M=11,532, SD=3,459) demonstrated no significant difference in coverages at p<.05. t (26) = 1.92, p=.66

| Time of Service | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Before COVID-19 | 15900 | 16000 | 16000 | 13000 | 12000 | 15800 | 14000 | 11800 | 12200 | 14000 | 13700 | 10500 | 0 | 0 |
| After COVID- 19 | 13000 | 15500 | 16000 | 16200 | 15900 | 15400 | 10000 | 10200 | 8000 | 6000 | 9000 | 8500 | 8100 | 7800 |

**Table 1:** *Women of reproductive age (WRA) who received Family Planning (FP) Commodities before and after COVID- 19*

| Sub County | Tigania West | Tigania East | Imenti South | Imenti North | Imenti Central | Buuri | Igembe South | Igembe Central | Igembe North | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| Before COVID- 19 | 14 | 12 | 76 | 32 | 19 | 48 | 64 | 146 | 23 | 434 |
| After COVID- 19 | 104 | 28 | 436 | 449 | 18 | 21 | 190 | 390 | 64 | 1,700 |
| Total | 118 | 40 | 512 | 481 | 37 | 69 | 254 | 536 | 87 | 2,134 |

**Table 2:** *No of Teenager (10 – 14 Years) Pregnant on First ANC Visit before and after COVID- 19 Pandemic per Sub-County*

A total of 434 adolescents (10 – 14 years) were pregnant on the first ANC visit before COVID - 19 pandemic in Meru County. Slightly more than a third of the cases 146 (33.6%) were reported in Igembe Central Sub- County. During the pandemic, 1,700 adolescents presented with pregnancies during the first ANC visit. Imenti North reported the highest number of cases (449) followed by Imenti South (436) and Igembe North in that order.

The proportion of Pregnant women who were adolescents presenting with pregnancies during the first ANC visit 12 months before COVID 19 (M=36.17, SD =14.94) compared to 12 months after COVID 19 pandemic (M=127.93, SD=96.56) demonstrated significant difference in teenage pregnancies during the COVID- 19 period at $p<.05$. $t(26) = -3.25$, $p=.003$.

## Discussion

The performance of Bacille Calmette-Guérin (BCG), the currently most extensively administered vaccine globally, was examined. Like other countries, Kenya which has national childhood immunization programmes, administer BCG. The vaccine has protective effect against severe rare forms of TB such as TB meningitis and non-tuberculous mycobacterial including leprosy and Buruli ulcer (Chika et al, 2022). The study looked at the coverage of BCG during and after COVID-19 Pandemic due to its importance.

The proportions of BCG coverage before and after COVID- 19 periods in the nine sub-counties of Meru differed probably because of lockdowns and travel restrictions as explained by the key informants during the interviews.

However, despite variations in the intra sub-county coverages, the overall BCG performance before and after COVID- 19 periods did not differ. The reason for status quo in our case is explained by Key Informant interviews which found mothers that believed routine vaccination had protection against COVID- 19 infections. This was so in Buuri, Igembe Central Imenti South, Tigania East and Tigania West. This finding disagrees with others that found 25% global reduction of BCG consumption within the disruption period (Shaikh et al, 2021).

The examination of fully immunized children (FIC), who had received (1-dose BCG, 3-dose DTP-HepB-Hib, 3-dose polio, 1-dose measles, and 3-doses pneumococcal vaccines) children aged 12 to 23 months during the pre-COVID and post COVID era in Meru County presented different performance patterns across the sub counties before and after COVID- 19.

The proportion of fully immunized children before COVID- 19 in Buuri, Igembe Central and Igembe South sub-counties demonstrated worse coverages. The performance after COVID- 19 were significantly better at $p<.05$. $t(26) = -2.37031$, $p=.026$. The key informants in those sub counties

alluded to the routine vaccines' ability to protect children against COVID- 19. The findings correspond with other studies reporting improved vaccination during the pandemic (SeyedAlinaghi et al, 2022).

In Igembe North and Imenti South sub counties, the proportion of fully immunized children did not differ between the two periods. These findings concur with those of a study in Kilifi County Kenya, where the pandemic did not adversely affect vaccination achievements. (Lucinde et al, 2022). However, in Imenti North, the mean proportion of FIC before COVID 19 (M=97.81, SD =12.9) was better compared to vaccination after COVID- 19 (M= 83.49, SD 7.6). t (26) = 3.37767, p=.002 at p<.05. The findings in this subcounty concurs with studies done in Canada (Akseer et al, 2020: Ji C et al, 2022). In such a scenario, it is likely that children missed some antigens during the pandemic and catch-up immunization activities are necessary. This is consistent with studies in Pakistani and Canada, where children were found to have missed measles and polio vaccines (Rana et al, 2021; MacDonald et al, 2021).

It is highly probable that overall, the proportion of fully immunized children (FIC) before COVID-19 (M=63.78, SD =11.2) compared to post COVID-19 period (M=72.32, SD=14) demonstrated no significant difference at p<.05 as t (24) = 1.72, p=.098 because of the sub counties that performed better during COVID-19 pandemic. Moreover, mothers in five counties believed routine immunization prevented SARS CoV-2 as well as other preventable diseases. In spite of that, there were missed opportunities across sub counties. This finding concurs with a study where declines in children's immunizations was reported in India (Chakrabarti et al, 2023).

Reproductive health services presented with more spectacular results during the study. The number of women of reproductive age (WRA) who received Family Planning (FP) Commodities remained the same throughout the two periods. The study agrees with the findings of UNFPA which found no declines in use of modern contraception in Burkina Faso, Democratic Republic of the Congo, Kenya and Nigeria (UNFPA, 2021). However, the proportion of adolescents who presented with pregnancies during the first ANC visit before COVID 19 (M=36.17, SD =14.94) compared to post pandemic period (M=127.93, SD=96.56), demonstrated significant difference in teenage pregnancies during the COVID- 19 period at p<.05, t (26) = -3.25, p=.003.

A total of 434 adolescents (10 – 14 years) were pregnant on the first ANC visit before COVID - 19 pandemic in Meru County. The highest number (449/1700 cases) of teenage pregnancies occurring during the pandemic were reported in Imenti North subcounty. This was slightly more than a quarter of the total cases (26.4%). Nonetheless, this disagrees with findings a study done in Uganda where the prevalence of teenage pregnancy was higher at 30.6% during the pandemic (Musinguzi et al, 2022).

In Meru County, 1700 adolescents were reported pregnant on first ANC visit. Imenti North reported the highest number of the cases (449) followed by Imenti South (449) and Igembe Central (390) in that order. All the three sub counties have large urban centres, where probably, the teenagers could have been lured into illicit sex during the lockdowns. Igembe central sub county had the highest proportion of adolescent pregnancies at 146 and before COVID-19 (Table 1). COVID- 19 pandemic therefore, could have worsened an already worse situation.

The sub county located in a miraa growing area, known for high dropout rates among school children. It has close proximity to large urban centres (Maua and Kangeta). The interplay of those factors might have exacerbated the engagement of girls into unprotected pre-marital sex leading to higher number of pregnancies than in other sub counties.

Coincidentally, two of the other sub counties with high numbers of teenage pregnancies, have larger urban centres as their headquarters. Meru town is the headquarters of Imenti North which has the second highest number of teenage pregnancies. Nkubu Municipality is the headquarters of Imenti South. Juxtaposition of adolescents to

those urban centres might have had negative influence putting the adolescents who were out of school at risk of engaging in illicit sexual activities. This observation corroborates the findings of another study which found teenage girls at risk of pregnancy during the COVID- 19 lockdowns (Ouma et al, 2022).

The girls were out of school for long periods during the lockdowns. This latitude created negative ripple effect on adolescent sexual and reproductive health among school going girls. In a sense, COVID- 19 eroded gains made on adolescent reproductive health including counselling and advisories from teachers and health workers as found in other studies (Okeke et al, 2022).This study corroborates findings of others which found girls subjected to COVID- 19 measures, at risk of getting pregnant (Zulaika et al, 2022: Groenewald et al, 2022: Wood et al, 2022).

The findings in this study also concur with a study in Uganda which found a third of in-school teenage girls pregnant during the pandemic (MusinguziI et al, 2022). Our study clearly shows more teenage pregnancies occurred during the COVID19- pandemic. This was due to limited access to reproductive health services in son sub counties in Meru County. These findings agree with others that found COVID- 19 pandemic to have escalated the problem of poor access to reproductive health services (Meherali et al, 2021).

## Conclusions

COVID- 19 pandemic did not fundamentally affect MCH services during the first year of the sickness in Meru County. However, the proportion of teenage pregnancies increased significantly, while the proportion of women with 4$^{th}$ Antenatal care (ANC) visit decreased. The Ministry of Health should enhance ANC attendance among women. The County health services should identify and counsel the school girls who conceived before and during the pandemic with a view to giving them an opportunity to continue with their education.

## Authors' contributions

*GM Conceived the study, collected the data, performed data analysis, wrote and reviewed the manuscript for publication.*

## Acknowledgements

*I acknowledge Meru County Health Services for allowing me to use their data MCH data during the study.*

## Funding

*I am most grateful to Meru University of Science and Technology (MUST). Without the funding from the University, this study could not have been carried out.*

## Competing interests

*None declared.*

## Ethical approval

*Ethical clearance was obtained from Meru University of Science and Technology Institutional Ethical Review Committee (MIRERC)*

## References

Akseer N., Kandru G., Keats E.C, and Zulfiqar A. B. (2020). COVID-19 Pandemic and Mitigation Strategies: Implications for Maternal and Child Health and Nutrition

Bong CL, Brasher C, Chikumba E, McDougall R, Mellin-Olsen J, Enright A. (2020). The COVID-19 pandemic: effects on low and middle-income countries. *Anesth Analg* 2020; published online April 1. DOI:10.1213/ANE.0000000000004846.

Candice Groenewald, Nazeema Isaacs and Dane Isaacs (2021) Adolescent Sexual and Reproductive Health during the COVID-19 Pandemic: A Mini Review Front. Reprod. Health, 30 March 2022 Sec. Adolescent Reproductive Health and Well-being

Chika N. Okafor; Ayesan Rewane; Ifeanyi I. Momodu (2022). Bacillus Calmette Guerin: Bookshelf ID: NBK538185PMID: 30844212

Chmielewska B, Barratt I, Townsend R, Kalafat E, van der Meulen J, Gurol-Urganci I, O'Brien P, Morris E, Draycott T, Thangaratinam S, Le Doare K, Ladhani S, von Dadelszen P, Magee L, Khalil A. (2021). Effects of the COVID-19 pandemic on maternal and perinatal outcomes: a systematic review and meta-analysis. Lancet Glob Health. 2021 Jun; 9(6):e759-e772. doi: 10.1016/S2214-109X(21)00079-6. Epub 2021

Mar 31. Erratum in: Lancet Glob Health. 2021 Jun; 9(6):e758. PMID: 33811827; PMCID: PMC8012052.

Clara Menendez, Raquel Gonzalez, [...], and Rose G F Leke. (2020). Avoiding indirect effects of COVID-19 on maternal and child health. www.thelancet.com/lancetgh Vol 8 July 2020, May 12, 2020 https://doi.org/10.1016/ S2214-109X (20)30239-4 See Articles page e901

Congo, O., Otieno, G., Wakhungu, I., Harrington, E. K., Kimanthi, S., Biwott, C., ... & Onono, M. (2022). Pregnancy trends and associated factors among Kenyan adolescent girls and young women pre-and post-COVID-19 lockdown. *Adv Glob Health*, *1*(1), 1811306.

DO - 10.1101/2021.02.14.21251721

E MacDonald, Yuba Raj Paudel, Marilou Kiely, Ellen Rafferty, Manish Sadarangani, Joan L Robinson, S Michelle Driedger, Lawrence W Svenson (2021). Impact of the COVID-19 pandemic on vaccine coverage for early childhood vaccines in Alberta, Canada: a population-based retrospective cohort study Shannon. BMJ Open: first published as 10.1136/bmjopen-2021-055968 on 25 January 2022.

Garazi Zulaika,1. Miriam Bulbarelli, Elizabeth Nyothach, Annemieke van Eijk, Linda Mason, Eunice Fwaya,4 David Obor,3 Daniel Kwaro,3 Duolao Wang, Supriya D Mehta, Penelope A Phillips-Howard (2022). Impact of COVID-19 lockdowns on adolescent pregnancy and school dropout among secondary schoolgirls in Kenya. BMJ Glob Health: first published as 10.1136/bmjgh-2021-007666 on 13 January 2022.

Ghinai, I; McPherson, Tristan D; Hunter, Jennifer C; Kirking, Hannah L; Christiansen, Demian; Joshi, Kiran; Rubin, Rachel; Morales-Estrada, Shirley; Black, Stephanie R; Pacilli, Massimo; Fricchione, Marielle J; Chugh, Rashmi K; Walblay, Kelly A; Ahmed, N Seema; Stoecker, William C; Hasan, Nausheen F; Burdsall, Deborah P; Reese, Heather E; Wallace, Megan; Wang, Chen; Moeller, Darcie; Korpics, Jacqueline; Novosad, Shannon A; Benowitz, Isaac; Jacobs, Max W; Dasari, Vishal S; Patel, Megan T; Kauerauf, Judy; Charles, E Matt; Ezike, Ngozi O; Chu, Victoria; Midgley, Claire M; Rolfes, Melissa A; Gerber, Susan I; Lu, Xiaoyan; Lindstrom, Stephen; Verani, Jennifer R; Layden, Jennifer E (2020). "First Known Person-To-Person Transmission of Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) in the USA". *Lancet*. 395 (10230): 1137–1144. Doi: 10.1016/S0140-6736(20)30607-3. PMC 7158585. PMID 32178768.

Gianfranco Spiteri , James Fielding , Michaela Diercke , Christine Campese , Vincent Enouf , Alexandre Gaymard , Antonino Bella , Paola Sognamiglio , Maria José Sierra Moros , Antonio Nicolau Riutort , Yulia V. Demina , Romain Mahieu , Markku Broas , Malin Bengnér , Silke Buda , Julia Schilling , Laurent Filleul , Agnès Lepoutre , Christine Saura , Alexandra Mailles , Daniel Levy-Bruhl , Bruno Coignard , Sibylle Bernard-Stoecklin , Sylvie Behillil , Sylvie van der Werf , Martine Valette , Bruno Lina , Flavia Riccardo , Emanuele Nicastri , Inmaculada Casas , Amparo Larrauri , Magdalena Salom Castell , Francisco Pozo , Rinat A. Maksyutov , Charlotte Martin , Marc Van Ranst , Nathalie Bossuyt , Lotta Siira, Jussi Sane , Karin Tegmark-Wisell , Maria Palmérus , Eeva K. Broberg , Julien Beauté , Pernille Jorgensen , Nick Bundle , Dmitriy Pereyaslov , Cornelia Adlhoch , Jukka Pukkila , Richard Pebody , Sonja Olsen , Bruno Christian Ciancio (2020). First cases of coronavirus disease 2019 (COVID-19) in the WHO European Region, 24 January to 21 February 2020. Eurosurveillance Volume 25, Issue 9, 05/Mar/2020

Gianfranco Spiteri, James Fielding, Michaela Diercke, Christine Campese, Vincent Enouf, Alexandre Gaymard, Antonino Bella, Paola Sognamiglio, Maria José Sierra Moros, Antonio Nicolau Riutort, Yulia V. Demina, Romain Mahieu, Markku Broas, Malin Bengnér,[14] Silke Buda, Julia Schilling, Laurent Filleul, Agnès Lepoutre, Christine Saura, Alexandra Mailles, Daniel Levy-Bruhl, Bruno

Coignard, Sibylle Bernard-Stoecklin, Sylvie Behillil, Sylvie van der Werf, Martine Valette, Bruno Lina, Flavia Riccardo, Emanuele Nicastri, Inmaculada Casas, Amparo Larrauri, Magdalena Salom Castell, Francisco Pozo, Rinat A. Maksyutov, Charlotte Martin, Marc Van Ranst, Nathalie Bossuyt, Lotta Siira, Jussi Sane, Karin Tegmark-Wisell, Maria Palmérus, Eeva K. Broberg, Julien Beauté, Pernille Jorgensen, Nick Bundle, Dmitriy Pereyaslov, Cornelia Adlhoch, Jukka Pukkila,[2] Richard Pebody, Sonja Olsen, and Bruno Christian Ciancio (2020). First cases of coronavirus disease 2019 (COVID-19) in the WHO European Region, 24 January to 21 February 2020Euro Surveill. 2020 Mar 5; 25(9): 2000178. doi: 10.2807/1560-7917.ES.2020.25.9.2000178.

Ji C, Piché-Renaud PP, Apajee J, Stephenson E, Forte M, Friedman JN, Science M, Zlotkin S, Morris SK, Tu K. Impact of the COVID-19 pandemic on routine immunization coverage in children under 2 years old in Ontario, Canada: A retrospective cohort study. Vaccine. 2022 Mar 15;40(12):1790-1798. doi: 10.1016/j.vaccine.2022.02.008. Epub 2022 Feb 8. PMID: 35164987; PMCID: PMC8824235.

Kassa ZY, Scarf V, Fox D. (2022). The effect of Ebola virus disease on maternal health service utilisation and perinatal outcomes in West Africa: a systematic review. Reprod Health. 2022 Feb 4; 19(1):35. doi: 10.1186/s12978-022-01343-8. PMID: 35120540; PMCID: PMC8815720.

Laura Sochas, Andrew Amos Channon and Sara Nam (2017). Counting Indirect Crisis-Related Deaths in the Context of a Low-Resilience Health System: The Case of Maternal and Neonatal Health during the Ebola Epidemic in Sierra Leone. Health Policy and Planning, 32, 2017, iii32–iii39 doi: 10.1093/heapol/czx108.

Lone SA, Ahmad A. COVID-19 pandemic - an African perspective. Emerg Microbes Infect. 2020 Dec; 9(1):1300-1308. doi: 10.1080/22221751.2020.1775132. PMID: 32458760; PMCID: PMC7473237

Lucinde RK, Karia B, Ouma N, Amadi D, Nyundo C, Mataza C, Nyaguara A, Scott JAG, Gallagher KE, Kagucia E. The impact of the COVID-19 pandemic on vaccine coverage in Kilifi, Kenya: A retrospective cohort study. Vaccine. 2023 Jan 16; 41(3):666-675. doi: 10.1016/j.vaccine.2022.10.074. Epub 2022 Nov 1. PMID: 36543684; PMCID: PMC9622384.

Marvin Musinguzil D, Edward KumakechID, Anne Grace Auma, Ruth Anne Akello, Eustes Kigongo 1, Raymond Tumwesigye, Bosco Opio, Amir Kabunga, Bernard Omech (2022). Prevalence and correlates of teenage pregnancy among in-school teenagers during the COVID-19 pandemic in Hoima district western Uganda–A cross sectional community-based study. https://doi.org/10.1371/journal.pone.0278772

Meherali S, Adewale B, Ali S, Kennedy M, Salami B, Richter S, Okeke-Ihejirika PE, Ali P, da Silva KL, Adjorlolo S, Aziato L, Kwankye SO, Lassi Z. Impact of the COVID-19 Pandemic on Adolescents' Sexual and Reproductive Health in Low- and Middle-Income Countries. *International Journal of Environmental Research and Public Health*. 2021; 18(24):13221. https://doi.org/10.3390/ijerph182413221

Musinguzi M, Kumakech E, Auma AG, Akello RA, Kigongo E, Tumwesigye R, Opio B, Kabunga A, Omech B. Prevalence and correlates of teenage pregnancy among in-school teenagers during the COVID-19 pandemic in Hoima district western Uganda-A cross sectional community-based study. PLoS One. 2022 Dec 16;17(12): e0278772. doi: 10.1371/journal.pone.0278772. PMID: 36525426; PMCID: PMC9757589.

Okeke, S.R., Idriss-Wheeler, D. & Yaya, S. Adolescent pregnancy in the time of COVID-19: what are the implications for sexual and reproductive health and rights globally. *Reprod Health* **19**, 207 (2022). https://doi.org/10.1186/s12978-022-01505-8

SeyedAlinaghi S, Karimi A, Mojdeganlou H, Alilou S, Mirghaderi SP, Noori T, Shamsabadi A, Dadras O, Vahedi F, Mohammadi P, Shojaei A, Mahdiabadi S, Janfaza N, Keshavarzpoor Lonbar

A, Mehraeen E, Sabatier JM. Impact of COVID-19 pandemic on routine vaccination coverage of children and adolescents: A systematic review. Health Sci Rep. 2022 Feb 18; 5 (2):e00516. doi: 10.1002/hsr2.516. PMID: 35224217; PMCID: PMC8855492.

Shaikh N, Pelzer PT, Thysen SM, Roy P, Harris RC, White RG. Impact of COVID-19 Disruptions on Global BCG Coverage and Paediatric TB Mortality: A Modelling Study. Vaccines (Basel). 2021 Oct 22;9(11):1228. doi: 10.3390/vaccines9111228. PMID: 34835161; PMCID: PMC8624525.

Shared Responsibility, Global Solidarity: Responding to the Socio-Economic Impacts of Covid-19 March 2020 https://www.un.org/Sites/Un2.Un.Org/Files/Sg_Report_Socio-Economic_Impact_Of_Covid19.Pdf http://www.ugogentilini.net/wp-content/uploads/2020/04/Country-social-protection-COVID-responses_April3-1.pdf

Stein D, Ward K, Cantelmo C. (2020). Estimating the potential impact of COVID-19 on mothers and newborns in low- and middle-income countries. https:// medium.com/@HealthPolicyPlus/estimating-the-potential-impact-ofcovid- 19-on-mothers-and-newborns-in-low-and-middle-income-3a7887e4a0ff (accessed May 5, 20

Timothy Roberton, Emily D Carter, Victoria B Chou, Angela R Stegmuller, Bianca D Jackson, Yvonne Tam, Talata Sawadogo-Lewis, Neff Walker (2020). Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: a modelling study. Lancet Glob Health 2020; 8: e901–08. www.thelancet.com/lancetgh Vol 8 July 2020

UNFPA (2020) Impact of COVID-19 on Family Planning: What we know one year into the pandemic. Technical note updates data provided 27 April 2020 by UNFPA, with family planning research by Avenir Health.

UNFPA (2020). Coronavirus Disease (COVID-19) Preparedness and Response - UNFPA Technical Briefs V March 23_2020.

UNFPA (2020). Protecting midwives to keep women and babies safe amid the COVID-19 pandemic. Statement by UNFPA Executive Director Dr. Natalia Kanem on World Health Day

Volume 4 - 2022 | https://doi.org/10.3389/frph.2022.794477.

WHO. WHO recommendations on antenatal care for a positive pregnancy experience. https://www.unaids.org/en/resources/presscentre/pressreleaseandstatementarchive/2020/march/20200305_weve-got-thepower (accessed May 5, 2020).

Wood SN, Byrne ME, Thiongo M, Devoto B, Wamue-Ngare G, Decker MR, Gichangi P. Fertility and contraceptive dynamics amidst COVID-19: who is at greatest risk for unintended pregnancy among a cohort of adolescents and young adults in Nairobi, Kenya? BMJ Open. 2023 May 2;13(5):e068689. doi: 10.1136/bmjopen-2022-068689. PMID: 37130679; PMCID: PMC10163330.

World Health Organization. (2020) . COVID-19: operational guidance for maintaining essential health services during an outbreak: interim guidance, 25 March 2020. World Health Organization. https://apps.who.int/iris/handle/10665/331561. License: CC BY-NC-SA 3.0 IGO