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Impact of COVID-19 Pandemic on Utilization of Facility-Based Essential Maternal and Child Health Services in North Shewa Zone, Ethiopia

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Impact of COVID-19 Pandemic on Utilization of Facility-Based Essential Maternal and Child Health Services in North Shewa Zone, Ethiopia

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Abstract

Introduction: Ethiopia registered its first case of COVID-19 on March 13, 2020. We aimed to assess maternal, newborn, and child health care (MNCH) utilization during the first six months of the COVID-19 pandemic, as well as potential barriers and enablers of service utilization from health care providers and clients.

Methods: Mixed study design was conducted as part of the Birhan Health and Demographic Surveillance System in Ethiopia. The trend of service utilization during the first six months of COVID-19 was compared to corresponding time and data points of the preceding year.

Result: Service utilization of new family planning visits (43.2 to 28.5/month, $p = 0.014$) and sick under five child visits (225.0 to 139.8/month, $P = 0.007$) declined during the initial six months of the pandemic compared to the same period in the preceding year. Antenatal and postnatal care visits, facility delivery rates, and child routine immunization visits also decreased although this did not reach statistical significance. Interviews with health care providers and clients highlighted several barriers to service utilization during COVID-19, including fear of disease transmission, economic hardship, and transport service disruptions and restrictions. Enablers of service utilization included communities' decreased fear of COVID-19, and awareness-raising activities.

Conclusion: Provision of essential MNCH services is crucial to ascertain favorable maternal and child health outcomes. In low- and middle-income country settings like Ethiopia, health systems might be fragile to withstand the caseloads and priority setting due to the pandemic. Our study presents early findings on the utilization of MNCH services that were maintained except sick child and new family planning visits. Government leaders, policy makers, and clinicians who wish to improve the resilience of their health system will need to continuously monitor service utilization and clients' evolving concerns during the pandemic to prevent increases in maternal and child morbidity and mortality.

What is already known?

Facility-based essential MNCH services utilization decreased during the initial phase of the pandemic and similarly facility-based healthcare utilizations were reduced in the 2014-2015 Ebola outbreak in west Africa.

What are the new findings?

Facility based essential MNCH services such as antenatal care, postnatal care, family planning, facility deliveries, routine immunization and repeat family planning utilization were maintained in the initial six month of the pandemic unlike other similar studies elsewhere.

What do the new findings imply?

In light of a pandemic, essential MNCH services such as antenatal and postnatal care, family planning, facility deliveries, repeat family planning and routine immunizations can be sustained in a health system. More attention may be given to better understand the reduction of sick under five visits. Further research can be conducted on the utilization of essential MNCH services on maternal and child health outcomes. Our results emphasize the importance of health systems and clinicians to sustain the resilience of their health system. Among those the Ministry of Health

(MoH) directive to avail MNCH services in all facilities during the pandemic and the maturity level of some programs (Even though new family planning utilizers are limited, they know the benefit and would want to continue the repeat family planning utilization, benefits of facility delivery, routine immunization, antenatal care and postnatal care).

Strengths and limitations of this study

Strengths of the study:

- ✓ We present primary data on service utilization during the early months of the pandemic in an area of Ethiopia, one of the agrarian regions, which is generalizable to 80% of the country's population.
- ✓ The mixed methods approach integrated both quantitative service utilization coverage data with sociocultural, contextual, and exploratory qualitative to better understand our findings and reasons for changes in service utilization.
- ✓ The study highlights success stories in community-based care and government leadership for key services like routine immunization that may benefit other settings.

Limitation of the study:

- ✓ Our study focused on service utilization and may not have been powered to detect significant differences. Furthermore, we focused on coverage of service utilization as the primary outcome rather than mortality or morbidity.
- ✓ We do not have detailed data on service provision (e.g., which services were restricted and for how long, in what manner).
- ✓ There is the potential of recall bias were possible limitation since qualitative data was collected three months later than the initial six months of the pandemic (March to August 2020).

INTRODUCTION

The World Health Organization (WHO) declared coronavirus disease-2019 (COVID-19) a global pandemic on March 11, 2020¹ and the first case of COVID-19 in Ethiopia was registered on March 13, 2020.² Multiple preventive measures focusing on social distancing and wearing masks were undertaken.³ Some health facilities were assigned as COVID-19 isolation and quarantine centers, and many suspended conducting elective surgeries and select outpatient services. This increasing burden of managing COVID-19 on health facilities and health care providers leaves the health system overstretched, challenging its ability to operate effectively. As shown during the 2014-2015 Ebola outbreak in west Africa, when health systems are overwhelmed by outbreaks, mortality from vaccine-preventable and other treatable diseases can increase dramatically.^{4,5}

Well-organized and prepared health systems can continue to provide equitable access to essential services throughout an emergency⁶, but health systems in developing countries are often fragile when affected by emergencies such as pandemics. Accordingly, the WHO advises that countries should identify and prioritize essential services like routine vaccination, reproductive health services including care during pregnancy and childbirth, and care of young infants and

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3 older adults in their efforts to maintain continuity of service delivery and make strategic shifts to
4 ensure that increasingly limited resources provide maximum benefit for the population.⁷ The
5 disruption of services and diversion of resources away from essential sexual and reproductive
6 health care due to the prioritization of the COVID-19 response are expected to increase risks of
7 maternal and child morbidity and mortality.⁸
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10 The Ministry of Health (MOH) of Ethiopia focused on prevention and control of the pandemic.
11 Possible shifts of the health workforce and the health system towards the COVID-19 response
12 may contribute towards low utilization of routine services. For example, “half sit” policies (29
13 March 2020) decreased maximum occupancy on public transit, thus cutting the number of seats
14 in half and increasing the cost of transportation when traveling within the region while
15 transportation between regions was paused completely. Additionally, school closures (March
16 2020), declaration of state of emergency (08 April 2020), awareness campaigns about the
17 pandemic, and case reports, both suspected and confirmed cases, may have all contributed to
18 growing fear of exposure to COVID-19, especially for patients visiting health facilities.
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22 A modelling study of essential maternal and child health interventions across 118 low- and middle-
23 income countries over a 6-month period estimated reduction of services by 9.8–18.5% and 39.3–
24 51.9% in the least and most severe scenarios, respectively,⁹ due to the pandemic. Service
25 reductions have already borne out in several contexts. In China, health service utilization declined
26 significantly after the outbreak and all indicators rebounded beginning in March, but most had not
27 recovered to their pre-COVID-19 levels by June 2020.¹⁰ In Bangladesh, Nigeria, and South Africa,
28 between March and May 2020, the utilization of basic essential MNCH services such as antenatal
29 care (ANC), family planning (FP), and immunization reduced due to lockdowns that triggered fear
30 of contracting COVID-19, shifts of health system focused on managing the pandemic, and
31 resource constraints.¹¹ During the early phase of the COVID-19 outbreak (March–April 2020) in
32 Rwanda, utilization of ANC, deliveries, postnatal care (PNC) and immunizations significantly
33 declined.¹² Similarly, a study in western Ethiopia showed a significant reduction in mean utilization
34 of ANC, health facility birth, FP, and newborn immunization services between March–June 2019
35 and March–June 2020.¹³
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40 In Nepal, a qualitative study found that maternity services, immunizations, and supply of essential
41 medicine were the most affected health services during the lockdown. Interruptions were mainly
42 due to the closure of health services at local health care facilities, limited affordability, involvement
43 of private health sectors during the pandemic, fears of COVID-19 transmission among health care
44 workers and within health centers, and disruption of transportation services. Participants
45 expressed frustrations on poor testing, isolation and quarantine services related to COVID-19,
46 and poor accountability from the government at all levels towards health services continuation
47 and management during the COVID-19 pandemic.¹⁴
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51 To understand these effects COVID-19 pandemic in Ethiopia, the HaSET Maternal and Child
52 Health Research Program assessed trends in MNCH care utilization from March 2019 to August
53 2020 as well as health care providers’ and clients’ perceptions on the barriers to and enablers of
54 service provision and utilization during the COVID-19 emergency. This study has paramount
55 importance in filling the evidence gap on MNCH service utilization during COVID-19, both in the
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Ethiopian context and other low- and middle-income countries, to prevent significant damage to the gains achieved in such areas over the past several decades.

METHODS

We conducted the study in eight health facilities, five health centers, and three hospitals (two public and one private), as part of the Birhan Health and Demographic Surveillance System (HDSS) in North Shewa Zone, Amhara Region, Ethiopia. Those facilities provide essential MNCH services for both rural (majority) and urban populations coming from HDSS catchment and non-catchment areas.

The health centers provide ANC, PNC, delivery, abortion, routine immunization (RI), integrated management of neonatal and childhood illness (IMNCI), and FP. Each health center also has a minimum of five service extension health posts mainly for FP and RI in each kebele (the lowest simplest administration unit), and each health post sends activity reports to health centers monthly. Two public hospitals (one primary and one referral) and the remaining one private general hospital also provide the above-mentioned essential MNCH services, except for RI, which is given mainly in health centers and catchment health posts.

Mixed qualitative and quantitative methods were employed. For the quantitative part of the study, a facility-based cross-sectional survey was conducted with MNCH healthcare providers to assess the impact of COVID-19 on essential MNCH service provision or utilization and provider-side barriers to service provision and utilization in Birhan catchment health facilities. Healthcare utilization time-series data from each facility was retrospectively collected and analyzed to understand the impact of COVID-19. In addition to this, a phenomenological qualitative design utilizing in-depth interviews was implemented to assess client and provider side barriers and enablers to service provision/utilization in Birhan catchment health facilities.

Birhan HDSS catchment health facilities' medical records and monthly facility reports, interviews with health care providers working in the MNCH department, and interviews with women who delivered at home and facility, had ANC follow up, and who missed follow up were the data sources. All Birhan catchment health facilities were sampled for service statistics and health care providers who were working in essential MNCH departments and available at the time of visit were asked for respective sections. For the qualitative data, purposive sampling was implemented, and in-depth interviews were conducted until theoretical saturation was reached.

To assess health care providers' perceptions on possible barriers to service utilization during the time of COVID-19, data were collected from interviews with health providers working in respective MNCH departments and facility and department heads. Retrospective facilities service statistics were collected over an 18-month period from March 2019 to August 2020 using Computer Assisted Field Editing (CAFE). Data was abstracted by uniformly structured questionnaires and entered to Open Data kit (ODK) collect and uploaded to ODK aggregate. The facilities' monthly reports and medical registers data were collected separately. The monthly reports include services given in the health posts that are extension sites for the health center, but the facility registers are exclusively for services given in the health centers.

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4 An interview guide with open-ended questions was used to elicit the qualitative information from
5 informants. Face-to-face interviews were conducted in the facilities with women who visited
6 facilities during COVID-19 and women who delivered at home. Women who missed an ANC follow
7 up were interviewed by phone. With the permission of the respondent, all interviews were
8 recorded, and all recorded data was transcribed for further analysis. To ensure the safety of the
9 data collectors and participants, masks were worn, and social distancing practices were
10 implemented during training and data collection from 2 – 20 November 2020.
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14 The extracted data was exported to Stata 17.0 for analysis and the average MNCH services
15 uptake was calculated each month to quantify the changes pre – COVID-19 (March to August
16 2019) and during the COVID-19 (March to August 2020) pandemic. For the purposes of analysis,
17 March to August 2019 and March to August 2020 were considered as pre-COVID-19 and COVID-
18 19 periods, respectively. To avoid the effect of missing and partially filled values, analogous
19 months data from the same facility were excluded from the data analysis. Finally, an independent
20 sample t-test was done to compare pre-COVID-19 and COVID-19 time months. This analysis was
21 repeated for the initial two-months (March to April 2020) of the pandemic and the analogous
22 period, March to April 2019, to examine changes in service utilization at the onset of the COVID-
23 19 pandemic and a significance level of $\alpha=0.05$ was used for all statistical tests.
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27 In addition to the quantitative metrics listed above, English language transcript data was entered
28 in Dedoose software for qualitative data analysis. After familiarization with the data, the content
29 of the data was coded line by line for thematic analysis following a framework theory approach to
30 describe and interpret health providers' and communities' perceptions on barriers and enablers
31 to MNCH service provision. The framework approach involves using some pre-assigned themes
32 to initially categorize data while also adjusting and iterating the coding scheme to accommodate
33 newly emergent themes, sub-themes, and categories through inductive interpretation.¹⁵ Coded
34 data was examined for potential relationships and themes were also assessed across relevant
35 participant demographic categories to understand different user perspectives. Findings were
36 described under pre-assigned and newly emerged themes.
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41 **Ethic Statement**

42 This study involves human participants and was approved by Ethics Review Board (IRB) of Saint
43 Paul's Hospital Millennium Medical college (SPHMMC) and Harvard T.H. Chan School of Public
44 Health (HSPH) (IRB20-1574). To extract MNCH service statistics, permission was obtained from
45 individual health facilities and individual verbal consent was obtained from respondents.
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48 **Patient and Public Involvement**

49 Meeting was restricted during protocol development and study period due to COVID-19 pandemic
50 and it was not possible to involve clients or the public in the design, study, reporting and
51 dissemination plans of our research.
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RESULTS

For the quantitative section of the study, data were abstracted from a total of eight health facilities (three hospitals and five health centers) and interviews with 103 healthcare providers working in the MNCH units of the facilities. In addition to these, ten facility or MNCH department heads and nine women (pregnant and delivered in the time of COVID-19) were asked open-ended questions.

Maternal health facility visits for ANC, PNC, facility delivery, and abortion-related services decreased in the time of COVID; however, we do not see a statistically significant change. The FP services utilization in the health centers and hospitals declined from 105.5 visits per month to 66.5 visits per month ($p < 0.05$) after the onset of the pandemic and within the subset of FP visits, repeat and unclassified FP visits significantly declined while new FP visits did not change. When combining health facilities with community health post data, the new FP services declined significantly from 43.2 visits per month to 28.5 visits per month ($p = 0.029$) but no significant changes in repeat, unclassified, and mean FP visits.

Declines in service utilization were found among sick child visits, which was defined as a facility visit for sick children under five years old. The mean number of IMNCI visits for sick children under 5 years old declined from 225.0 visits per month in 2019 to 139.8 visits per month in 2020 ($p = 0.014$). This significant relationship persists for two age stratifications of IMNCI visits (2 months to under 2 years, and 2 years to under 5 years). On the other hand, there was no significant change in child visits for routine immunizations, including BCG, OPV-0, pentavalent (DPT-HepB-HIP) and measles vaccinations.

Table 1. Comparing essential MNCH service utilization over six months between COVID-19 (Mar-Aug 2020) and analogous pre-COVID-19 (Mar-Aug 2019) periods.

| Visit Type | Mean number of visits/month over six months | | t-statistic | p-value | Lower p-value [†] | Upper p-value ^{††} | Paired observations |
|-------------------------------------------------|---------------------------------------------|--------------|-------------|--------------|----------------------------|-----------------------------|---------------------|
| | 2019 | 2020 | | | | | |
| I. Maternal visit | 376.3 | 321.2 | 1.11 | 0.270 | 0.865 | 0.135 | 48 |
| 1. Antenatal care | 208.9 | 181.7 | 0.79 | 0.433 | 0.784 | 0.216 | 40 |
| 2. Postnatal care | 26.6 | 19.8 | 1.44 | 0.155 | 0.922 | 0.078 | 30 |
| | | | | | | * | |
| 3. Facility delivery | 90.7 | 84.2 | 0.29 | 0.776 | 0.612 | 0.388 | 41 |
| 4. Abortion-related services | 11.8 | 9.8 | 0.56 | 0.578 | 0.711 | 0.289 | 34 |
| 5. Combined FP services in HP, HC and hospitals | 313.3 | 273.4 | 0.82 | 0.415 | 0.792 | 0.207 | 47 |
| 5.1 New FP services | 43.2 | 28.5 | 1.22 | 0.029 | 0.986 | 0.014 | 47 |
| | | | | | | ** | |
| 5.2 Repeat FP services | 270.2 | 244.9 | 0.57 | 0.567 | 0.716 | 0.284 | 47 |
| 6. FP services in HCS and hospital | 105.5 | 66.5 | 1.99 | 0.051 | 0.974 | 0.026 | 33 |
| | | | | | | ** | |
| 6.1 New FP services | 8.9 | 7.1 | 0.84 | 0.406 | 0.797 | 0.203 | 33 |

| | | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-------------|--------------|--------------|---------------------|-----------|
| 6.2 Repeat FP services | 96.5 | 59.3 | 1.03 | 0.046 | 0.977 | 0.023 ** | 33 |
| 6.3 Unclassified FP services | 17.7 | 1.3 | 1.12 | 0.039 | 0.981 | 0.019 ** | 26 |
| II. Sick child visit (0-5years)) | 225.0 | 139.8 | 1.51 | 0.014 | 0.993 | 0.007 *** | 46 |
| 1. MNCI Visit (< 2 months) | 10.8 | 7.7 | 0.82 | 0.412 | 0.794 | 0.206 | 46 |
| 2. IMNCI Visit (2 months – 2 year) | 101.6 | 50.4 | 1.68 | 0.009 | 0.996 | 0.004 *** | 46 |
| 3. IMNCI Visit (2 year – 5 year) | 111.6 | 81.8 | 1.15 | 0.034 | 0.983 | 0.017 ** | 46 |
| III. Routine Immunization visit | 37.0 | 36.8 | 0.02 | 0.982 | 0.509 | 0.491 | 23 |
| 1. BCG Vaccine | 31.4 | 36.5 | -0.39 | 0.701 | 0.350 | 0.650 | 30 |
| 2. Oral Polio (0) Vaccine | 3.2 | 1.0 | 0.88 | 0.384 | 0.808 | 0.192 | 23 |
| 3. Pentavalent (DPT-HepB-HIP) (all types) | 100.4 | 101.5 | -0.05 | 0.958 | 0.479 | 0.521 | 30 |
| 4. Measles – 1 | 10.3 | 27.5 | -1.99 | 0.051 | 0.026 | 0.974 | 30 |
| 5. Vitamin A Dose | 8.6 | 5.7 | 0.67 | 0.506 | 0.747 | 0.253 | 14 |
| Other types of visits | | | | | | | |
| All visits | 2568.9 | 2606.7 | -0.05 | 0.956 | 0.478 | 0.522 | 48 |
| Adult Outpatient Visit | 2121.2 | 2239.7 | -0.17 | 0.868 | 0.434 | 0.566 | 44 |
| * p < 0.10 ** p < 0.05 *** p < 0.01, † Lower-tailed test: mean number of visits $H_1: \mu_{2019} < \mu_{2020}$, †† Upper-tailed test: mean number of visits $H_1: \mu_{2019} > \mu_{2020}$ | | | | | | | |

“Ninety-one healthcare providers who were working in maternal, newborn and child health were asked about the client flow during COVID-19. Sixty-seven percent of the health care providers (HCPs) perceived that client flow decreased and 31% of them considered the same. Qualitative interviews also supported the observed decrease in client flow, with descriptions of sharper contractions in service utilization in the first couple of months after the onset of the pandemic but resumed to approximately normal levels over subsequent months. To explore the perception of lower service utilization during the initial couple of months of COVID-19 by clients of the health system and HCPs, data on the initial two pre-COVID (March to April 2019) months were compared with analogous COVID time months (March to April 2020) and there were no statistically significant changes in the number of visits for maternal and childhood visits overall, except sick child visit (**Supp Table 1**).

Barriers to service provision and utilization during COVID-19

Even though the essential MNCH service utilization was maintained; clients’ fear of acquiring the disease from the facility, travel restrictions, increased transportation cost due to the half seat order by the government, and fear of acquiring the disease on the way to the health facility were the main barriers for service utilization perceived by healthcare providers.

Table 2. Possible barriers to service utilization in the time of COVID-19 based on healthcare providers’ perception.

| Possible barriers to service utilization in the time of COVID-19 | Count | % |
|----------------------------------------------------------------------------------------|------------|----|
| 1. Fear of acquiring the diseases from the facility | 97 | 94 |
| 2. Travel restrictions | 90 | 87 |
| 3. Increased transportation cost (due to half sit order by the government) | 89 | 86 |
| 4. Fear of acquiring the disease on the way to the health facility | 86 | 83 |
| 5. Lack of transport to the HP/HC site | 72 | 70 |
| 6. Lack of PPE for clients | 67 | 65 |
| 7. Clients' perception of limited implementation of protective measures by | 58 | 56 |
| 8. healthcare providers | | |
| 9. Healthcare providers advice to stay at home | 54 | 52 |
| 10. Limited-service hours or absence of health care workers | 17 | 17 |
| 11. Unavailability of ambulance | 7 | 7 |
| 12. Unavailability of healthcare providers in facilities to provide outreach services. | 7 | 7 |
| Total eligible respondents | 103 | |

These secondhand perspectives from healthcare providers about the barriers that clients face was largely supported by qualitative interviews with clients. Fear of contracting the disease and lack of access to transportation are the most described barriers (**Supp table 2**). Particularly during the first few months after the onset of COVID-19 in Ethiopia and the imposition of travel restrictions and other public health measures like state of emergency, communities fear of acquiring the disease and high levels of public panic were barriers for facility-based services utilization. This fear extended to visiting facilities during the pandemic; community members were afraid of contracting the disease in crowded spaces, public transportation routes to facilities, or at facilities themselves from health care workers or other patients, particularly when they heard of COVID-19 cases present at facilities and this fear often resulted in delayed care-seeking. A woman said that *"I have postponed my follow up at that time for fear of acquiring the disease from health professionals and health centers. The same is true for other clients in our area, and some mothers have received their visit in private clinics as we perceived almost all staff were infected"*.

The economic hardship during COVID-19 prevented some clients from being able to pay for transportation due to transportation restriction with half seats and doubled transportation fee, and other direct or indirect costs of attending facilities. Clients described lacking money to purchase PPE and one HCP noted that the closed market movement affected people's incomes, as reflected by patients delaying treatment until conditions are more severe or defaulting on treatment.

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3 Lastly, bottlenecks on the health system side provided another barrier to service utilization.
4 Facilities restricted some services at the beginning of the pandemic's onset and clients were
5 unable to access certain services or assumed that services were restricted even after they had
6 resumed, as one HCP suggested. Additionally, multiple clients described fearing that they might
7 be forcibly quarantined or presumed COVID-19-positive if they were to visit facilities and this fear
8 deterred facility visits. HCPs described many challenges related to the under preparedness of the
9 health system for managing suspected cases of COVID-19. Often these challenges manifested
10 through physical infrastructure constraints and a shortage of guidelines for managing quarantine
11 and isolation centers for suspected COVID-19 cases.
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14 15 **Enablers of service provision and utilization during COVID-19**

16 In terms of knowledge of COVID-19, all women had heard about the disease, but a few were in
17 doubt about COVID-19 existence in the area which may be an enabling factor for facility-based
18 service utilization. A client respondent said, *"I do not believe it exists, especially in our area. It*
19 *might be real / exist in other areas/countries. They just suspect and take everyone into an*
20 *isolation/quarantine center, but they are healthy and free of any signs and symptoms..."*. Some
21 described that COVID-19 could not affect them because God and/or Mary will protect them, citing
22 the importance of prayer as a protective measure.
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26 Facility adaptations like training for healthcare providers, hand washing facilities, physical
27 distancing, and awareness creation and health education which was given by local authorities
28 increased the client awareness on COVID-19 prevention and facility-based service utilization
29 through time (**Supp table 3**).
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31

32 **Understanding Service Utilization Trends during COVID-19**

33 The barriers and enablers highlighted in the interviews interact with each other dynamically, as
34 depicted below. Certain barriers were more substantial than others, particularly fear of the
35 disease, transportation access, and economic-related barriers, while certain pull factors
36 encouraged facility visits, particularly over time as fear subsided, community awareness
37 measures were undertaken, and facilities implemented adaptations to manage both COVID-19
38 and routine services (**Diagram 01**).
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42 **DISCUSSION**

43
44 We examined the impact of the COVID-19 pandemic on essential MNCH service utilization by
45 analyzing data from health facility records and healthcare providers and patients' perspectives.
46 In the context of already poor health outcomes, significant reductions in service utilization for
47 maternal and child health may have substantial adverse impacts. A modelling study of 118 low-
48 and middle-income countries estimated an additional 12,200-56,700 maternal and 253,500-
49 1,157,000 child deaths using several hypothetical scenarios in which the coverage of essential
50 maternal and child health interventions were reduced by 9.8-51.9% due to the pandemic over 6
51 months.⁹
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3 For maternal health, FP, ANC, PNC, facility delivery, and abortion services utilization decreased,
4 but the change was not significant during the initial six months of the pandemic. Globally,
5 contraception services were shut down or not accessible,¹⁶ which was also observed in our study
6 resulting in reduced family planning service utilization and a drastic drop in new family planning
7 services. Service utilization for family planning was stable at health posts (community-based
8 clinics that are an extension of health centers) suggesting that utilization of family planning
9 services was more likely to occur when clinics are nearby without extensive travel.
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13 For child health, the number of Integrated Management of Neonatal and Childhood Illness
14 (IMNCI) visits, also referred to as sick child visits, significantly declined by 38%. It is possible that
15 the decrease in child sick visits was related to COVID-19 prevention and control activities. The
16 leading causes of under five years old children morbidity in Ethiopia,¹⁷ acute respiratory illness,
17 fever and diarrhea may have decreased due to school closures (older siblings less exposed),
18 limited interactions with peers in the community, spending more time indoors, mask-wearing at
19 community gatherings, hand washing, physical distancing, and other personal protective
20 equipment and practices. We found that RI remained stable during the initial six months of the
21 pandemic, which was different than the findings from studies in Colombia, India, and Brazil where
22 RI declined during the pandemic.¹⁸⁻²⁰ The Ethiopian MOH prioritized RI, especially measles,
23 during COVID-19. Ethiopia deploys health extension workers stationed at health posts for
24 community-based services hygiene and sanitation, FP and RI which may have sustained
25 accessibility to these services during COVID-19. It is worth noting that the source of data for FP
26 and RI in this study included aggregated data from the health management information system
27 (HMIS) at health centers which may be less reliable than directly collecting data from hospital and
28 health centers' records other services like IMNCI and sick child visits. ²¹ In Ethiopia, during
29 COVID, there was a marked reduction in supply chain distribution of vaccines implying that the
30 RI coverage like decreased nationally.²²
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36 Overall, with the exception of RI, our findings are similar to other global studies that have also
37 found declines in service utilization during the COVID-19 pandemic. A systematic review of eighty-
38 one studies in twenty countries reported a reduction in health care utilization with a median 37%
39 reduction in overall services, including 42% reduction for visits, 28% for admissions, 31% for
40 diagnostics, and 30% for therapeutics between pandemic and pre-pandemic periods in the initial
41 two months of the pandemic.²³ There was also a reduction in utilization of basic essential MNCH
42 services such as ANC, FP and RI in Bangladesh, Nigeria, Rwanda and South Africa between
43 March and May 2020.^{11,12} In a semi-pastoralist area in western Ethiopia, there was a significant
44 reduction in mean utilization of ANC, health facility births, FP, and RI.¹³
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48 The reduction in service utilization was observed in the setting of the communities' experiences
49 of and perceptions toward COVID-19, including misinformation, misconceptions, and doubt. As
50 the pandemic has progressed, service utilization may further decline as fear settles in. At the time
51 of data collection, early in the pandemic, respondents largely described not feeling many tangible
52 impacts of COVID-19 on their daily lives or consequences of lack of adherence to preventive
53 measures, so they went about life as usual. This easing fear of COVID-19 may have enabled
54 women to feel that they could safely attend services, but it also has important implications as the
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3 pandemic continues, particularly as cases in Ethiopia have risen substantially. Awareness and
4 education campaigns are needed to produce actual behavior change. Moreover, communities'
5 belief that God may protect them from infection indicates the important role of engaging religious
6 leaders as champions in behavior change campaigns. An additional key recommendation is
7 systematically addressing misinformation and doubt to increase population compliance with
8 preventive measures, particularly as Ethiopia faces a rising caseload, increasing prevalence of
9 variants, and a stalled vaccine rollout that may take months or years to reach substantial
10 population coverage. Less than 2% of the population has received at least one dose of COVID-
11 19 vaccine.²⁴
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15 Barriers to maternal facility visits included women not wanting to bother anyone, lack of support
16 from healthcare workers, influence of the media,²⁵ lockdown, fear of contracting the disease,²⁶
17 shift of focus towards pandemic, and resource constraints.¹¹ In addition, women experienced
18 fears of contracting the disease, economic hardship, and lack of access to transportation.
19 Particularly during the first few months after the onset of COVID-19 in Ethiopia, there was an
20 imposition of travel restrictions and other public health measures like state of emergency, and
21 high levels of public panic. In addition, facilities restricted some services at the beginning of the
22 pandemic and clients were unable to access certain services. Multiple clients described fearing
23 that they might be forcibly quarantined or presumed COVID-19-positive if they were to visit
24 facilities; this fear deterred facility visits. While we found that sick child visits and new family
25 planning services were most affected by the pandemic, the declines among other essential
26 services were not as significant indicating hope in service resilience and the ability to introduce
27 rapid and substantial facility adaptations to maintain the health system (e.g., personal protective
28 equipment, infection prevention measures, improved sanitation/hygiene).
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33 **Strengths of the study:** We present primary data on service utilization during the early months
34 of the pandemic in an area of Ethiopia, one of the agrarian regions, which is generalizable to 80%
35 of the country's population. We leveraged an existing research network, HaSET MNCH research
36 program (www.hasetmch.org), and established field site²⁷ to rapidly collect data from all available
37 sources. The mixed methods approach integrated both quantitative service utilization coverage
38 data with sociocultural, contextual, and exploratory qualitative to better understand our findings
39 and reasons for changes in service utilization. The study highlights success stories in community-
40 based care and government leadership for key services like routine immunization that may benefit
41 other settings.
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45 **Limitation of the study:** Our study focused on service utilization and may not have been powered
46 to detect significant differences. Furthermore, we focused on coverage of service utilization as
47 the primary outcome rather than mortality or morbidity. We do not have detailed data on service
48 provision (e.g., which services were restricted and for how long, in what manner). There is the
49 potential of recall bias were possible limitation since qualitative data was collected three months
50 later than the initial six months of the pandemic (March to August 2020).
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54 CONCLUSION

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3 Utilization of essential MNCH services is crucial to achieve favorable health outcomes. In the
4 setting of developing countries like Ethiopia, health systems are often too fragile to withstand the
5 direct increase in volume of patients and indirect health consequences of a pandemic. Our study
6 presents early findings on the decline in the utilization of MNCH services especially in new family
7 planning services and sick child visits. Further study is needed to assess the effect of service
8 utilization decline on MNCH morbidity and mortality. To prevent worsening maternal and child
9 morbidity and mortality as a result of the pandemic, resources are required by government
10 leaders, policy makers, and clinicians to improve the resilience of their health system to
11 continuously monitor service utilization, while at the same time engaging with providers and
12 clients to understand and address their evolving concerns about MNCH service uptake.
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16 **ABBREVIATIONS**

17 CAFÉ: Computer Assisted Field Editing, COVID-19: Coronavirus Disease - 2019, DPT: Diphtheria
18 Pertussis and Tetanus, EOC: Emergency Operation center, EPHI: Ethiopian Public Health
19 Institute, FP: Family Planning, HC: Health Center, HCP: Healthcare provider, HDSS: Health and
20 Demographic Surveillance System, HepB: Hepatitis B, HIP: Haemophilus influenzae, HIV/AIDS:
21 Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome, HP: Health post,
22 HSPH: Harvard School of Public Health, IRB: Institutional Review Board, MCH: Maternal and
23 Child Health, MNCH: Maternal, Newborn and Child Health, MOH: Ministry of Health, ODK: Open
24 Data Kit, PNC: Postnatal care, RI: Routine immunization, RMNCH: Reproductive, Maternal,
25 Newborn and Children Health, SPHMMC: Saint Paul Hospital Millennium Medical College, W:
26 Women, WHO: World Health organization.
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36

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44

45 **AVAILABILITY OF DATA AND MATERIALS**

46 The datasets used and/or analyzed during the current study are available from the corresponding
47 author on reasonable request.
48
49

50 **COMPETING INTERESTS**

51 The authors declare that they have no competing interests.
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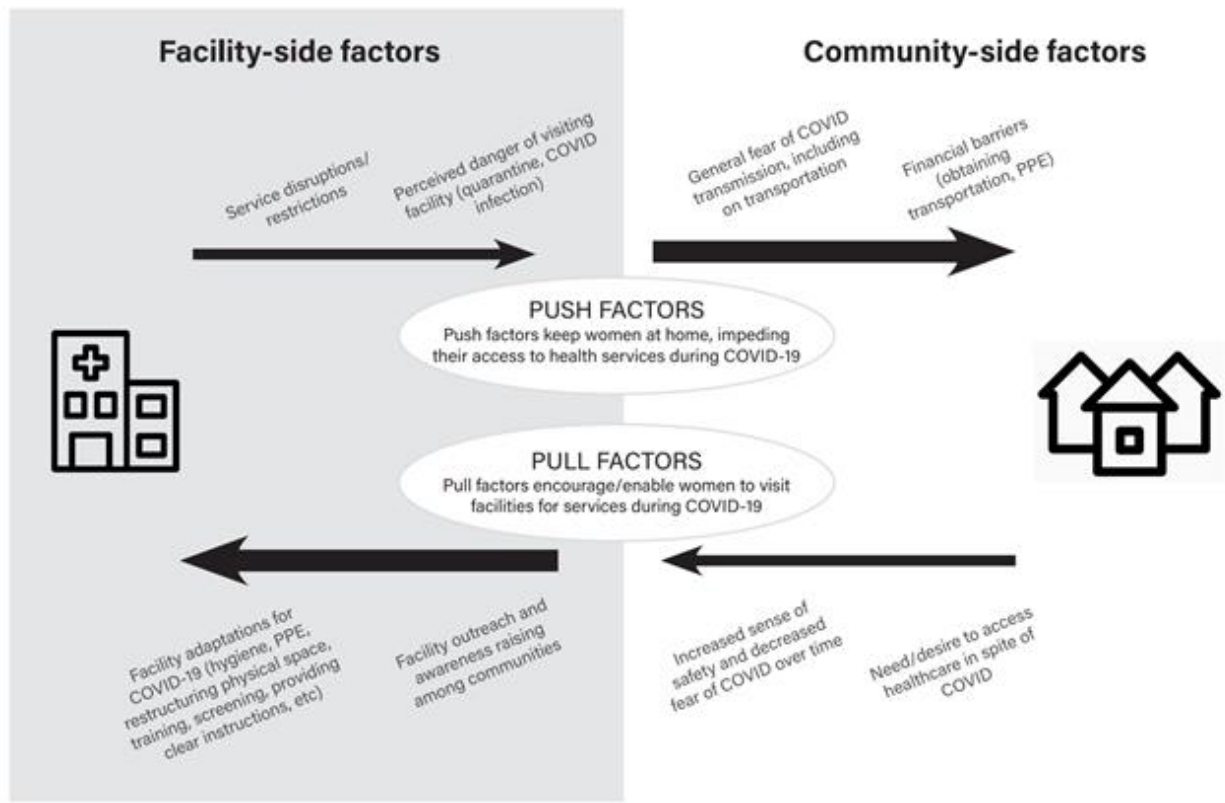
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Figure legends

- 22 ✓ **Diagram 1:** Enabling (pull) factors and barriers (push factors) for service utilization
23 highlighted in the qualitative interviews.
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Review only

Supplementary Tables

Supplementary Table 1. Comparing essential MNCH service utilization over two months between COVID (April- May 2020) and analogous pre-COVID (April-May 2019) periods.

| Visit Type | Mean number of visits/ months over six months | | t-statistic | p-value | Lower p-value | Upper p-value | Number of paired observations |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------|-------------|--------------|---------------|---------------|-------------------------------|
| | 2019 | 2020 | | | | | |
| I. Maternal visit | 331.3 | 327.3 | 0.05 | 0.959 | 0.520 | 0.480 | 16 |
| 1. Antenatal care | 198.0 | 176.5 | 0.39 | 0.702 | 0.649 | 0.351 | 13 |
| 2. Postnatal care | 17.8 | 20.7 | -0.30 | 0.768 | 0.384 | 0.616 | 9 |
| 3. Facility delivery | 85.6 | 87.0 | -0.04 | 0.970 | 0.485 | 0.515 | 14 |
| 4. FP related services | 84.1 | 95.1 | -0.38 | 0.712 | 0.356 | 0.644 | 10 |
| 5. FP related services (hospitals, HCs and HPs combined) | 289.4 | 227.8 | 0.86 | 0.398 | 0.801 | 0.199 | 16 |
| 6. Abortion-related services | 10.5 | 10.7 | -0.05 | 0.964 | 0.482 | 0.518 | 11 |
| II. Sick child visit (0-5years) | 201.0 | 126.6 | 1.68 | 0.103 | 0.948 | 0.052* | 15 |
| 1. IMCI Visit (< 2 months) | 7.3 | 3.3 | 1.21 | 0.235 | 0.882 | 0.118 | 15 |
| 2. IMNCI Visit (2 months – 2 year) | 105.0 | 77.4 | 1.54 | 0.134 | 0.933 | 0.067* | 15 |
| 3. IMNCI Visit (2 year – 5 year) | 89.7 | 45.9 | 1.43 | 0.164 | 0.918 | 0.082* | 15 |
| III. Routine Immunization visit | 41.0 | 38.1 | 0.16 | 0.875 | 0.563 | 0.437 | 7 |
| 1. BCG Vaccine | 28.0 | 36.9 | -0.40 | 0.695 | 0.347 | 0.653 | 10 |
| 2. Oral Polio (0) Vaccine | 3.4 | 1.0 | 0.61 | 0.556 | 0.722 | 0.278 | 7 |
| 3. Pentavalent (DPT-HepB-HIP) (all types) | 100.4 | 101.4 | -0.03 | 0.978 | 0.489 | 0.511 | 10 |
| 4. Measles – 1 | 5.6 | 28.3 | -1.45 | 0.163 | 0.082* | 0.918 | 10 |
| 5. Vitamin A Dose (any dose) | 6.0 | 1.0 | 0.87 | 0.419 | 0.791 | 0.209 | 4 |
| Other types of visits | | | | | | | |
| 4. All visits | 2031.9 | 2323.5 | -0.27 | 0.787 | 0.394 | 0.606 | 16 |
| 5. Adult Outpatient Visit | 1811.6 | 2147.5 | -0.29 | 0.773 | 0.386 | 0.614 | 14 |
| * p < 0.10 ** p < 0.05 *** p < 0.01, † Lower-tailed test: mean number of visits $H_1: \mu_{2019} < \mu_{2020}$, †† Upper-tailed test: mean number of visits $H_1: \mu_{2019} > \mu_{2020}$ | | | | | | | |

Supplementary Table 2. Themes and illustrative quotes on factors enabling community facility visits during COVID-19.

| Themes | Illustrative Quotes |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| COVID-19 perception | |
| People are in doubt about COVID-19 existence in the area. | <ul style="list-style-type: none"> ➤ I do not believe it exists, especially in our area. It might be real / exist in other areas/countries. They just suspect and take everyone into an isolation/quarantine center, but they are healthy and free of any signs and symptoms.... (W) ➤ I have never seen anyone with such a real problem in our area. We have heard about it on radio and TV, so I found it difficult to believe and I do not believe it is real (W). ➤ There are huge gaps, misconceptions, and challenges in practical preventive practices. They even perceived that the disease may not be real. Clients recovered from COVID-19 without any sign and symptom disseminated the information to the community and based on that the community misconceived that the virus might not be real from the beginning (HCP). ➤ Right now, the entire community members have no fear or concern about acquiring the disease we are not concerned about client decrement related to COVID-19. Specially after the 5 months state of emergency was lifted things are returned to pre-COVID time, (HCP). |
| No/Low COVID-19 impact perception on daily life | <ul style="list-style-type: none"> ➤ COVID was for outsiders not for us, it was for political issues, the machine for COVID test was false (W). ➤ Has COVID-19 been affecting your life in any way? P: No nothing (W) ➤ I do not think we are at risk because we are not getting out of home most of the time and living in rural areas without any contact (W). |
| Knowledge on transmission methods | <ul style="list-style-type: none"> ➤ Crowding at one place like the market and public transportation(W). ➤ She laughed. "Media expresses it well; we know well it is also an infected person who can transmit it ..." it was not on her tip of tongue she encouraged simply to remember and told me freely "...contact, breathing" (W). ➤ It can be transmitted through air/ breathing, shaking hands, kissing, contact with others and when face masks are not applied properly (W). |
| Facility adaptation | |

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|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Training provided to HCP | <ul style="list-style-type: none"> ➤ there was continuous and repeated awareness creation on the preventive measures, how they apply it to prevent COVID-19... (HCP) ➤ After the first case of COVID-19 was confirmed in our country, all health care providers including supportive staff were oriented about covid-19 and how to protect themselves and their clients (HCP). ➤ Training was given for all health professionals by trained woreda health professionals, how the health professional can use mask and keeping distance, source of the virus's transition and the like (HCP). |
| PPE use and social distancing | <ul style="list-style-type: none"> ➤ All health workers have applied face masks and sanitizer while providing services (W). ➤ Health professionals kept all PPE materials in place while serving clients (HCP). ➤ Health professionals have put on their face masks, enforce clients to wear face masks during facility visits and hand washing soap has also been kept in place for clients (W). ➤ We had arranged client sitting chairs at all departments to keep their social distance; we had assigned one personnel to educate and to keep their social distance (HCP). ➤ We were giving care for patients face to face in and in close contact so far, but now we are providing two meters distance (HCP). |

Supplementary Table 3. Themes and illustrative quotes on perception of client flow and barriers of community facility visit.

| Themes | Illustrative Quotes |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Perception of client flow | |
| Client flow decreased initially and increased through time | <ul style="list-style-type: none"> ➤ During my ANC visit, I have seen some clients receiving health services. At the beginning of coronavirus some people did not want to receive the services for fear of contracting the disease. So, client flow at that time has decreased (W). ➤ Following of covid-19 positive case detection in the country, somewhat patient flow was decreased HCP). ➤ During COVID-19 time, the patient flow has dramatically decreased at the beginning (HCP). ➤ Right now, the entire community members have no fear or concern about acquiring the disease (HCP). ➤ Becomes the same as pre-COVID-19 time since the state of emergency lifted (HCP). |
| Barriers for service utilization | |

| | |
|-----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fair of acquiring the disease in the facility | <ul style="list-style-type: none"> ➤ You can have this risk at transport and at health facilities during service provision and from other clients/patients. That is the first fear (HCP). ➤ Health professionals subjected to additional COVID-19 related tasks, patient flow decreased due to emerging concerns and fears of contracting the disease (HCP). ➤ I have postponed my follow up at that time for fear of acquiring the disease from health professionals/health centers. The same is true for other clients in our area and some mothers have received their visit in private clinics as we perceived almost all staff were infected (W). ➤ Health workers wear face masks for themselves, but they don't let all clients wear face masks during facility visits (W). |
| Service deprioritized | <ul style="list-style-type: none"> ➤ As much as possible we tried to make faster service provision for their children and give advice for them not come back frequently, they can manage themselves at home if it is easy (HCP) ➤ We also used tele medicine for mild cases, because at the initial phase there was a direction of avoiding hospital visits for cases other than emergency (HCP). ➤ Initially priority was given for patients who have cough but without compromising maternal and child health care services (HCP). |
| Low transportation access | <ul style="list-style-type: none"> ➤ It is also another common reason for all of us to reduce client flow to the facility (W). ➤ Initially mothers were staying at hospital unnecessarily due to absence of transportation/ambulance/ (HCP). ➤ In this area there was no transport restriction, but numbers were reduced to half sit and cost was doubled. It was one of the factors to reduce flow (HCP). ➤ Travel restrictions are also another reason for low client flow which is more pronounced among mothers from far kebeles (HCP). |
| Public panic | <ul style="list-style-type: none"> ➤ At the beginning of covid-19 occurrence, the community panicked and feared acquiring the disease (HCP). ➤ Our basic challenge is fear of the disease. The community heard the severity of the disease in the developed country in the media, but now the problem is solved (HCP). ➤ Nationally the people panicked so there was a tendency of not visiting hospitals (HCP). ➤ The community has been frightened of contracting the disease at the beginning (W). |

BMJ Open

Impact of COVID-19 Pandemic on Utilization of Facility-Based Essential Maternal and Child Health Services from March to August 2020 Compared to Pre-Pandemic March to August 2019: a Mixed Method Study in North Shewa Zone, Ethiopia

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4 2 **and Child Health Services from March to August 2020 Compared to Pre-Pandemic**
5 3 **March to August 2019: a Mixed Method Study in North Shewa Zone, Ethiopia**
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7 5

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1 Abstract

2 **Introduction:** Ethiopia registered its first case of COVID-19 on March 13, 2020, and various
3 measures were taken since then to prevent the transmission of the virus. As a result of the
4 ongoing preventive measures and community fear of exposure, we anticipated that utilization of
5 maternal, newborn and child health (MNCH) services at health facilities would decrease and
6 aimed to assess the MNCH services utilization during the first six months of the COVID-19
7 pandemic.

8 **Methods:** The study was conducted in all BIRHAN Health and Demographic Surveillance System
9 (HDSS) catchment health facilities in Ethiopia. Mixed study design was conducted as part of the
10 Birhan HDSS in Ethiopia. The trend of service utilization during the first six months of COVID-19
11 was compared to corresponding time and data points of the preceding year.

12 **Result:** New family planning visits (43.2 to 28.5/month, $p = 0.014$) and sick under five child visits
13 (225.0 to 139.8/month, $P = .007$) declined compared to the same period in the preceding year.
14 Antenatal (208.9 to 181.7/month, $P = 0.433$), and postnatal care (26.6 to 19.8/month, $P = 0.155$)
15 visits, facility delivery rates (90.7 to 84.2/months, $P = 0.776$), aver all family planning (313.3 to
16 273.4/month, $P = 0.415$) and child routine immunization (37.0 to 36.8/month, $P = 0.982$) visits
17 were maintained over the six months compared to the same period in the preceding year.

18 **Conclusion:** Provision of essential MNCH services is crucial to ascertain favorable maternal and
19 child health outcomes. Our study presents early findings on the utilization of MNCH services that
20 were maintained except sick child and new family planning visits. Stakeholders in low- and middle-
21 income countries who wish to improve the resilience of their fragile health system will need to
22 continuously monitor service utilization and clients' evolving concerns during the pandemic to
23 prevent maternal and child morbidity and mortality.

24 Strengths and limitations of this study

25 Strengths of the study:

- 26 ✓ We presented primary data on service utilization during the early months of the pandemic
27 in an area of Ethiopia, one of the agrarian regions.
- 28 ✓ The mixed methods approach integrated both quantitative service utilization coverage,
29 and exploratory qualitative to better understand our findings and reasons for changes in
30 service utilization.

31 Limitation of the study:

- 32 ✓ We focused on coverage of service utilization as the primary outcome rather than mortality
33 or morbidity.
- 34 ✓ We do not have detailed data on quality-of-service provision (e.g., which services were
35 restricted and for how long, in what manner).
- 36 ✓ Recall bias was a possible limitation since qualitative data was collected three months
37 later than the initial six months of the pandemic (March to August 2020).

1 INTRODUCTION

2 The World Health Organization (WHO) declared coronavirus disease-2019 (COVID-19) a global
3 pandemic on March 11, 2020¹ and the first case of COVID-19 in Ethiopia was registered on March
4 13, 2020. Ethiopia was one of the countries with lower COVID-19 prevalence and related death
5 during the study period with 63,367 confirmed cases and 974 deaths in ~119 million population
6 as of 10 Sep 2022.² Majority of cases were from the city Addis Ababa and only 365 confirmed
7 cases and 8 deaths were register up to 30 Aug 2020 in the zone (the 3rd administration unit of the
8 country) occurred where study was conducted.

9 Multiple preventive measures focusing on social distancing and wearing masks were
10 undertaken.³ Some health facilities were assigned as COVID-19 isolation and quarantine centers,
11 and many suspended conducting elective surgeries and select outpatient services. This
12 increasing burden of managing COVID-19 on health facilities and health care providers leaves
13 the health system overstretched, challenging its ability to operate effectively. As shown during the
14 2014-2015 Ebola outbreak in west Africa, when health systems are overwhelmed by outbreaks,
15 mortality from vaccine-preventable and other treatable diseases can increase dramatically.^{4,5}

16 Well-organized and prepared health systems can continue to provide equitable access to
17 essential services throughout an emergency⁶, but health systems in developing countries are
18 often fragile when affected by emergencies such as pandemics. Accordingly, the WHO advises
19 that countries should identify and prioritize essential services like routine vaccination, reproductive
20 health services including care during pregnancy and childbirth, and care of young infants and
21 older adults in their efforts to maintain continuity of service delivery and make strategic shifts to
22 ensure that increasingly limited resources provide maximum benefit for the population.⁷ The
23 disruption of services and diversion of resources away from essential sexual and reproductive
24 health care due to the prioritization of the COVID-19 response are expected to increase risks of
25 maternal and child morbidity and mortality.⁸

26 In general lockdown or stay-at-home policy was not in place in Ethiopia where the study took
27 place and health facilities were open during the study time period March to August 2019. The
28 Ministry of Health (MOH) of Ethiopia focused on prevention and control of the pandemic. Possible
29 shifts of the health workforce and the health system towards the COVID-19 response may
30 contribute towards low utilization of routine services. For example, “half sit” policies (29 March
31 2020) decreased maximum occupancy on public transit, thus cutting the number of seats in half
32 and increasing the cost of transportation when traveling within the region while transportation
33 between regions was paused completely. Additionally, school closures (March 2020), declaration
34 of state of emergency (08 April 2020), awareness campaigns about the pandemic, and case
35 reports, both suspected and confirmed cases, may have all contributed to growing fear of
36 exposure to COVID-19, especially for patients visiting health facilities.

37 A modelling study of essential maternal and child health interventions across 118 low- and middle-
38 income countries over a 6-month period estimated reduction of services by 9.8–18.5% and 39.3–
39 51.9% in the least and most severe scenarios, respectively,⁹ due to the pandemic. Service
40 reductions have already borne out in several contexts. In China, health service utilization declined

1 significantly after the outbreak and all indicators rebounded beginning in March, but most had not
2 recovered to their pre-COVID-19 levels by June 2020.¹⁰ In Bangladesh, Nigeria, and South Africa,
3 between March and May 2020, the utilization of basic essential MNCH services such as antenatal
4 care (ANC), family planning (FP), and immunization reduced due to lockdowns that triggered fear
5 of contracting COVID-19, shifts of health system focused on managing the pandemic, and
6 resource constraints.¹¹ During the early phase of the COVID-19 outbreak (March-April 2020) in
7 Rwanda, utilization of ANC, deliveries, postnatal care (PNC) and immunizations significantly
8 declined.¹² Similarly, a study in western Ethiopia showed a significant reduction in mean utilization
9 of ANC, health facility birth, FP, and newborn immunization services between March–June 2019
10 and March–June 2020.¹³

11 In Nepal, a qualitative study found that maternity services, immunizations, and supply of essential
12 medicine were the most affected health services during the lockdown. Interruptions were mainly
13 due to the closure of health services at local health care facilities, limited affordability, involvement
14 of private health sectors during the pandemic, fears of COVID-19 transmission among health care
15 workers and within health centers, and disruption of transportation services. Participants
16 expressed frustrations on poor testing, isolation and quarantine services related to COVID-19,
17 and poor accountability from the government at all levels towards health services continuation
18 and management during the COVID-19 pandemic.¹⁴

19 To understand these effects COVID-19 pandemic in Ethiopia, the HaSET maternal and child
20 health research program assessed trends in MNCH care utilization from March 2019 to August
21 2020 as well as health care providers' and clients' perceptions on the barriers to and enablers of
22 service provision and utilization during the COVID-19 emergency. This study has paramount
23 importance in filling the evidence gap on MNCH service utilization during COVID-19, both in the
24 Ethiopian context and other low- and middle-income countries, to prevent significant damage to
25 the gains achieved in such areas over the past several decades.

26 **METHODS**

27 We conducted the study in Birhan Health and Demographic Surveillance System (HDSS)
28 catchment health facilities in North Shewa Zone, Amhara Region, Ethiopia. The HDSS was
29 established by Harvard University (HU) and Saint Paul's Hospital Millennium Medical College
30 (SPHMMC) in Jun 2018, and it is a community based continuous follow up of health and
31 demographic conditions to give up-to-date information about the catchment population and
32 establishes a population frame to nest studies. There are five health centers, two primary
33 hospitals (one public and one private) and one referral hospital in the area, and all (eight)
34 catchment health facilities were selected for this study. Those facilities provide essential MNCH
35 services for both rural (majority) and urban populations coming from HDSS catchment and non-
36 catchment areas.

37 The health centers provide ANC, PNC, delivery, abortion, routine immunization (RI), integrated
38 management of neonatal and childhood illness (IMNCI), and FP. Each health center also has a
39 minimum of five service extension health posts mainly for FP and RI in each kebele (the simplest
40 administration unit), and each health post sends activity reports to health centers monthly basis.

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3 1 Two public hospitals (one primary and one referral) and the remaining one private general hospital
4 2 also provide the above-mentioned essential MNCH services, except for RI, which is given mainly
5 3 in health centers and catchment health posts.

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8 4 Mixed phenomenological qualitative and facility-based cross-sectional study designs were
9 5 employed. For the quantitative part of the study, a facility-based cross-sectional survey was
10 6 conducted to assess the impact of COVID-19 on essential MNCH service provision or utilization
11 7 and provider-side barriers to service provision and utilization in Birhan catchment health facilities.
12 8 Ninety-one MNCH healthcare providers (doctors, nurses, midwives, and clinical officers available
13 9 at the time of data collection) were asked with uniformly structured questionnaires about their
14 10 perception of client flow and possible barriers for respective sections. Twelve out of 91 healthcare
15 11 providers were working in two MNCH departments and interviewed twice. In addition to this,
16 12 healthcare utilization time-series data from each facility was retrospectively collected from medical
17 13 records and monthly facility reports. Retrospective facilities service statistics were collected over
18 14 an 18-month period from March 2019 to August 2020 using Computer Assisted Field Editing
19 15 (CAFE). Data was abstracted by uniformly structured questionnaires and entered to Open Data
20 16 kit (ODK) collect and uploaded to ODK aggregate. The facilities' monthly reports and medical
21 17 registers data were collected separately. The health centers monthly reports include services
22 18 given in the health posts that are extension sites for the health center, but the facility registers are
23 19 exclusively for services given in the health centers.

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28 20 In addition to the cross-sectional study, a phenomenological qualitative design utilizing in-depth
29 21 interviews was implemented to assess client and provider side barriers and enablers to service
30 22 provision/utilization in Birhan catchment health facilities. Purposive sampling was implemented,
31 23 and in-depth interviews were conducted until theoretical saturation was reached. Ten facility or
32 24 department heads, and nine women (delivered at home/facility, had ANC, or missed ANC follow
33 25 up) were interviewed. An interview guide with open-ended questions was translated from English
34 26 to Amharic and used to elicit the qualitative information from informants and face-to-face
35 27 interviews were conducted in the facilities with facility/department heads, women who visited
36 28 facilities during COVID-19 and women who delivered at home. Women who missed an ANC follow
37 29 up were interviewed by phone. With the permission of the respondent, all interviews were
38 30 recorded, and all recorded data was transcribed to English for further analysis. To ensure the
39 31 safety of the data collectors and participants, masks were worn, and social distancing practices
40 32 were implemented during training and data collection from 2 – 20 November 2020.

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45 33 The extracted data was exported to Stata 17.0 for analysis and the average MNCH services
46 34 uptake was calculated each month to quantify the changes pre – COVID-19 (March to August
47 35 2019) and during the COVID-19 (March to August 2020) pandemic. For the purposes of analysis,
48 36 March to August 2019 and March to August 2020 were considered as pre-COVID-19 and COVID-
49 37 19 periods, respectively. We had 48 paired months observations of essential MNCH variables
50 38 except RI, which was 30 paired months, since it was given only in five health centers including
51 39 extension health posts. The facilities medical records were archived misplaced, and we found
52 40 some months data missing and partially field. To avoid the effect of missing and partially filled
53 41 values, analogous months data from the same facility were excluded from the data analysis.
54 42 Finally, an independent sample t-test was done to compare pre-COVID-19 and COVID-19 time

1 months. This analysis was repeated for the initial two-months (March to April 2020) of the pandemic and the analogous period, March to April 2019, to examine changes in service utilization at the onset of the COVID-19 pandemic and a significance level of $\alpha=0.05$ was used for all statistical tests.

In addition to the quantitative metrics listed above, English language transcript data was entered in Dedoose software for qualitative data analysis. After familiarization with the data, the content of the data was coded line by line for thematic analysis following a framework theory approach to describe and interpret health providers' and communities' perceptions on barriers and enablers to MNCH service provision. The framework approach involves using some pre-assigned themes to initially categorize data while also adjusting and iterating the coding scheme to accommodate newly emergent themes, sub-themes, and categories through inductive interpretation.¹⁵ Coded data was examined for potential relationships and themes were also assessed across relevant participant demographic categories to understand different user perspectives. Findings were described under pre-assigned and newly emerged themes.

Ethic Statement

This study involves human participants and was approved by Ethics Review Board (IRB) of Saint Paul's Hospital Millennium Medical college (SPHMMC) and Harvard T.H. Chan School of Public Health (HSPH) (IRB20-1574). To extract MNCH service statistics, permission was obtained from individual health facilities and individual verbal consent was obtained from respondents.

Patient and Public Involvement

Meeting was restricted during protocol development and study period due to COVID-19 pandemic and it was not possible to involve clients or the public in the design, study, reporting and dissemination plans of our research.

RESULTS

For the quantitative section of the study, data were abstracted from a total of eight health facilities (three hospitals and five health centers) and interviews with 103 healthcare providers working in the MNCH units of the facilities. In addition to these, ten facility or MNCH department heads and nine women (pregnant and delivered in the time of COVID-19) were asked open-ended questions.

We did not see a statistically significant change in maternal health facility visits for ANC, PNC, facility delivery, and abortion related. The FP services utilization in the health centers and hospitals declined from 105.5 to 66.5 visits per month ($p < 0.05$) after the onset of the pandemic and within the subset of FP visits, repeat and unclassified FP visits significantly declined while new FP visits did not change. Since the FP services are given in health posts, the source of data for FP is aggregated data from both health posts and health centers¹⁶ and the overall FP service utilization was maintained (313.3 to 273.4/month, $P = 0.415$), except, the new FP services which declined significantly from 43.2 visits per month to 28.5 visits per month ($p = 0.029$).

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3 1 Declines in service utilization were found among sick child visits, which was defined as a facility
4 2 visit for sick children under five years old. The mean number of IMNCI visits for sick children under
5 3 5 years old declined from 225.0 visits per month in 2019 to 139.8 visits per month in 2020 ($p =$
6 4 0.014). This significant relationship persists for two age stratifications of IMNCI visits (2 months
7 5 to under 2 years, and 2 years to under 5 years). On the other hand, there was no significant
8 6 change (37.0 to 36.8/month, $P = 0.982$) in child visits for routine immunizations, including BCG,
9 7 OPV-0, pentavalent (DPT-HepB-HIP) and measles vaccinations (**Table 1**).

12 8 Ninety-one healthcare providers who were working in maternal, newborn and child health were
13 9 asked about the client flow during COVID-19. Sixty-seven percent of the health care providers
14 10 (HCPs) perceived that client flow decreased and 31% of them considered the same (**Supp Table**
15 11 **1**). Qualitative interviews also supported the observed decrease in client flow, with descriptions
16 12 of sharper contractions in service utilization in the first couple of months after the onset of the
17 13 pandemic but resumed to approximately normal levels over subsequent months. To explore the
18 14 perception of lower service utilization during the initial couple of months of COVID-19 by clients
19 15 of the health system and HCPs, data on the initial two pre-COVID (March to April 2019) months
20 16 were compared with analogous COVID time months (March to April 2020) and there were no
21 17 statistically significant changes in the number of visits for maternal and childhood visits overall,
22 18 except sick child visit (**Supp Table 2**).

27 19

28 20 **Barriers to service provision and utilization during COVID-19**

30 21 Even though the essential MNCH service utilization was maintained; clients' fear of acquiring the
31 22 disease from the facility, travel restrictions, increased transportation cost due to the half seat order
32 23 by the government, and fear of acquiring the disease on the way to the health facility were the
33 24 main barriers for service utilization perceived by healthcare providers (**Table 2**).

36 25 These secondhand perspectives from healthcare providers about the barriers that clients face
37 26 was largely supported by qualitative interviews with clients. Fear of contracting the disease and
38 27 lack of access to transportation are the most described barriers (**Supp table 3**). Particularly during
39 28 the first few months after the onset of COVID-19 in Ethiopia and the imposition of travel restrictions
40 29 and other public health measures like state of emergency, communities fear of acquiring the
41 30 disease and high levels of public panic were barriers for facility-based services utilization. This
42 31 fear extended to visiting facilities during the pandemic; community members were afraid of
43 32 contracting the disease in crowded spaces, public transportation routes to facilities, or at facilities
44 33 themselves from health care workers or other patients, particularly when they heard of COVID-19
45 34 cases present at facilities and this fear often resulted in delayed care-seeking. A woman said that
46 35 *"I have postponed my follow up at that time for fear of acquiring the disease from health*
47 36 *professionals and health centers. The same is true for other clients in our area, and some mothers*
48 37 *have received their visit in private clinics as we perceived almost all staff were infected"*.

53 39 The economic hardship during COVID-19 prevented some clients from being able to pay for
54 40 transportation due to transportation restriction with half seats and doubled transportation fee, and
55 41 other direct or indirect costs of attending facilities. Clients described lacking money to purchase

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3 1 PPE and one HCP noted that the closed market movement affected people's incomes, as
4 2 reflected by patients delaying treatment until conditions are more severe or defaulting on
5 3 treatment.
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8 5 Lastly, bottlenecks on the health system side provided another barrier to service utilization.
9 6 Facilities restricted some services at the beginning of the pandemic's onset and clients were
10 7 unable to access certain services or assumed that services were restricted even after they had
11 8 resumed, as one HCP suggested. Additionally, multiple clients described fearing that they might
12 9 be forcibly quarantined or presumed COVID-19-positive if they were to visit facilities and this fear
13 10 deterred facility visits. HCPs described many challenges related to the under preparedness of the
14 11 health system for managing suspected cases of COVID-19. Often these challenges manifested
15 12 through physical infrastructure constraints and a shortage of guidelines for managing quarantine
16 13 and isolation centers for suspected COVID-19 cases.
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15 15 **Enablers of service provision and utilization during COVID-19**

16 16 In terms of knowledge of COVID-19, all women had heard about the disease, but a few were in
17 17 doubt about COVID-19 existence in the area which may be an enabling factor for facility-based
18 18 service utilization. A client respondent said, "*I do not believe it exists, especially in our area. It
19 19 might be real / exist in other areas/countries. They just suspect and take everyone into an
20 20 isolation/quarantine center, but they are healthy and free of any signs and symptoms...*". Some
21 21 described that COVID-19 could not affect them because God and/or Mary will protect them, citing
22 22 the importance of prayer as a protective measure.
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24 24 Facility adaptations like training for healthcare providers, hand washing facilities, physical
25 25 distancing, and awareness creation and health education which was given by local authorities
26 26 increased the client awareness on COVID-19 prevention and facility-based service utilization
27 27 through time (**Supp table 4**).
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29 29 **Understanding Service Utilization Trends during COVID-19**

30 30 The barriers and enablers highlighted in the interviews interact with each other dynamically, as
31 31 depicted below. Certain barriers were more substantial than others, particularly fear of the
32 32 disease, transportation access, and economic-related barriers, while certain pull factors
33 33 encouraged facility visits, particularly over time as fear subsided, community awareness
34 34 measures were undertaken, and facilities implemented adaptations to manage both COVID-19
35 35 and routine services (**Diagram 01**).
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37 37 **DISCUSSION**

38 38 We examined the impact of the COVID-19 pandemic on essential MNCH service utilization by
39 39 analyzing data from health facility records and healthcare providers and patients' perspectives.
40 40 The MNCH services utilization were maintained over six months compared to the same period
41 41 in the preceding year, except new family planning initiation and sick under five years old child
42 42 visits. Although our samples were eight health facilities available in the HDSS they are likely to
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3 1 be representative because clients and healthcare providers' views were added in addition to six
4 2 analogous months data abstraction from medical records.
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7 3 Studies reported a 37% overall healthcare utilization and 42% of visit reduction¹⁷ and ANC, PNC
8 4 and facility delivery were affected in African countries.^{11,12,18,19} On the other hand FP, institutional
9 5 delivery, RI and ANC did not vary significantly between pre-COVID-19 and during COVID-19 in
10 6 Amhara region, Ethiopia²⁰ and Kenya.²¹ Similarly, our study showed that maternal facility-based
11 7 healthcare provision was maintained and it might be due to the government response for COVID-
12 8 19, because the stay at home/lockdown policy was not in place, the prevalence of confirmed
13 9 cases and death were lower, and facilities were open for MNCH services through study period.
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16 10 Globally, contraception services were shut down or not accessible²² and the service provision
17 11 was declined.^{23,24} In our study health center and hospital based family planning service utilization
18 12 decreased (105.5 to 66.5/ months, $P = 0.051$), but the family planning service is given by health
19 13 extension workers at health posts which are service extension sites of health centers in the
20 14 villages and the combined FP service utilization was maintained (313.3 to 273.4/month, $P =$
21 15 0.415), except new FP initiations which was significantly affected (43.2 to 28.5/month, $P = 0.029$).
22 16 This is suggesting that utilization of family planning services was more likely to occur when
23 17 uncrowded clinics are nearby without extensive travel.
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27 18 For child health, the number of Integrated Management of Neonatal and Childhood Illness
28 19 (IMNCI) visits, also referred to as sick child visits, significantly declined by 38% (**225.0 to 139.8,**
29 20 **$P = 0.014$**). Similarly, child health service declined by 33% in three sub-Saharan Africa countries
30 21 including Ethiopia due to COVID-19²⁴ and it is possible that the decrease in child sick visits was
31 22 related to COVID-19 prevention and control activities. The leading causes of under five years old
32 23 children morbidity in Ethiopia,²⁵ acute respiratory illness, fever and diarrhea may have decreased
33 24 due to school closures (older siblings less exposed), limited interactions with peers in the
34 25 community, spending more time indoors, mask-wearing at community gatherings, hand washing,
35 26 physical distancing, and other personal protective equipment and practices. We found that RI
36 27 remained stable during the initial six months of the pandemic, which was different than the findings
37 28 from studies in Colombia, India, and Brazil where RI declined during the pandemic.²⁶⁻²⁸ The MOH
38 29 of Ethiopian prioritized RI, especially measles, during COVID-19 and existing health extension
39 30 workers stationed at health posts for community-based services hygiene and sanitation, FP and
40 31 RI which may have sustained accessibility to these services during COVID-19 because home to
41 32 home visits creates close relations with clients and health posts are not crowded., even though,
42 33 there was a marked reduction in supply chain distribution of vaccines in Ethiopia during COVID-
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48 35 At the time of data collection, early in the pandemic, respondents largely described not feeling
49 36 many tangible impacts of COVID-19 on their daily lives if they fail to adherence to preventive
50 37 measures, so they went about life as usual. This easing fear of COVID-19 may have enabled
51 38 women to feel that they could safely attend services, but it also has important implications as the
52 39 pandemic continues, particularly as cases in Ethiopia have risen substantially. Awareness and
53 40 education campaigns are needed to produce actual behavior change. Moreover, communities'
54 41 belief that God may protect them from infection indicates the important role of engaging religious
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3 1 leaders as champions in behavior change campaigns. An additional key recommendation is
4 2 systematically addressing misinformation and doubt to increase population compliance with
5 3 preventive measures, particularly as Ethiopia faces a rising caseload, increasing prevalence of
6 4 variants, and a stalled vaccine rollout that may take months or years to reach substantial
7 5 population coverage. Less than 8.4% of the population has received at least one dose of COVID-
8 6 19 vaccine as of 19 Feb 2022.³⁰

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11 7 Barriers to maternal facility visits included women not wanting to bother anyone, lack of support
12 8 from healthcare workers, influence of the media,³¹ lockdown, fear of contracting the disease,³²
13 9 shift of focus towards pandemic, resource constraints¹¹ and non-conducive working environments
14 10 for healthcare providers³³. In addition, women experienced fears of contracting the disease,
15 11 economic hardship, and lack of access to transportation. Particularly during the first few months
16 12 after the onset of COVID-19 in Ethiopia, there was an imposition of travel restrictions and other
17 13 public health measures like state of emergency, and high levels of public panic. Multiple clients
18 14 described fearing that they might be forcibly quarantined or presumed COVID-19-positive if they
19 15 were to visit facilities; this fear deterred facility visits. While we found that sick child visits and new
20 16 family planning services were affected by the pandemic, the declines among other essential
21 17 services were not as significant indicating hope in service resilience and the ability to introduce
22 18 rapid and substantial facility adaptations to maintain the health system (e.g., personal protective
23 19 equipment, infection prevention measures, improved sanitation/hygiene).

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28 20 **Strengths of the study:** We present primary data on service utilization during the early months
29 21 of the pandemic in an area of Ethiopia, one of the agrarian regions, which is generalizable to 80%
30 22 of the country's rural population. ³⁴ We leveraged an existing research network, HaSET MNCH
31 23 research program (www.hasetmch.org), and established field site³⁵ to rapidly collect data from all
32 24 available sources. The mixed methods approach integrated both quantitative service utilization
33 25 coverage data with sociocultural, contextual, and exploratory qualitative to better understand our
34 26 findings and reasons for changes in service utilization. The study highlights success stories in
35 27 community-based care and government leadership for key services like routine immunization that
36 28 may benefit other settings.

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40 29 **Limitation of the study:** Our study focused on service utilization and may not have been
41 30 powered to detect significant differences. Furthermore, In Kenya, Tanzania and Uganda,
42 31 maternal and neonatal mortality rates exacerbated due to COVID-19, ³⁶ but we couldn't see this
43 32 effect in the Ethiopian context since we focused on coverage of service utilization as the primary
44 33 outcome rather than mortality or morbidity. We do not have detailed data on service provision
45 34 (e.g., which services were restricted and for how long, in what manner). There is the potential of
46 35 recall bias were possible limitation since qualitative data was collected three months later than
47 36 the initial six months of the pandemic (March to August 2020).

50 51 37 **CONCLUSION**

52 38 Utilization of essential MNCH services is crucial to achieve favorable health outcomes. In the
53 39 setting of developing countries like Ethiopia, health systems are often too fragile to withstand the
54 40 direct increase in volume of patients and indirect health consequences of a pandemic. Our study
55 41 presents early findings of maintained utilization of MNCH services, except new family planning

1 services and sick child visits. Further study is needed to assess the effect of the pandemic on
2 women and children morbidity and mortality. To prevent worsening maternal and child morbidity
3 and mortality as a result of the pandemic, resources are required by government leaders, policy
4 makers, and clinicians to improve the resilience of their health system to continuously monitor
5 service utilization, while at the same time engaging with providers and clients to understand and
6 address their evolving concerns about MNCH service uptake.

7 **ABBREVIATIONS**

8 CAFÉ: Computer Assisted Field Editing, COVID-19: Coronavirus Disease - 2019, DPT: Diphtheria
9 Pertussis and Tetanus, EOC: Emergency Operation center, EPHI: Ethiopian Public Health
10 Institute, FP: Family Planning, HC: Health Center, HCP: Healthcare provider, HDSS: Health and
11 Demographic Surveillance System, HepB: Hepatitis B, HIP: Haemophilus influenzae, HIV/AIDS:
12 Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome, HP: Health post,
13 HSPH: Harvard School of Public Health, IRB: Institutional Review Board, MCH: Maternal and
14 Child Health, MNCH: Maternal, Newborn and Child Health, MOH: Ministry of Health, ODK: Open
15 Data Kit, PNC: Postnatal care, RI: Routine immunization, RMNCH: Reproductive, Maternal,
16 Newborn and Children Health, SPHMMC: Saint Paul Hospital Millennium Medical College, W:
17 Women, WHO: World Health organization.

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27 **AVAILABILITY OF DATA AND MATERIALS**

28 The datasets used and/or analyzed during the current study are available from the corresponding
29 author on reasonable request.

30 **COMPETING INTERESTS**

31 The authors declare that they have no competing interests.

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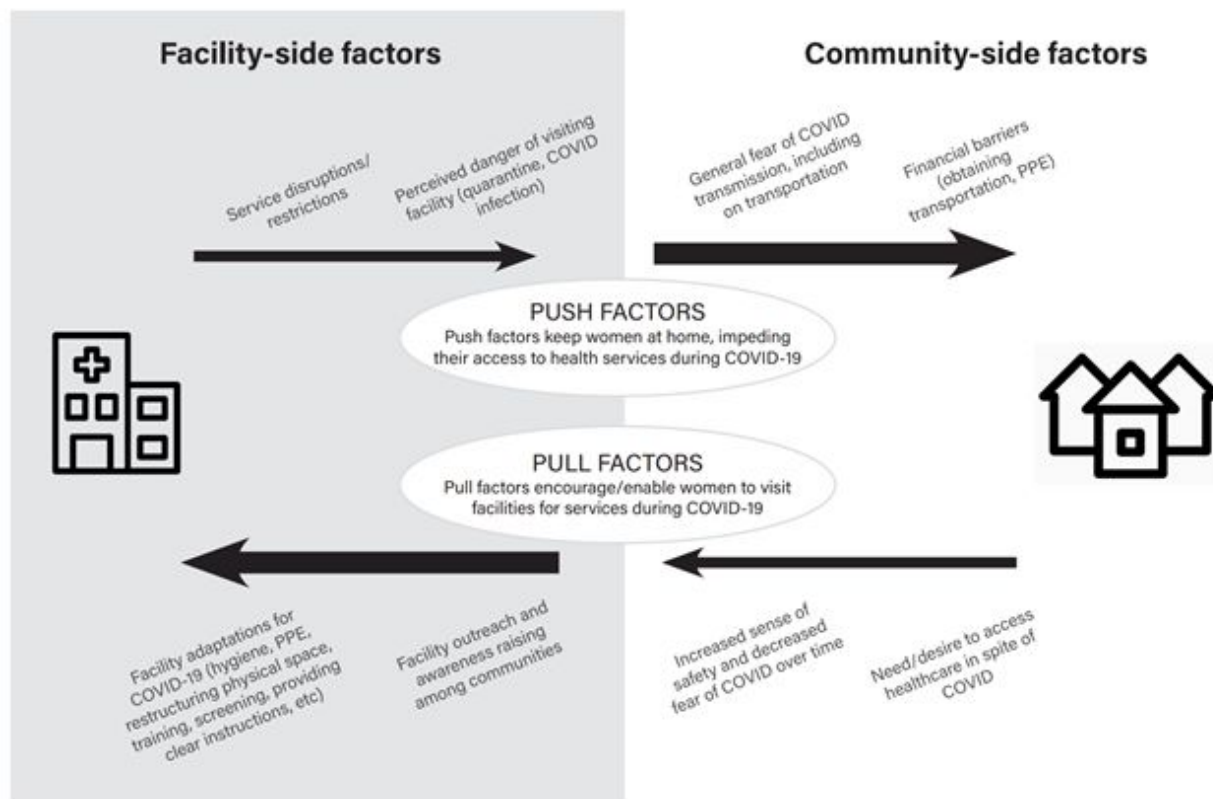
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6 **Figure and tables**

7 **Diagram 1:** Enabling (pull) factors and barriers (push factors) for service utilization highlighted in
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38 **Table 1.** Comparing essential MNCH service utilization over six months between COVID-19 (Mar-
39 Aug 2020) and analogous pre-COVID-19 (Mar-Aug 2019) periods.
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| Visit Type | Mean number of visits/month over six months | | t-statistic | p-value | Lower p-value † | Upper p-value †† | Paired observations |
|--------------------------|---------------------------------------------|--------------|-------------|--------------|-----------------|------------------|---------------------|
| | 2019 | 2020 | | | | | |
| I. Maternal visit | 376.3 | 321.2 | 1.11 | 0.270 | 0.865 | 0.135 | 48/48 |
| 1. Antenatal care | 208.9 | 181.7 | 0.79 | 0.433 | 0.784 | 0.216 | 40/48 |
| 2. Postnatal care | 26.6 | 19.8 | 1.44 | 0.155 | 0.922 | 0.078* | 30/48 |
| 3. Facility delivery | 90.7 | 84.2 | 0.29 | 0.776 | 0.612 | 0.388 | 41/48 |

| | | | | | | | |
|----------------------------------------------------------------------|--------------|--------------|-------------|--------------|--------------|---------------------|-------|
| 4. Abortion-related services | 11.8 | 9.8 | 0.56 | 0.578 | 0.711 | 0.289 | 34/48 |
| 5. Overall FP services in health posts, health centers and hospitals | 313.3 | 273.4 | 0.82 | 0.415 | 0.792 | 0.207 | 47/48 |
| 5.1 New FP services | 43.2 | 28.5 | 1.22 | 0.029 | 0.986 | 0.014** | 47/48 |
| 5.2 Repeat FP services | 270.2 | 244.9 | 0.57 | 0.567 | 0.716 | 0.284 | 47/48 |
| 6. FP services in health centers and hospitals | 105.5 | 66.5 | 1.99 | 0.051 | 0.974 | 0.026** | 33/48 |
| 6.1 New FP services | 8.9 | 7.1 | 0.84 | 0.406 | 0.797 | 0.203 | 33/48 |
| 6.2 Repeat FP services | 96.5 | 59.3 | 1.03 | 0.046 | 0.977 | 0.023** | 33/48 |
| 6.3 Unclassified FP services | 17.7 | 1.3 | 1.12 | 0.039 | 0.981 | 0.019** | 26/48 |
| II. Sick child visit (0-5years)) | 225.0 | 139.8 | 1.51 | 0.014 | 0.993 | 0.007** * | 46/48 |
| 1. MNCI Visit (< 2 months) | 10.8 | 7.7 | 0.82 | 0.412 | 0.794 | 0.206 | 46/48 |
| 2. IMNCI Visit (2 months – 2 year) | 101.6 | 50.4 | 1.68 | 0.009 | 0.996 | 0.004*** | 46/48 |
| 3. IMNCI Visit (2 year – 5 year) | 111.6 | 81.8 | 1.15 | 0.034 | 0.983 | 0.017** | 46/48 |
| III. Routine Immunization visit | 37.0 | 36.8 | 0.02 | 0.982 | 0.509 | 0.491 | 23/30 |
| 1. BCG Vaccine | 31.4 | 36.5 | -0.39 | 0.701 | 0.350 | 0.650 | 30/30 |
| 2. Oral Polio (0) Vaccine | 3.2 | 1.0 | 0.88 | 0.384 | 0.808 | 0.192 | 23/30 |
| 3. Pentavalent (DPT-HepB-HIP) (all types) | 100.4 | 101.5 | -0.05 | 0.958 | 0.479 | 0.521 | 30/30 |
| 4. Measles – 1 | 10.3 | 27.5 | -1.99 | 0.051 | 0.026 | 0.974 | 30/30 |
| 5. Vitamin A Dose | 8.6 | 5.7 | 0.67 | 0.506 | 0.747 | 0.253 | 14/30 |
| Other types of visits | | | | | | | |

| | | | | | | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|-------|-------|-------|-------|-------|
| All visits | 2568.9 | 2606.7 | -0.05 | 0.956 | 0.478 | 0.522 | 48/48 |
| Adult Outpatient Visit | 2121.2 | 2239.7 | -0.17 | 0.868 | 0.434 | 0.566 | 44/48 |
| <p>* p < 0.10 ** p < 0.05 *** p < 0.01, † Lower-tailed test: mean number of visits H₁: $\mu_{2019} < \mu_{2020}$, †† Upper-tailed test: mean number of visits H₁: $\mu_{2019} > \mu_{2020}$</p> | | | | | | | |

1 **Table 2.** Possible barriers to service utilization in the time of COVID-19 based on healthcare
 2 providers' perception.

| Possible barriers to service utilization in the time of COVID-19 | Count | % |
|-------------------------------------------------------------------------------------------------|------------|----|
| 1. Fear of acquiring the diseases from the facility | 97 | 94 |
| 2. Travel restrictions | 90 | 87 |
| 3. Increased transportation cost (due to half sit order by the government) | 89 | 86 |
| 4. Fear of acquiring the disease on the way to the health facility | 86 | 83 |
| 5. Lack of transport to the HP/HC site | 72 | 70 |
| 6. Lack of PPE for clients | 67 | 65 |
| 7. Clients' perception of limited implementation of protective measures by healthcare providers | 58 | 56 |
| 8. Healthcare providers advice to stay at home | 54 | 52 |
| 9. Limited-service hours or absence of health care workers | 17 | 17 |
| 10. Unavailability of ambulance | 7 | 7 |
| 11. Unavailability of healthcare providers in facilities to provide outreach services. | 7 | 7 |
| Total interviews | 103 | |

Note: Twelve healthcare providers were working in different departments and asked twice.

3

Supplementary Tables

Supplementary Table 1: Healthcare providers' perception about MNCH clients flow to the facility in the time of COVID-19.

| Response | Count | Percent |
|------------|-------|---------|
| Increasing | 2 | 2% |
| The same | 28 | 31% |
| Decreasing | 61 | 67% |
| Total | 91 | 100% |

Supplementary Table 2. Comparing essential MNCH service utilization over two months between COVID (April- May 2020) and analogous pre-COVID (April-May 2019) periods.

| Visit Type | Mean number of visits/ months over six months | | t- statis tic | p- value | Low er p- valu e | Upp er p- valu e | Number of paired observa tions |
|----------------------------------------------------------|-----------------------------------------------|-------|---------------------|-------------|---------------------------|---------------------------|--------------------------------------------|
| | 2019 | 2020 | | | | | |
| I. Maternal visit | 331.3 | 327.3 | 0.05 | 0.959 | 0.520 | 0.480 | 16 |
| 1. Antenatal care | 198.0 | 176.5 | 0.39 | 0.702 | 0.649 | 0.351 | 13 |
| 2. Postnatal care | 17.8 | 20.7 | -0.30 | 0.768 | 0.384 | 0.616 | 9 |
| 3. Facility delivery | 85.6 | 87.0 | -0.04 | 0.970 | 0.485 | 0.515 | 14 |
| 4. FP related services | 84.1 | 95.1 | -0.38 | 0.712 | 0.356 | 0.644 | 10 |
| 5. FP related services (hospitals, HCs and HPs combined) | 289.4 | 227.8 | 0.86 | 0.398 | 0.801 | 0.199 | 16 |
| 6. Abortion-related services | 10.5 | 10.7 | -0.05 | 0.964 | 0.482 | 0.518 | 11 |
| II. Sick child visit (0-5years) | 201.0 | 126.6 | 1.68 | 0.103 | 0.948 | 0.052* | 15 |

| | | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|-------|-------|--------|--------|----|
| 1. IMCI Visit (< 2 months) | 7.3 | 3.3 | 1.21 | 0.235 | 0.882 | 0.118 | 15 |
| 2. IMNCI Visit (2 months – 2 year) | 105.0 | 77.4 | 1.54 | 0.134 | 0.933 | 0.067* | 15 |
| 3. IMNCI Visit (2 year – 5 year) | 89.7 | 45.9 | 1.43 | 0.164 | 0.918 | 0.082* | 15 |
| III. Routine Immunization visit | 41.0 | 38.1 | 0.16 | 0.875 | 0.563 | 0.437 | 7 |
| 1. BCG Vaccine | 28.0 | 36.9 | -0.40 | 0.695 | 0.347 | 0.653 | 10 |
| 2. Oral Polio (0) Vaccine | 3.4 | 1.0 | 0.61 | 0.556 | 0.722 | 0.278 | 7 |
| 3. Pentavalent (DPT-HepB-HIP) (all types) | 100.4 | 101.4 | -0.03 | 0.978 | 0.489 | 0.511 | 10 |
| 4. Measles – 1 | 5.6 | 28.3 | -1.45 | 0.163 | 0.082* | 0.918 | 10 |
| 5. Vitamin A Dose (any dose) | 6.0 | 1.0 | 0.87 | 0.419 | 0.791 | 0.209 | 4 |
| Other types of visits | | | | | | | |
| 4. All visits | 2031.9 | 2323.5 | -0.27 | 0.787 | 0.394 | 0.606 | 16 |
| 5. Adult Outpatient Visit | 1811.6 | 2147.5 | -0.29 | 0.773 | 0.386 | 0.614 | 14 |
| * p < 0.10 ** p < 0.05 *** p < 0.01, † Lower-tailed test: mean number of visits $H_1: \mu_{2019} < \mu_{2020}$, †† Upper-tailed test: mean number of visits $H_1: \mu_{2019} > \mu_{2020}$ | | | | | | | |

Supplementary Table 3. Themes (authors interpretation) and illustrative quotes of key informants on factors enabling community facility visits during COVID-19.

| Themes | Illustrative Quotes |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| COVID-19 perception | |
| People are in doubt about COVID-19 | ➤ I do not believe it exists, especially in our area. It might be real / exist in other areas/countries. They just suspect and take everyone into an isolation/quarantine center, but they are healthy and free of any signs and symptoms.... (W) |

| | |
|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>existence in the area.</p> | <ul style="list-style-type: none"> ➤ I have never seen anyone with such a real problem in our area. We have heard about it on radio and TV, so I found it difficult to believe and I do not believe it is real (W). ➤ There are huge gaps, misconceptions, and challenges in practical preventive practices. They even perceived that the disease may not be real. Clients recovered from COVID-19 without any sign and symptom disseminated the information to the community and based on that the community misconceived that the virus might not be real from the beginning (HCP). ➤ Right now, the entire community members have no fear or concern about acquiring the disease we are not concerned about client decrement related to COVID-19. Specially after the 5 months state of emergency was lifted things are returned to pre-COVID time, (HCP). |
| <p>No/Low COVID-19 impact perception on daily life</p> | <ul style="list-style-type: none"> ➤ COVID was for outsiders not for us, it was for political issues, the machine for COVID test was false (W). ➤ Has COVID-19 been affecting your life in any way? P: No nothing (W) ➤ I do not think we are at risk because we are not getting out of home most of the time and living in rural areas without any contact (W). |
| <p>Knowledge on transmission methods</p> | <ul style="list-style-type: none"> ➤ Crowding at one place like the market and public transportation(W). ➤ She laughed. "Media expresses it well; we know well it is also an infected person who can transmit it ..." it was not on her tip of tongue she encouraged simply to remember and told me freely "...contact, breathing" (W). ➤ It can be transmitted through air/ breathing, shaking hands, kissing, contact with others and when face masks are not applied properly (W). |
| <p>Facility adaptation</p> | |
| <p>Training provided to HCP</p> | <ul style="list-style-type: none"> ➤ there was continuous and repeated awareness creation on the preventive measures, how they apply it to prevent COVID-19... (HCP) ➤ After the first case of COVID-19 was confirmed in our country, all health care providers including supportive staff were oriented about covid-19 and how to protect themselves and their clients (HCP). ➤ Training was given for all health professionals by trained woreda health professionals, how the health professional can use mask and keeping distance, source of the virus's transition and the like (HCP). |
| <p>PPE use and social distancing</p> | <ul style="list-style-type: none"> ➤ All health workers have applied face masks and sanitizer while providing services (W). ➤ Health professionals kept all PPE materials in place while serving clients (HCP). |

- Health professionals have put on their face masks, enforce clients to wear face masks during facility visits and hand washing soap has also been kept in place for clients (W).
- We had arranged client sitting chairs at all departments to keep their social distance; we had assigned one personnel to educate and to keep their social distance (HCP).
- We were giving care for patients face to face in and in close contact so far, but now we are providing two meters distance (HCP).

Supplementary Table 4. Themes (authors interpretation) and illustrative quotes of key informants on perception of client flow and barriers of community facility visit.

| Themes | Illustrative Quotes |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Perception of client flow | |
| Client flow decreased initially and increased through time | <ul style="list-style-type: none"> ➤ During my ANC visit, I have seen some clients receiving health services. At the beginning of coronavirus some people did not want to receive the services for fear of contracting the disease. So, client flow at that time has decreased (W). ➤ Following of covid-19 positive case detection in the country, somewhat patient flow was decreased HCP). ➤ During COVID-19 time, the patient flow has dramatically decreased at the beginning (HCP). ➤ Right now, the entire community members have no fear or concern about acquiring the disease (HCP). ➤ Becomes the same as pre-COVID-19 time since the state of emergency lifted (HCP). |
| Barriers for service utilization | |
| Fear of acquiring the disease in the facility | <ul style="list-style-type: none"> ➤ You can have this risk at transport and at health facilities during service provision and from other clients/patients. That is the first fear (HCP). ➤ Health professionals subjected to additional COVID-19 related tasks, patient flow decreased due to emerging concerns and fears of contracting the disease (HCP). ➤ I have postponed my follow up at that time for fear of acquiring the disease from health professionals/health centers. The same is true for other clients in our area and some mothers have received their visit in private clinics as we perceived almost all staff were infected (W). ➤ Health workers wear face masks for themselves, but they don't let all clients wear face masks during facility visits (W). |

| | |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Service deprioritized | <ul style="list-style-type: none"> ➤ As much as possible we tried to make faster service provision for their children and give advice for them not come back frequently, they can manage themselves at home if it is easy (HCP) ➤ We also used tele medicine for mild cases, because at the initial phase there was a direction of avoiding hospital visits for cases other than emergency (HCP). ➤ Initially priority was given for patients who have cough but without compromising maternal and child health care services (HCP). |
| Low transportation access | <ul style="list-style-type: none"> ➤ It is also another common reason for all of us to reduce client flow to the facility (W). ➤ Initially mothers were staying at hospital unnecessarily due to absence of transportation/ambulance/ (HCP). ➤ In this area there was no transport restriction, but numbers were reduced to half sit and cost was doubled. It was one of the factors to reduce flow (HCP). ➤ Travel restrictions are also another reason for low client flow which is more pronounced among mothers from far kebeles (HCP). |
| Public panic | <ul style="list-style-type: none"> ➤ At the beginning of covid-19 occurrence, the community panicked and feared acquiring the disease (HCP). ➤ Our basic challenge is fear of the disease. The community heard the severity of the disease in the developed country in the media, but now the problem is solved (HCP). ➤ Nationally the people panicked so there was a tendency of not visiting hospitals (HCP). ➤ The community has been frightened of contracting the disease at the beginning (W). |

BMJ Open

Impact of the COVID-19 Pandemic on Utilization of Facility-Based Essential Maternal and Child Health Services from March to August 2020 Compared to Pre-Pandemic March to August 2019: a Mixed Method Study in North Shewa Zone, Ethiopia

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3 1 **Impact of the COVID-19 Pandemic on Utilization of Facility-Based Essential**
4 2 **Maternal and Child Health Services from March to August 2020 Compared to Pre-**
5 3 **Pandemic March to August 2019: a Mixed Method Study in North Shewa Zone,**
6 4 **Ethiopia**
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1 Abstract

2 **Introduction:** Health systems are often weakened by public health emergencies that make it
3 harder to access health services We aimed to assess MNCH service utilization during the first six
4 months of the COVID-19 pandemic compared to prior to the pandemic.

5 **Methods:** We conducted a mixed study design in eight health facilities that are part of the Birhan
6 field site in Amhara, Ethiopia and compared the trend of service utilization in the first six months
7 of COVID-19 to the corresponding time and data points of the preceding year.

8 **Result:** New family planning visits (43.2 to 28.5/month, $P = 0.014$) and sick under five child visits
9 (225.0 to 139.8/month, $P = .007$) declined over the first six months of the pandemic compared to
10 the same period in the preceding year. Antenatal (208.9 to 181.7/month, $P = 0.433$) and postnatal
11 care (26.6 to 19.8/month, $P = 0.155$) visits, facility delivery rates (90.7 to 84.2/month, $P = 0.776$),
12 family planning (313.3 to 273.4/month, $P = 0.415$) declined although this did not reach statistical
13 significance. Routine immunization (37.0 to 36.8/month, $P = 0.982$) visits for children were
14 maintained. Interviews with health care providers and clients highlighted several barriers to
15 service utilization during COVID-19, including fear of disease transmission, economic hardship,
16 and transport service disruptions and restrictions. Enablers of service utilization included
17 communities' decreased fear of COVID-19, and awareness-raising activities.

18 **Conclusion:** We observed a decline in essential MNCH services particularly in sick children
19 and new family planning visits. To improve the resiliency of fragile health systems resources are
20 needed to continuously monitor service utilization and clients' evolving concerns during public
21 health emergencies.

22 Strengths and limitations of this study

23 Strengths of the study:

- 24 • We presented data on service utilization during the early months of the pandemic in a
25 rural, agrarian region in Ethiopia.
- 26 • The mixed-methods approach integrated both quantitative service utilization coverage and
27 exploratory qualitative interviews to understand our findings and the reasons for changes
28 in service utilization.

29 Limitation of the study:

- 30 • We focused on the coverage of service utilization as the primary outcome rather than
31 mortality or morbidity rates.
- 32 • We do not have detailed data on service provision (e.g., which services were restricted
33 and for how long, in what manner).
- 34 • Since we collected the qualitative data three months past the initial six months of the
35 pandemic (March to August 2020), there may be recall bias.

1 INTRODUCTION

2 The World Health Organization (WHO) declared coronavirus disease-2019 (COVID-19) a global
3 pandemic on 11 March 2020¹ and Ethiopia registered its first case of COVID-19 on 13 March
4 2020. Ethiopia has reported relatively low numbers of COVID-19 cases and COVID-related
5 deaths, with 63,367 confirmed cases and 974 deaths in a population of 119 million, as of 10
6 September 2020.² The majority of reported cases were from the capital city, Addis Ababa, and
7 only 365 confirmed cases and 8 deaths were registered by 30 August 2020 in the North Shewa
8 Zone (the 3rd administration unit of the country) where the study was conducted.

9 Multiple preventive measures focused on social distancing and wearing masks were undertaken
10 in Ethiopia.³ Some health facilities were assigned as COVID-19 isolation and quarantine centers,
11 and many health facilities suspended elective surgeries and select outpatient services. This
12 increasing burden of managing COVID-19 on health facilities and health care providers left the
13 health system overstretched, challenging its ability to operate effectively. As shown during the
14 2014-2015 Ebola outbreak in West Africa, when health systems are overwhelmed by outbreaks,
15 mortality from vaccine-preventable and other treatable diseases can increase dramatically.^{4,5}

16 Well-organized and equipped health systems can continue to provide equitable access to
17 essential services through an emergency⁶, but fragile health systems in developing countries face
18 organizational and resource constraints when confronted with emergencies such as pandemics.
19 The WHO advises nations to identify and prioritize MNCH essential services like routine
20 vaccination, reproductive health services, childbirth, and care of young infants and older adults in
21 their efforts to maintain continuity of service delivery and make strategic shifts to ensure limited
22 resources provide maximum benefit for the population.⁷ However, the disruption of services and
23 diversion of resources away from essential sexual and reproductive health care due to the
24 prioritization of the COVID-19 response are expected to increase the risks of maternal and child
25 morbidity and mortality.⁸

26 A lockdown or stay-at-home policy was largely not in place in Ethiopia where the study was
27 conducted, and health facilities were open during the study period from March to August 2020.
28 The Ministry of Health (MOH) of Ethiopia focused on preventive measures and control of the
29 pandemic. Possible shifts of the health workforce and the health system toward the COVID-19
30 response may have contributed to low utilization of routine services. For example, “half sit”
31 policies (29 March 2020) decreased maximum occupancy on public transit by half and increased
32 the cost of transportation when traveling within the region, while transportation between regions
33 was paused completely. Additionally, school closures (March 2020), the declaration of a state of
34 emergency (08 April 2020), awareness campaigns about the pandemic, and case reports, both
35 suspected and confirmed, may have contributed to the fear of exposure to COVID-19, especially
36 for patients visiting health facilities.

37 To understand these effects COVID-19 pandemic in Ethiopia, the HaSET Maternal and Child
38 Health Research Program assessed trends in MNCH care utilization from March 2019 to August
39 2020 as well as health care providers’ and clients’ perceptions of the barriers to and enablers of
40 service provision and utilization during the COVID-19 emergency. This study has paramount

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3 1 importance in filling the evidence gap on MNCH service utilization during COVID-19, both in the
4 2 Ethiopian context and other low- and middle-income countries, to prevent significant damage to
5 3 the gains achieved in such areas over the past several decades.
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8 4 **METHODS**

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10 5 We conducted the study in eight health facilities in the Birhan North Shewa Zone, Amhara Region,
11 6 Ethiopia. The field site was established in June 2018. The Birhan field site is a community-based
12 7 continuous follow-up study of health and demographic conditions that provide up-to-date
13 8 information on the catchment population and establish a population frame to nest studies. We
14 9 selected all catchment health facilities for this study, including five health centers, two primary
15 10 hospitals (one public and one private), and one referral hospital. These facilities provide essential
16 11 MNCH services for both the rural majority population and urban population within the field site
17 12 catchment and non-catchment areas.
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21 13 The health centers provide ANC, PNC, delivery, abortion, routine immunization (RI), integrated
22 14 management of neonatal and childhood illness (IMNCI), and FP. Each health center also has a
23 15 minimum of five service extension health posts, mainly for FP and RI in each kebele (the lowest
24 16 administration unit in Ethiopia), and each health post sends monthly activity reports to health
25 17 centers. Two public hospitals (one primary and one referral) and one private general hospital also
26 18 provide the fore mentioned essential MNCH services, except for RI, which is given mainly in health
27 19 centers and catchment health posts.
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31 20 Mixed phenomenological qualitative and facility-based cross-sectional study designs were
32 21 employed. For the quantitative part of the study, a facility-based cross-sectional survey was
33 22 conducted to assess the impact of COVID-19 on essential MNCH service provision or utilization
34 23 and provider-side barriers to service provision and utilization in the Birhan field site catchment
35 24 health facilities. We interviewed 91 MNCH healthcare providers (doctors, nurses, midwives, and
36 25 clinical officers available at the time of data collection) with uniformly structured questionnaires
37 26 about their perception of client flow and possible barriers for respective sections. Twelve out of
38 27 91 healthcare providers were working in two MNCH departments and were interviewed twice. In
39 28 addition to this, we extracted retrospective, healthcare utilization time-series data from each
40 29 facility using monthly facility reports and medical registers. Retrospective facilities service
41 30 statistics were collected over an 18-month period from March 2019 to August 2020 using
42 31 Computer Assisted Field Editing (CAFE). We extracted data from the uniformly structured
43 32 questionnaires, entered it into the Open Data Kit (ODK), and collected and uploaded the data to
44 33 the ODK aggregate. The monthly facility reports, and medical registers data were collected
45 34 separately. The health centers' monthly reports include services given in the health posts that are
46 35 extension sites for the health center, but the facility registers are exclusively for services given in
47 36 the health centers.
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52 37 In addition to the cross-sectional study, we implemented a phenomenological qualitative design
53 38 utilizing in-depth interviews to assess client and provider side barriers and enablers to service
54 39 provision/utilization in the Birhan field site catchment health facilities. We sampled and conducted
55 40 in-depth interviews until we reached theoretical saturation. For this section of the study, we
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1 interviewed ten facility or department heads, and nine mothers (delivered at home or facility, had
2 ANC, or missed ANC follow-up). An interview guide with open-ended questions was translated
3 from English to Amharic and was used to elicit the qualitative information from informants. We
4 conducted in-person interviews with facility or department heads and women who visited facilities
5 during COVID-19, and women who delivered at the facilities and phone interviews with women
6 who missed an ANC follow-up or delivered at home. With the permission of the respondents, we
7 recorded all interviews and transcribed all records into English for further analysis. To ensure the
8 safety of the data collectors and participants, data collectors wore masks and practiced physical
9 distancing during training and data collection from 2–20 November 2020.

10 The extracted data was exported to Stata 17.0 for analysis and the average MNCH services
11 utilization was calculated each month to quantify the changes pre-COVID-19 (March to August
12 2019) and during the COVID-19 (March to August 2020) pandemic. To control for potential
13 seasonal fluctuations in service utilization, March to August 2019 and March to August 2020 were
14 considered pre-COVID-19 and COVID-19 periods, respectively. Across all health facilities, we
15 had 48 paired months of observations (6 months for each of 8 facilities) for all essential MNCH
16 variables except for RI, which was only administered at the five health centers (and corresponding
17 extension health posts), resulting in 30 paired months. Errors were found in some cases where
18 medical records were misplaced and data for some months were missing or partially filled. To
19 avoid the effect of missing and partially filled values, analogous months' data from the same
20 facility were excluded from the data analysis. Finally, we compared visits for each MNCH service
21 in the pre-COVID-19 and COVID-19 period using a two-tailed independent sample t-test. We
22 repeated the analysis for the initial two months (March to April 2020) of the pandemic and the
23 analogous period (March to April 2019) to examine changes in service utilization at the onset of
24 the COVID-19 pandemic. We used a significance level of $\alpha = 0.05$ for all statistical tests.

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26 In addition to the quantitative metrics listed above, English language transcript data was entered
27 in Dedoose software for qualitative data analysis. After familiarization with the data, the content
28 of the data was coded line by line for thematic analysis following a framework theory approach to
29 describe and interpret health providers' and communities' perceptions of barriers and enablers to
30 MNCH service provision. The framework approach involves using some pre-assigned themes to
31 initially categorize data while also adjusting and iterating the coding scheme to accommodate
32 newly emergent themes, sub-themes, and categories through inductive interpretation.⁹ Coded
33 data were examined for potential relationships and themes were also assessed across relevant
34 participant demographic categories to understand different user perspectives. Findings were
35 described under pre-assigned and newly emerged themes.

36 **Ethic Statement**

37 This study involved human participants and the protocol was approved by the Institutional Review
38 Board (IRB) of Saint Paul's Hospital Millennium Medical College (SPHMMC) (PM23/104) and the
39 Harvard T.H. Chan School of Public Health (HSPH) (IRB20-1574). We obtained permission from
40 all individual health facilities and individual verbal consent from interview respondents.

1 Patient and Public Involvement

2 As in-person meetings were restricted by local authorities during protocol development and data
3 collection due to COVID-19 pandemic, we were not permitted to involve clients or the public in
4 study design or reporting and dissemination plans of our research.

5 RESULTS

6 We extracted data from three hospitals and five health centers (includes 34 service expansion
7 health posts in the community). Maternal health facility visits for ANC, PNC, facility delivery, and
8 abortion-related services decreased in the time of COVID; however, we do not see a statistically
9 significant change. The FP services utilization in the health centers and hospitals declined from
10 105.5 to 66.5 visits per month ($P = 0.051$) after the onset of the pandemic. Repeat FP visits
11 significantly declined ($P = 0.046$) while new FP visits did not change. When combining health
12 facilities with community health post data¹⁰ the new FP visits declined significantly from 43.2 visits
13 per month to 28.5 visits per month ($P = 0.029$) and there was no significant change in repeat FP
14 visits.

15 Declines in service utilization were also observed for Integrated Management of Neonatal and
16 Childhood Illness (IMNCI), or sick child visits, defined as a facility visit for a sick child under five
17 years old. The mean number of IMNCI visits for sick children under 5 years old declined from
18 225.0 visits per month in 2019 to 139.8 visits per month in 2020 ($P = 0.014$). This significant
19 decline persists for two age stratifications of IMNCI visits (2 months to under 2 years, and 2 years
20 to under 5 years). However, there was no significant change (37.0 to 36.8/month, $P = 0.982$) in
21 child visits for routine immunizations, including BCG, OPV-0, pentavalent (DPT-HepB-HIP) and
22 measles vaccinations (**Table 1**). Similar results were found comparing essential MNCH service
23 over two months during COVID and the analogous pre-COVID two-month period (**Supp Table 1**)

24 Ninety-one healthcare providers working in maternal, newborn, and child health services were
25 asked about the client flow during COVID-19. Sixty-seven percent of the health care providers
26 (HCPs) perceived that client flow decreased and 31% of them believed client flow did not change
27 (**Supp Table 2**). Qualitative interviews also supported the observed decrease in client flow, with
28 descriptions of sharper contractions in service utilization in the first couple of months after the
29 onset of the pandemic but resumed to approximately normal levels over subsequent months. In
30 exploring the perception of lower service utilization during the initial couple of months of COVID-
31 19 by clients of the health system and HCPs, a study in southwest Ethiopia compares the initial
32 two months of the COVID-19 pandemic (March to April 2020) to analogous pre-COVID-19 months
33 (March to April 2019).

34 Barriers to service provision and utilization during COVID-19

35 Even though essential MNCH service utilization was largely maintained, clients' fear of acquiring
36 the disease from the facility, travel restrictions, increased transportation costs due to the half-seat
37 order by the government, and fear of acquiring the disease on the way to the health facility were
38 the main barriers for service utilization perceived by healthcare providers (**Table 2**).

39 Fear of contracting the disease and lack of access to transportation were the most described
40 barriers (**Supp Table 3**). Particularly during the first few months after the onset of COVID-19 in

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3 1 Ethiopia and the imposition of travel restrictions and other public health measures, heightened
4 2 community fear of acquiring the disease and high levels of public panic were barriers to facility-
5 3 based service utilization. Community members were afraid of contracting the disease in crowded
6 4 spaces, on public transportation routes to facilities, and at facilities from health care workers or
7 5 other patients, especially as confirmed COVID-19 cases were reported at facilities, causing further
8 6 delay of care-seeking. One client said *“I have postponed my follow up at that time for fear of*
9 7 *acquiring the disease from health professionals and health centers. The same is true for other*
10 8 *clients in our area, and some mothers have received their visit in private clinics as we perceived*
11 9 *almost all staff were infected”*.
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16 11 The economic hardship and half-seat transportation restrictions during COVID-19 prevented
17 12 some clients from being able to pay for transportation. Clients described lacking money to
18 13 purchase PPE and one HCP noted that the closed market movement affected people’s incomes,
19 14 as reflected by patients delaying treatment until conditions were more severe or defaulting on
20 15 treatment.

21 16 Lastly, multiple clients described that they might be forcibly quarantined or presumed COVID-19-
22 17 positive if they were to visit facilities, and this fear also deterred facility visits. HCPs described
23 18 many challenges related to the under-preparedness of the health system to manage suspected
24 19 cases of COVID-19. Often these challenges manifested through physical infrastructure
25 20 constraints and a shortage of guidelines for managing quarantine and isolation centers for
26 21 suspected COVID-19 cases.
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30 22 31 23 **Enablers of service provision and utilization during COVID-19**

32 24 In terms of knowledge of COVID-19, all women had heard about the disease, but a few were in
33 25 doubt about the existence of COVID-19 in the area, which might be an enabling factor for facility-
34 26 based service utilization. A client respondent said, *“I do not believe it exists, especially in our area.*
35 27 *It might be real / exist in other areas/countries. Healthcare providers just suspect and take*
36 28 *everyone into an isolation/quarantine center, even though they are healthy and free of any signs*
37 29 *and symptoms...”*. Some described that COVID-19 could not affect them because God and/or
38 30 Mary will protect them, citing the importance of prayer as a protective measure.
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42 32 Facility adaptations, including training for healthcare providers, hand washing facilities, physical
43 33 distancing and awareness creation, and health education given by local authorities, increased
44 34 client awareness of COVID-19 prevention and facility-based service utilization amid the pandemic
45 35 over time (**Supp Table 4**).
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47 37 **Understanding Service Utilization Trends during COVID-19**

48 38 The barriers and enablers highlighted in the interviews interact with each other dynamically, as
49 39 depicted below. Some barriers were more substantial than others, particularly fear of the disease,
50 40 transportation access, and economic-related barriers, while certain pull factors encouraged facility
51 41 visits, particularly over time as fear subsided, community awareness measures were undertaken,
52 42 and facilities implemented adaptations to manage both COVID-19 and routine services (**Figure**
53 43 **01**).
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1 DISCUSSION

2 We examined the impact of the COVID-19 pandemic on essential MNCH service utilization by
3 analyzing data from health facility records and healthcare providers' and patients' perspectives.
4 In the context of already poor health outcomes, significant reductions in service utilization for
5 maternal and child health may have substantial adverse impacts. Essential MNCH services such
6 as family planning initiation and sick visits for under five years old significantly declined during the
7 COVID-19 pandemic. For maternal health, FP, ANC, PNC, facility delivery, and abortion services
8 utilization decreased, but the change was not significant during the initial six months of the
9 pandemic likely because of a small sample size.

10 A modeling study of essential maternal and child health interventions across 118 low- and middle-
11 income countries over a six-month period estimated a reduction of services by 9.8–18.5% and
12 39.3–51.9% in the least and most severe scenarios, respectively,¹¹ due to the COVID-19
13 pandemic and in China, health service utilization declined significantly after the outbreak and all
14 indicators rebounded beginning in March 2020, but most had not recovered to their pre-COVID-
15 19 levels by June 2020.¹² Other studies from African countries have reported a 37% overall
16 healthcare utilization and 42% of visit reduction¹³ and impacts on ANC, PNC, and facility
17 delivery.^{14,15,16,17} In Addis Ababa, COVID-19 confirmed cases and public panic were higher than
18 in other areas of Ethiopia and women and children's facility-based services utilization declined.¹⁸
19 Similarly, a significant reduction of essential MNCH service utilization was observed from March
20 to June 2020 in southwest Ethiopia.¹⁹ In contrast, FP, institutional delivery, RI, and ANC did not
21 vary significantly between pre-COVID-19 and during COVID-19 in the Amhara region, Ethiopia²⁰
22 and in Kenya.²¹ Similarly, in our study maternal facility-based healthcare provision was not
23 significantly affected. These findings may be due to the government response to COVID-19,
24 including absence of a stay at home/lockdown policy, relatively low numbers of confirmed cases
25 and death, and facilities open for MNCH services throughout the study period.

26 Globally, contraception services were shut down or not accessible²² and service provision
27 declined.^{23,24} In Addis Ababa, FP service utilization declined for new users and repeat users.¹⁸
28 In our study health center and hospital-based family planning service utilization decreased (105.5
29 to 66.5/month, $P = 0.051$), but this may have been balanced by services provided by health
30 extension workers at health posts in villages which when combined shows that repeat FP service
31 utilization was maintained (313.3 to 273.4/month, $P = 0.415$). New FP initiation w significantly
32 declined (43.2 to 28.5/month, $P = 0.029$). These results suggest that utilization of family planning
33 services is more likely to occur in uncrowded service delivery locations that are nearby without
34 requiring extensive travel.

35 For child health, the number of IMNCI visits, or sick child visits, significantly declined by 38%
36 (225.0 to 139.8/month, $P = 0.014$). Similarly, child health services declined by 33% in three sub-
37 Saharan African countries including Ethiopia due to COVID-19.²⁴ It is possible that the decrease
38 in child sick visits was related to COVID-19 prevention and control activities. The leading causes
39 of under five-year-old children morbidity in Ethiopia,²⁵ including acute respiratory illness, fever,
40 and diarrhea, may have decreased due to school closures (older siblings less exposed), limited
41 interactions with peers in the community, spending more time indoors, mask-wearing at

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3 1 community gatherings, hand washing, physical distancing, and other personal protective
4 2 equipment and practices. Despite a marked reduction in supply chain distribution of vaccines in
5 3 Ethiopia during COVID-19,²⁶ we found that RI remained stable during the initial six months of the
6 4 pandemic, which was different from the findings in Colombia, India, and Brazil where RI declined
7 5 during the pandemic.²⁷⁻²⁹ The MOH of Ethiopia prioritized RI, especially measles, during COVID-
8 6 19. Existing health extension workers stationed at health posts for community-based services,
9 7 offering hygiene and sanitation services, FP, and RI, may have sustained accessibility to these
10 8 services during COVID-19 as they have close relationships with clients and health posts and are
11 9 often not crowded.

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15 10 At the time of data collection, early in the pandemic, respondents mainly described not feeling
16 11 many tangible impacts of COVID-19 on their daily lives, so they conducted daily living activities
17 12 as usual. This easing fear of COVID-19 may have enabled women to feel that they could safely
18 13 attend services, but it also has important implications as the pandemic continues, particularly as
19 14 cases in Ethiopia have risen substantially. Awareness and education campaigns are needed to
20 15 encourage behavior change. Moreover, communities' belief that God may protect them from
21 16 infection indicates the important role of engaging religious leaders as champions in behavior
22 17 change campaigns. An additional key recommendation is systematically addressing
23 18 misinformation and doubt to increase population compliance with preventive measures,
24 19 particularly as Ethiopia faces a rising caseload, increasing prevalence of variants, and a stalled
25 20 vaccine rollout that may take months or years to reach substantial population coverage. Less than
26 21 8.4% of the population has received at least one dose of the COVID-19 vaccine as of 19 February
27 22 2022.³⁰

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32 23 Barriers to maternal facility visits included women not wanting to bother anyone, lack of support
33 24 from healthcare workers, the influence of the media,³¹ lockdowns, fear of contracting the
34 25 disease,³² shift of focus towards pandemic, resource constraints¹⁴ and non-conducive working
35 26 environments for healthcare providers.³³ In addition, women experienced fears of contracting the
36 27 disease, economic hardship, and lack of access to transportation. Particularly during the first few
37 28 months after the onset of COVID-19 in Ethiopia, there was an imposition of travel restrictions and
38 29 other public health measures like a state of emergency, and high levels of public panic. Facilities
39 30 restricted some MNCH services at the beginning of the pandemic. Multiple clients described
40 31 fearing that they might be forcibly quarantined or presumed COVID-19-positive if they were to
41 32 visit facilities; this fear deterred facility visits. While we found that sick child visits and new family
42 33 planning services were most affected by the pandemic, despite the presence of those barriers, the
43 34 declines among other essential services were not as significant. Health system resilience and
44 35 adaptations to maintain provision of services was demonstrated through prioritization of key
45 36 interventions such as immunization and reliance on community sources of service provision such
46 37 as health posts for family planning to maintain the health system.

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51 38 **Strengths of the study:** We present primary data on service utilization during the early months
52 39 of the pandemic in an area of Ethiopia, one of its agrarian regions, which is generalizable to 80%
53 40 of the country's rural population.³⁴ We leveraged an existing research network, the HaSET MNCH
54 41 Research Program (www.hasetmch.org) and our existing Birhan field site.³⁵ The mixed-methods
55 42 approach integrated quantitative service utilization coverage data with sociocultural, contextual,
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1 and exploratory qualitative interviews to understand trends in service utilization. The study
2 highlights success stories in community-based care and government leadership for key services
3 like routine immunization that may benefit other settings.

4 **Limitations of the study:** Our study focused on service utilization and may not have been
5 powered to detect significant differences. We do not have detailed data on service provision.
6 Recall bias was a potential limitation since qualitative data were collected three months after the
7 study period (March to August 2020).

8 **CONCLUSION**

9 The utilization of essential MNCH services is crucial to achieving favorable health outcomes. In
10 developing countries like Ethiopia, health systems are often too fragile to withstand the direct
11 increase in the volume of patients and the indirect health consequences of a pandemic. Our study
12 presents early findings on a decline in the utilization of MNCH services especially in new family
13 planning services and sick child visits. Further study is needed to assess the effect of the
14 pandemic on morbidity and mortality among women and children. To sustain health service
15 utilization during challenging times such as the pandemic, resources are required by government
16 leaders, policymakers, and clinicians to improve the resilience of their health system to monitor
17 service utilization while at the same time engaging with providers and clients to understand and
18 address their evolving concerns about MNCH service uptake.

19 **ABBREVIATIONS**

20 CAFÉ: Computer Assisted Field Editing, COVID-19: Coronavirus Disease - 2019, DPT: Diphtheria
21 Pertussis and Tetanus, EOC: Emergency Operation center, EPHI: Ethiopian Public Health
22 Institute, FP: Family Planning, HC: Health Center, HCP: Healthcare provider, HepB: Hepatitis B,
23 HIP: Haemophilus influenza, HIV/AIDS: Human Immunodeficiency Virus/ Acquired Immune
24 Deficiency Syndrome, HP: Health post, HSPH: Harvard School of Public Health, Integrated
25 Management of Neonatal and Childhood Illness (IMNCI), IRB: Institutional Review Board, MCH:
26 Maternal and Child Health, MNCH: Maternal, Newborn and Child Health, MOH: Ministry of Health,
27 ODK: Open Data Kit, PNC: Postnatal care, RI: Routine immunization, RMNCH: Reproductive,
28 Maternal, Newborn and Children Health, SPHMMC: Saint Paul Hospital Millennium Medical
29 College,, WHO: World Health Organization.

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34 **CONTRIBUTORSHIP**

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36 analysis, interpretation, write up and submission process.
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25 **AVAILABILITY OF DATA AND MATERIALS**

26 The datasets used and/or analyzed during the current study are available from the corresponding
27 author on reasonable request.

28 **COMPETING INTERESTS**

29 The authors declare that they have no competing interests.

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Tables

Table 1. Comparing essential MNCH service utilization over six months between COVID-19 (Mar-Aug 2020) and analogous pre-COVID-19 (Mar-Aug 2019) periods.

| Visit Type | Mean number of visits/month over six months | t-statistic | p-value | Lower p-value | Upper p-value | Paired obser |
|------------|---------------------------------------------|-------------|---------|---------------|---------------|--------------|
| | | | | | | |

| | 2019 | 2020 | | | † | †† | ations |
|----------------------------------------------------------------------|--------------|--------------|-------------|--------------|--------------|---------------------|--------------|
| I. Maternal visit | 376.3 | 321.2 | 1.11 | 0.270 | 0.865 | 0.135 | 48/48 |
| 1. Antenatal care | 208.9 | 181.7 | 0.79 | 0.433 | 0.784 | 0.216 | 40/48 |
| 2. Postnatal care | 26.6 | 19.8 | 1.44 | 0.155 | 0.922 | 0.078* | 30/48 |
| 3. Facility delivery | 90.7 | 84.2 | 0.29 | 0.776 | 0.612 | 0.388 | 41/48 |
| 4. Abortion-related services | 11.8 | 9.8 | 0.56 | 0.578 | 0.711 | 0.289 | 34/48 |
| 5. Overall FP services in health posts, health centers and hospitals | 313.3 | 273.4 | 0.82 | 0.415 | 0.792 | 0.207 | 47/48 |
| 5.1 New FP services | 43.2 | 28.5 | 1.22 | 0.029 | 0.986 | 0.014** | 47/48 |
| 5.2 Repeat FP services | 270.2 | 244.9 | 0.57 | 0.567 | 0.716 | 0.284 | 47/48 |
| 6. FP services in health centers and hospitals | 105.5 | 66.5 | 1.99 | 0.051 | 0.974 | 0.026** | 33/48 |
| 6.1 New FP services | 8.9 | 7.1 | 0.84 | 0.406 | 0.797 | 0.203 | 33/48 |
| 6.2 Repeat FP services | 96.5 | 59.3 | 1.03 | 0.046 | 0.977 | 0.023** | 33/48 |
| 6.3 Unclassified FP services | 17.7 | 1.3 | 1.12 | 0.039 | 0.981 | 0.019** | 26/48 |
| II. Sick child visit (0-5years)) | 225.0 | 139.8 | 1.51 | 0.014 | 0.993 | 0.007** * | 46/48 |
| 1. MNCI Visit (< 2 months) | 10.8 | 7.7 | 0.82 | 0.412 | 0.794 | 0.206 | 46/48 |
| 2. IMNCI Visit (2 months – 2 year) | 101.6 | 50.4 | 1.68 | 0.009 | 0.996 | 0.004*** | 46/48 |
| 3. IMNCI Visit (2 year – 5 year) | 111.6 | 81.8 | 1.15 | 0.034 | 0.983 | 0.017** | 46/48 |
| III. Routine Immunization visit | 37.0 | 36.8 | 0.02 | 0.982 | 0.509 | 0.491 | 23/30 |
| 1. BCG Vaccine | 31.4 | 36.5 | -0.39 | 0.701 | 0.350 | 0.650 | 30/30 |
| 2. Oral Polio (0) Vaccine | 3.2 | 1.0 | 0.88 | 0.384 | 0.808 | 0.192 | 23/30 |

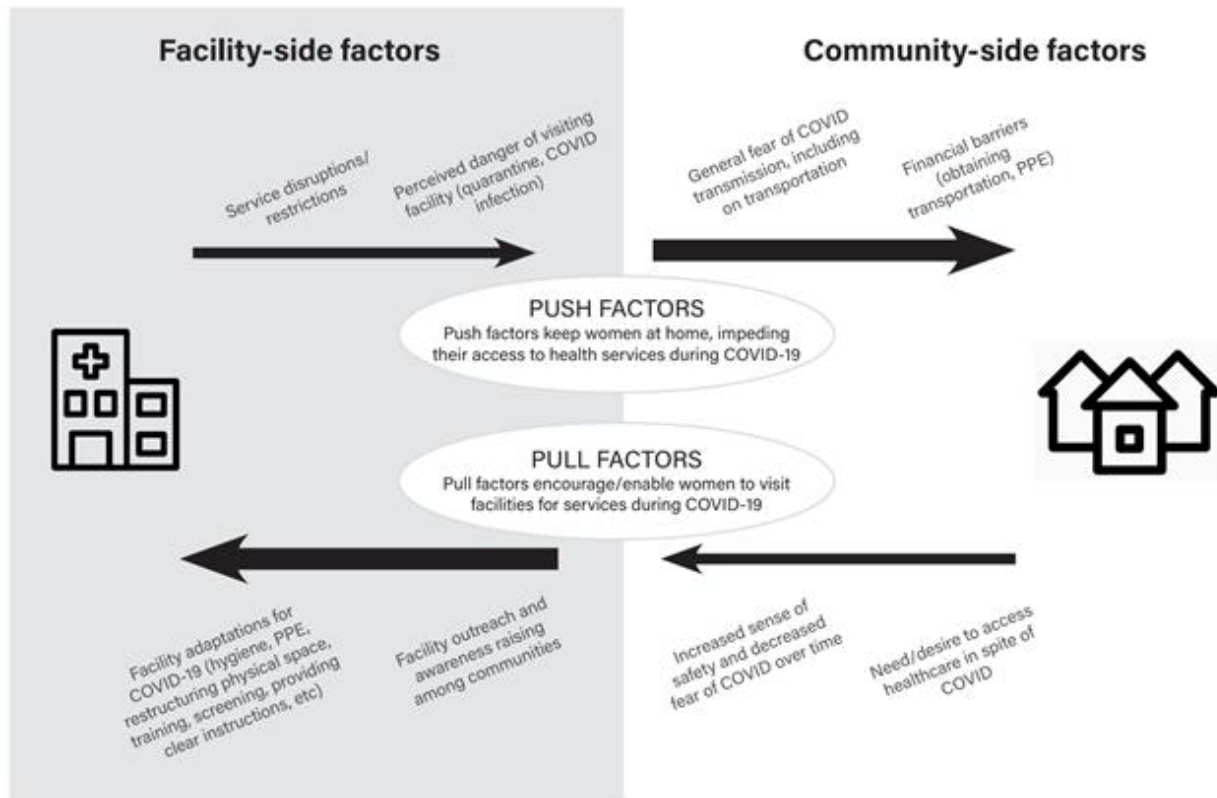
| | | | | | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|-------|-------|-------|-------|-------|
| 3. Pentavalent (DPT-HepB-HIP) (all types) | 100.4 | 101.5 | -0.05 | 0.958 | 0.479 | 0.521 | 30/30 |
| 4. Measles – 1 | 10.3 | 27.5 | -1.99 | 0.051 | 0.026 | 0.974 | 30/30 |
| 5. Vitamin A Dose | 8.6 | 5.7 | 0.67 | 0.506 | 0.747 | 0.253 | 14/30 |
| Other types of visits | | | | | | | |
| All visits | 2568.9 | 2606.7 | -0.05 | 0.956 | 0.478 | 0.522 | 48/48 |
| Adult Outpatient Visit | 2121.2 | 2239.7 | -0.17 | 0.868 | 0.434 | 0.566 | 44/48 |
| * p < 0.10 ** p < 0.05 *** p < 0.01, † Lower-tailed test: mean number of visits H ₁ : μ ₂₀₁₉ < μ ₂₀₂₀ , †† Upper-tailed test: mean number of visits H ₁ : μ ₂₀₁₉ > μ ₂₀₂₀ | | | | | | | |

1 **Table 2.** Possible barriers to service utilization in the time of COVID-19 based on healthcare
2 providers' perception.

| Possible barriers to service utilization in the time of COVID-19 | Count | % |
|-------------------------------------------------------------------------------------------------|------------|----|
| 1. Fear of acquiring the diseases from the facility | 97 | 94 |
| 2. Travel restrictions | 90 | 87 |
| 3. Increased transportation cost (due to half sit order by the government) | 89 | 86 |
| 4. Fear of acquiring the disease on the way to the health facility | 86 | 83 |
| 5. Lack of transport to the HP/HC site | 72 | 70 |
| 6. Lack of PPE for clients | 67 | 65 |
| 7. Clients' perception of limited implementation of protective measures by healthcare providers | 58 | 56 |
| 8. Healthcare providers advice to stay at home | 54 | 52 |
| 9. Limited-service hours or absence of health care workers | 17 | 17 |
| 10. Unavailability of ambulance | 7 | 7 |
| 11. Unavailability of healthcare providers in facilities to provide outreach services. | 7 | 7 |
| Total interviews | 103 | |

Note: Twelve healthcare providers were working in different departments and asked twice.

Figure 1: Enabling (pull) factors and barriers (push factors) for service utilization highlighted in the qualitative interviews.



ew only

Supplementary Tables

Supplementary Table 1. Comparing essential MNCH service utilization over two months between COVID (April- May 2020) and analogous pre-COVID (April-May 2019) periods.

| Visit Type | Mean number of visits/ months over six months | | t-statistic | p-value | Lower p-value | Upper p-value | Number of paired observations |
|----------------------------------------------------------|-----------------------------------------------|-------|-------------|---------|---------------|---------------|-------------------------------|
| | 2019 | 2020 | | | | | |
| I. Maternal visit | 331.3 | 327.3 | 0.05 | 0.959 | 0.520 | 0.480 | 16 |
| 1. Antenatal care | 198.0 | 176.5 | 0.39 | 0.702 | 0.649 | 0.351 | 13 |
| 2. Postnatal care | 17.8 | 20.7 | -0.30 | 0.768 | 0.384 | 0.616 | 9 |
| 3. Facility delivery | 85.6 | 87.0 | -0.04 | 0.970 | 0.485 | 0.515 | 14 |
| 4. FP related services | 84.1 | 95.1 | -0.38 | 0.712 | 0.356 | 0.644 | 10 |
| 5. FP related services (hospitals, HCs and HPs combined) | 289.4 | 227.8 | 0.86 | 0.398 | 0.801 | 0.199 | 16 |
| 6. Abortion-related services | 10.5 | 10.7 | -0.05 | 0.964 | 0.482 | 0.518 | 11 |
| II. Sick child visit (0-5years) | 201.0 | 126.6 | 1.68 | 0.103 | 0.948 | 0.052* | 15 |
| 1. IMCI Visit (< 2 months) | 7.3 | 3.3 | 1.21 | 0.235 | 0.882 | 0.118 | 15 |
| 2. IMNCI Visit (2 months – 2 year) | 105.0 | 77.4 | 1.54 | 0.134 | 0.933 | 0.067* | 15 |
| 3. IMNCI Visit (2 year – 5 year) | 89.7 | 45.9 | 1.43 | 0.164 | 0.918 | 0.082* | 15 |
| III. Routine Immunization visit | 41.0 | 38.1 | 0.16 | 0.875 | 0.563 | 0.437 | 7 |
| 1. BCG Vaccine | 28.0 | 36.9 | -0.40 | 0.695 | 0.347 | 0.653 | 10 |

| | | | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--------|-------|-------|--------|-------|----|
| 2. Oral Polio (0) Vaccine | 3.4 | 1.0 | 0.61 | 0.556 | 0.722 | 0.278 | 7 |
| 3. Pentavalent (DPT-HepB-HIP) (all types) | 100.4 | 101.4 | -0.03 | 0.978 | 0.489 | 0.511 | 10 |
| 4. Measles – 1 | 5.6 | 28.3 | -1.45 | 0.163 | 0.082* | 0.918 | 10 |
| 5. Vitamin A Dose (any dose) | 6.0 | 1.0 | 0.87 | 0.419 | 0.791 | 0.209 | 4 |
| Other types of visits | | | | | | | |
| 4. All visits | 2031.9 | 2323.5 | -0.27 | 0.787 | 0.394 | 0.606 | 16 |
| 5. Adult Outpatient Visit | 1811.6 | 2147.5 | -0.29 | 0.773 | 0.386 | 0.614 | 14 |
| * p < 0.10 ** p < 0.05 *** p < 0.01, † Lower-tailed test: mean number of visits H ₁ : μ ₂₀₁₉ < μ ₂₀₂₀ , †† Upper-tailed test: mean number of visits H ₁ : μ ₂₀₁₉ > μ ₂₀₂₀ | | | | | | | |

Supplementary Table 2: Healthcare providers' perception about MNCH clients flow to the facility in the time of COVID-19.

| Response | Count | Percent |
|------------|-------|---------|
| Increasing | 2 | 2% |
| The same | 28 | 31% |
| Decreasing | 61 | 67% |
| Total | 91 | 100% |

Supplementary Table 3. Themes (authors interpretation) and illustrative quotes of key informants on factors enabling community facility visits during COVID-19.

| Themes | Illustrative Quotes |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| COVID-19 perception | |
| People are in doubt about COVID-19 existence in the area. | ➤ I do not believe it exists, especially in our area. It might be real / exist in other areas/countries. They just suspect and take everyone into an isolation/quarantine center, but they are healthy and free of any signs and symptoms.... (Women) |

| | |
|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | <ul style="list-style-type: none"> ➤ I have never seen anyone with such a real problem in our area. We have heard about it on radio and TV, so I found it difficult to believe and I do not believe it is real (Women). ➤ There are huge gaps, misconceptions, and challenges in practical preventive practices. They even perceived that the disease may not be real. Clients recovered from COVID-19 without any sign and symptom disseminated the information to the community and based on that the community misconceived that the virus might not be real from the beginning (HCP). ➤ Right now, the entire community members have no fear or concern about acquiring the disease we are not concerned about client decrement related to COVID-19. Specially after the 5 months state of emergency was lifted things are returned to pre-COVID time, (HCP). |
| No/Low COVID-19 impact perception on daily life | <ul style="list-style-type: none"> ➤ COVID was for outsiders not for us, it was for political issues, the machine for COVID test was false (Women). ➤ Has COVID-19 been affecting your life in any way? P: No nothing (Women) ➤ I do not think we are at risk because we are not getting out of home most of the time and living in rural areas without any contact (Women). |
| Knowledge on transmission methods | <ul style="list-style-type: none"> ➤ Crowding at one place like the market and public transportation (Women). ➤ She laughed. "Media expresses it well; we know well it is also an infected person who can transmit it ..." it was not on her tip of tongue she encouraged simply to remember and told me freely "...contact, breathing" (Women). ➤ It can be transmitted through air/ breathing, shaking hands, kissing, contact with others and when face masks are not applied properly (Women). |
| Facility adaptation | |
| Training provided to HCP | <ul style="list-style-type: none"> ➤ there was continuous and repeated awareness creation on the preventive measures, how they apply it to prevent COVID-19... (HCP) ➤ After the first case of COVID-19 was confirmed in our country, all health care providers including supportive staff were oriented about covid-19 and how to protect themselves and their clients (HCP). ➤ Training was given for all health professionals by trained woreda health professionals, how the health professional can use mask and keeping distance, source of the virus's transition and the like (HCP). |
| PPE use and social distancing | <ul style="list-style-type: none"> ➤ All health workers have applied face masks and sanitizer while providing services (Women). ➤ Health professionals kept all PPE materials in place while serving clients (HCP). |

- Health professionals have put on their face masks, enforce clients to wear face masks during facility visits and hand washing soap has also been kept in place for clients (Women).
- We had arranged client sitting chairs at all departments to keep their social distance; we had assigned one personnel to educate and to keep their social distance (HCP).
- We were giving care for patients face to face in and in close contact so far, but now we are providing two meters distance (HCP).

Supplementary Table 4. Themes (authors interpretation) and illustrative quotes of key informants on perception of client flow and barriers of community facility visit.

| Themes | Illustrative Quotes |
|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Perception of client flow | |
| Client flow decreased initially and increased through time | <ul style="list-style-type: none"> ➤ During my ANC visit, I have seen some clients receiving health services. At the beginning of coronavirus some people did not want to receive the services for fear of contracting the disease. So, client flow at that time has decreased (Women). ➤ Following of covid-19 positive case detection in the country, somewhat patient flow was decreased HCP). ➤ During COVID-19 time, the patient flow has dramatically decreased at the beginning (HCP). ➤ Right now, the entire community members have no fear or concern about acquiring the disease (HCP). ➤ Becomes the same as pre-COVID-19 time since the state of emergency lifted (HCP). |
| Barriers for service utilization | |
| Fear of acquiring the disease in the facility | <ul style="list-style-type: none"> ➤ You can have this risk at transport and at health facilities during service provision and from other clients/patients. That is the first fear (HCP). ➤ Health professionals subjected to additional COVID-19 related tasks, patient flow decreased due to emerging concerns and fears of contracting the disease (HCP). ➤ I have postponed my follow up at that time for fear of acquiring the disease from health professionals/health centers. The same is true for other clients in our area and some mothers have received their visit in private clinics as we perceived almost all staff were infected (Women). ➤ Health workers wear face masks for themselves, but they don't let all clients wear face masks during facility visits (Women). |

| | |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Service deprioritized | <ul style="list-style-type: none"> ➤ As much as possible we tried to make faster service provision for their children and give advice for them not come back frequently, they can manage themselves at home if it is easy (HCP) ➤ We also used tele medicine for mild cases, because at the initial phase there was a direction of avoiding hospital visits for cases other than emergency (HCP). ➤ Initially priority was given for patients who have cough but without compromising maternal and child health care services (HCP). |
| Low transportation access | <ul style="list-style-type: none"> ➤ It is also another common reason for all of us to reduce client flow to the facility (Women). ➤ Initially mothers were staying at hospital unnecessarily due to absence of transportation/ambulance/ (HCP). ➤ In this area there was no transport restriction, but numbers were reduced to half sit and cost was doubled. It was one of the factors to reduce flow (HCP). ➤ Travel restrictions are also another reason for low client flow which is more pronounced among mothers from far kebeles (HCP). |
| Public panic | <ul style="list-style-type: none"> ➤ At the beginning of covid-19 occurrence, the community panicked and feared acquiring the disease (HCP). ➤ Our basic challenge is fear of the disease. The community heard the severity of the disease in the developed country in the media, but now the problem is solved (HCP). ➤ Nationally the people panicked so there was a tendency of not visiting hospitals (HCP). ➤ The community has been frightened of contracting the disease at the beginning (Women). |