BMJ Open

Impact of COVID-19 on health care service delivery in urban and rural Malawi

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-051125
Article Type:	Original research
Date Submitted by the Author:	20-Mar-2021
Complete List of Authors:	Phiri, Mackwellings; Malawi-Liverpool-Wellcome Trust Clinical Research Programme, MacPherson, Eleanor; Malawi-Liverpool-Wellcome Trust Clinical Research Programme; Liverpool School of Tropical Medicine Panulo, Mindy; Polytechnic, University of Malawi, Department of Enviromental Health and WASHTED centre Chidziwisano, Kondwani; Malawi Polytechnic, Environmental Health; University of Strathclyde, Department of Civil and Environmental Engineering Kalua, Khumbo; Blantyre Institute for Community Outreach Chirambo, Chawanangwa; Blantyre Institute for Community Outreach Kawalazira, Gift; Blantyre District Health Office Gundah, Zaziwe; Blantyre District Health Office Chunda, Penjani; Blantyre District Health Office Morse, Tracy; University of Strathclyde, Civil and Environmental Engineering; WASHTED center, Polytechnic, University of Malawi
Keywords:	COVID-19, Public health < INFECTIOUS DISEASES, QUALITATIVE RESEARCH, PUBLIC HEALTH

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Title: Impact of COVID-19 on health care service delivery in urban and rural Malawi

Mackwellings Phiri[1], Eleanor MacPherson[1,2], Mindy Panulo[3,4], Kondwani Chidziwisano[3,4,5], Khumbo Kalua[6], Chawanangwa Mahebere Chirambo[6], Gift Kawalazira[7], Zuziwe Gundah[7], Penjani Chunda[7], Tracy Morsey[3,4,5]

1. Malawi-Liverpool-Wellcome Trust
2. Liverpool School of Tropical Medicine
3. Department of Environmental Health and WASHTED Centre
4. Polytechnic, University of Malawi, Blantyre, Malawi
5. Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, UK
6. Blantyre Institute for Community Outreach, Blantyre, Malawi
7. Blantyre District Health Office, Blantyre, Malawi

Corresponding author's email address: mackmaganizo@hotmail.com/mmphiri@mlw.mw

Abstract

Objective Across Africa, the impact of COVID-19 continues to be acutely felt. This includes Malawi, where a key component of health service delivery to mitigate against COVID-19 are the primary health care facilities, strategically placed throughout districts to offer primary and maternal health care. These facilities have limited infrastructure and capacity, but are the most accessible and play a crucial role in responding to the COVID-19 pandemic. This study assessed health facility preparedness for COVID-19 and the impact of the pandemic on health service delivery and frontline workers.

Setting Primary and maternal health care in Blantyre District, Malawi.

Participants We conducted monthly visits to 31 health care facilities and a series of telephone-based qualitative interviews with frontline workers (n=52 with 28 participants) between August and October 2020.

Results Despite significant financial and infrastructure constraints health centres continued to remain open, with the majority being trained and having access to key resources for COVID-19 prevention measures. Nevertheless, the number of clients attending key services was seen to reduce. Key barriers to implementing COVID-19 prevention measures observed during health facility visits and through interviews were periodic shortages of resources (soap, hand sanitizer, water, masks, staff), and challenges in managing physical distancing and in handling suspected COVID-19 cases. However, even when available, we observed that access to resources, (e.g. face masks), did not always equate to use, despite the perceived risk reported. Frontline workers felt COVID-19 had negatively impacted their lives. They experienced fatigue and stress due to heavy workloads, stigma in the community, and worries about becoming infected with and transmitting COVID-19.

Conclusion Resource (human and material) inadequacy shaped the health facility capacity for support and response to COVID-19, and frontline workers may require psychosocial support to manage the impacts of the COVID-19 pandemic.

Summary box

Study strengths and limitations

- Using a mixed method approach allowed us to capture data from across the district and gain and an in-depth understanding of the findings.
- In-depth interviews were useful in allowing participants to express their lived realities through their own words.
- Quantitative structured data collection tools enabled real time data to be captured through direct observations at each health care facility.
- Collecting data from health care facility registers was challenging and required efforts to compare registers to centralised health management information records to ensure they were consistent.
- We only interviewed frontline workers, meaning that findings around patient behaviour were filtered through frontline workers perspectives.

Introduction

Since COVID-19 was identified in Wuhan, China in late 2019, this highly infectious respiratory disease has spread across the world causing a complex global health crisis. The devastating impact of the pandemic has been felt both within and beyond the health sector (1). Early research has demonstrated the extreme pressure on health workers to both treat patients with COVID-19, and also to maintain essential services (2). In low-and-middle income contexts, where health systems are often fragile and care-seeking pathways for patients more challenging, the ramifications of the pandemic are being felt in complex ways (3).

In Africa, the health sector has been impacted by critical shortages of health care workers and constrained infrastructure including water, sanitation and hygiene (WASH), a crucial component of ensuring good hygiene and infection control (4). Prior to COVID-19, studies have demonstrated that only half of health facilities in Sub Saharan Africa had basic access to water, and even less to soap or alcohol based hand sanitizer (5–7). This situation is further exacerbated by global shortages in access to Personal Protective Equipment (PPE) increasing the risk to health care workers and patients (8,9). Research has also demonstrated the detrimental effect caring for patients with COVID-19 in combination with an elevated risk of infection is having on health care workers psychosocial well-being across the globe (10,11).

Disruptions to health services have had both a direct and indirect impact on mortality, as care for all patients is affected (12). Recent work from the World Health Organization (WHO) analysed data on attendance for five key essential services (outpatient and inpatient admission, skilled birth attendance, treatment of confirmed malaria cases and provision of the combination pentavalent vaccine) from 14 countries in Africa, and found a reduction of 50% in May, June and July 2020 (13). This work speaks to the importance of capturing the impacts of COVID-19 on health service delivery in a wide range of contexts.

In April 2020, in response to the first cases of COVID-19, the Malawian Government closed international borders, suspended all flights and shut educational institutions. Legal injunctions prevented the implementation of any other restrictions of movement (14). The

first wave (March-September 2020) saw a much lower number of registered cases and deaths than initial models projected (15), reflecting wider trends in Sub-Saharan Africa (16). At the time of writing, registered deaths from the first wave in Malawi stood at 185 with 6,049 recorded cases (17). Preliminary immunology research undertaken with asymptomatic health workers found that 12.3% had antibodies for COVID-19, suggesting a higher rate of cases than was reported in official statistics (18). However, testing capacity was extremely limited meaning that an accurate picture of transmission was challenging.

The Malawian health system is structured around three levels, tertiary (large referral hospitals situated in major urban centres), secondary (district hospital) and primary (health facilities, community and home-based services). Primary health care facilities are central to Malawi's health service and provide a range of services including outpatient department (OPD), family planning (FP), maternal and child health (MCH), expanded programme of immunisation (EPI), tuberculosis (TB) testing and treatment, HIV testing, counselling and treatment, and cancer screening. Changes to service delivery in these facilities is likely to have significant impacts on health outcomes. This study was guided by three research objectives: *(1)* to assess preparedness for the pandemic in health facilities in Blantyre District; *(2)* to understand front-line workers experiences of providing care during COVID-19; and *(3)* to create feedback loops for assessment results to the district health office to help inform COVID-19 action plans.

Methods

Study context

Funding for the health sector is heavily dependent on international donors (20). Health services are provided by government, private and faith-based organisations; government services are the only ones provided without fees and recent estimates suggest they provide approximately 60% of services accessed (21,22). Despite policies being well-designed, key challenges faced in the health sector include chronic underfunding, shortage of staff and fragmentation of services (22). Management and oversight of primary health care facilities is provided by district health offices (23). This study was situated in Blantyre district in the Southern region, which is serviced by 31 government and faith based primary health care

facilities (n=14 urban; n=17 rural). The district has a total population of 1.25 million including Blantyre city (64%), the second largest city in Malawi.

Study Design

To understand the impact of COVID-19 on primary health care provision we used a mixed method approach. Combining qualitative and quantitative research methods allowed us to capture data from across the district and gain a deeper understanding of the findings through qualitative interviews. Quantitative structured data collection tools were selected to enable real time data to be captured through direct observations at each health care facility. Tools focused on the key components of the National COVID-19 Preparedness and Response Plan (24), reporting on preparedness proxies (e.g. hand washing facilities, soap, thermometers), and observed behaviour of frontline workers and clients (e.g. mask wearing, physical distancing). Qualitative interviews were selected because they allow participants to express their lived realities through their own words (25). To reduce the risk of COVID-19 transmission with prolonged contact with participants we conducted qualitative interviews over the telephone.

Data collection

Working in all 31 rural and urban health facilities in Blantyre District, we collected structured data at three time points (August, September and October 2020). Experienced researchers administered a questionnaire with the clinician responsible for managing the health facility or their representative. All quantitative data were collected using a pre-programmed questionnaire on KoboCollect (https://www.kobotoolbox.org). The questions included data on patient management, physical distancing, water, sanitation and hygiene (WASH) provision and practices, the presence and use of personal protective equipment (PPE) and patient attendance at routine health services. The team photographed clinic registers (without any identifying patient data) for OPD, EPI, TB, FP, HIV and cancer screening services; this data was collected from January 2019 to September 2020 to allow for comparison of patient numbers pre-COVID.

Following analysis of each round of data collection, “score cards” were generated for each health facility. The score cards summarised how the health care facilities were implementing COVID-19 preventative measures, including training of frontline staff, stock of WASH materials including location and presence hand washing facilities (with soap and water), stock and use of PPE including face masks at the health care facility, stock and use of thermometers, waste management, and case management. These scorecards were then provided to the District Health Office team through monthly feedback loops, to provide guidance on which health care facilities had managed to adapt their practices, and which facilities required further support.

Following the generation of the scorecards from the first round of quantitative data collection, eight health care facilities were purposively sampled to be included in the qualitative component of the study. In the sample we included both rural (n=4) and urban facilities (n=4). In these health care facilities, we conducted a total of 52 interviews with 28 participants. Interviews were conducted at three time points (August, September and October) to allow us to capture the dynamic nature of the pandemic (Table 1).

The first round selected up to four participants in each health care facility, this allowed us to capture a range of front-line workers including health workers and those employed to support operations at the clinic including grounds staff and cleaners. During the second round due to time and resource constraints we interviewed two participants per healthcare facility. In the third round we included only healthcare facility in-charges, those who manage the clinic (or their representative), this was because the final round of interviews focused more on broader changes to care provision. During the interviews key themes included experiences of COVID-19 preparedness activities including training, changes in work practices exploring both access to and use of key resources, access to psychological support, the impact of working during a pandemic on frontline workers life and well-being, and future changes to health care practice.

Data analysis

Quantitative discrete data was downloaded from KoboCollect (https://www.kobotoolbox.org) as a .csv file, cleaned and analysed using Microsoft Excel

V16 (Microsoft Corporation, Redmond, WA). Continuous data from health records were abstracted from photographs to Microsoft Excel V16 (Microsoft Corporation, Redmond, WA) for comparative analysis between 2019 and 2020 attendance. All data were analysed for Blantyre as a whole, and as a comparison between urban and rural facilities.

For the qualitative data we used thematic content analysis (26). All transcripts were transcribed, initial themes identified, and key gaps included in subsequent rounds of data collection. The study team (drawing together the quantitative and qualitative researchers) held weekly debriefing sessions to allow for discussion of findings from each week's data collection. Any new avenues of inquiry were incorporated into the data collection. Halfway through the study we presented initial findings to the District Health Office to gain feedback and participant checking.

Ethical approval

Ethical approval was granted from the National Health Science Research Committee (#20/06/2534). For the qualitative interviews, the participant information sheet and consent form were shared on WhatsApp before the interview to allow participants to review the information. Before the research began, the information was reviewed again, and oral consent was taken from the participants. No data collected from the clinic, including clinic registers contained patient's personal information.

Patient Involvement

This study was developed in partnership with the Blantyre District Health Office (DHO), specifically the team leading the COVID-19 preparedness and response for primary health care within Blantyre District. Halfway through the project we presented our initial findings to the District Health COVID-19 Task Force during their weekly meetings for direct feedback, incorporating their suggestions into the qualitative data collection.

Results

We present the qualitative and quantitative results concurrently around three themes: (1) implementation of COVID response policies and practices; (2) impacts of COVID on health service provision: and (3) the well-being of frontline workers. Table 2 illustrates a summary of quantitative measures implemented in the healthcare facilities across the three-month

monitoring period. A breakdown of urban versus rural coverage is available as supplementary material (S1) although no significant differences were noted.

Implementation of COVID-19 response policies and practices

While clinics remained open, the implementation of COVID-19 prevention measures were constrained. These constraints related both to existing infrastructure such as a lack of running water, limited space for implementing physical distancing, and provision and use of resources including PPE.

Training of frontline staff

Training of frontline staff was relatively rapid and well supported by the Blantyre DHO team. Over the three-month period there was a steady increase in the number of facilities which had over 90% of frontline staff trained (Month 1: 35%; Month 2: 48%; Month 3: 70%).

WASH

Despite provision of adequate moveable hand washing facilities (HWF) (e.g. buckets with taps), the placement, use and access to HWFs at entrances to the health care facilities (33%) and specific service areas was low (Table 2) with an average of two HWF available per facility during observation visits. The lack of use of HWF was attributed by health workers to lack of human resource to manage and refill these as needed to maintain use by staff and patients. Most concerningly HWF access and use appeared to drop off as the three months progressed (Table 2), in line with the reduced number of positive COVID-19 cases (Figure 1). It was difficult for the health care facilities to channel clients through one entrance to ensure hand washing on arrival, due to the open design of the facility. The location of HWF varied from clinic to clinic, and there was little consistency in the provision and location of HWFs over the three-month period in each facility. The highest concentration of consistent provision (i.e. available all three months) was found at OPD service areas (Month 1: 71%; Month 2: 58.1%; Month 3: 54.8%). Pleasingly, relatively small proportion of HWFs were found with no soap or water available over the three-month period (5.2%; 8.7%; 18.6%). This may be attributed to the fact that 77% of facilities had a tapped water supply within the facility compound, with only 2 having to access water from a borehole in the community outside the facility. Intermittent water cuts severely affected the ability of people in the

facility spaces to implement good handwashing. Staff at one facility reported having no access to potable water, which left them relying on hand sanitiser, a scarce resource (Table 2). In this situation there was insufficient sanitiser to share with patients, which meant patients were unable to wash their hands during visits to the health facilities.

> …we are facing a challenge of water, which is making it difficult for us to wash our hands. We just depend on hand sanitizers. We can't share them with the patients because there isn't enough. **[Health Surveillance Assistant, IDI20]**

Of significant concern, was the low provision of soap at available hand washing facilities throughout the study period, with this reducing to under 15% by October (Table 2); this was attributed to a number of factors including unavailability, theft by clients, and lack of understanding by both health workers and patients of the importance of soap in the reduction of COVID-19 transmission. Clients were more likely to follow social norms in only washing hands with water. In the absence of water and soap, particularly in consultation rooms, it was concerning to note low access to hand sanitiser for frontline workers, as a means of protecting both themselves and clients from transmission between consultations. During health care facility visits, it was noted on a number of occasions that HWFs were only put out for use when the research team arrived for assessment, indicating that there may have been some reflexive bias in observed practices. The team also noted that HWFs were often empty of water at the time of client arrival and were only filled once patients were asked to collect water from communal water points.

Client screening and isolation

Access to and use of thermometers for temperature checks was inconsistent with only 25% of facilities having thermometers available at any given time (Table 2). Indication of fever was established by visual assessment of patients during consultation, and no pre-consultation checks were conducted to isolate potential cases from others in the waiting areas. Sixty-one percent of the health care facilities had reported a suspected COVID-19 case by October 2020, with the main responses being to provide the patient with a mask, isolate where possible, and call the COVID-19 response team for advice and action.

PPE

The provision of PPE to health care facilities, particularly surgical masks, for frontline workers was high (Table 2), although in early visits and interviews healthcare workers reported shortages of PPE such as gloves, aprons and masks. Of the PPE available, a small amount that was initially supplied had passed expiry dates and staff were reluctant to use it. As one medical assistant narrated:

> We didn't have PPEs. The PPEs we were using had expired, so we were forced to move consultations outside. Yes, for example the date of the face masks that we had at the hospital had expired a long time ago **[Medical Assistant, IDI04].**

However, supply improved in the later stages of the data collection, with healthcare workers reporting more stable stock. For example, one Pharmacy Assistant reflected:

> Previously, it was hard to work because we didn't have enough personal protective equipment and as you know we reached a point of starting strikes. But as for now we have the PPEs" **[Pharmacy Assistant IDI06].**

Despite availability, mask wearing was intermittent. During the qualitative interviews, frontline workers reported adhering to the mask wearing regulations, however even in facilities where masks were available (83.9 – 100% of facilities) the quantitative team observed far less uptake than was reported, with less than 52% of health and frontline workers wearing masks all of the time they were observed (Table 2). To understand this, during the second round of qualitative interviews, we probed why frontline workers may not wear masks. We asked this question in the third person to ensure that frontline workers did not feel we were accusing them. The most common reason provided during these interviews was that masks were uncomfortable and impacted health:

> Some of the health workers that are not wearing a mask complain that the mask gives them a headache, others say the reason why they don't wear a mask is because they want free circulation of oxygen when breathing **[Health Surveillance Assistant, IDI15]**

Mask wearing (primarily cloth) by patients and guardians (family members taking care of patients) was seen to increase from month 1 (Patients not wearing: 74.2%; Guardians not

wearing: 96.8%) to month 2 (Patients not wearing: 19.4%; Guardians not wearing: 22.6%) with a slight decline again in month 3 (Table 2). Across the dataset, frontline workers reported some patients were reluctant to wear masks. They attributed this behaviour to the uncomfortableness in wearing a mask.

> Some people [patients] have been complaining that they suffocate when breathing through a mask and other people don't even know how to properly wear the masks. So those could be some of the reasons. **[Clinical Officer, IDI09]**

Disposal of PPE was relatively consistent, with 77% of facilities burning materials in either an incinerator or open fire. Concerningly, seven facilities were still disposing of PPE and clinical waste in an open pit which may expose others to infection and did not follow good clinical practice.

Physical distancing

Up to 58% of health facilities attempted to implement some level of physical distancing (Table 2), which reduced as the months progressed, and reported cases of COVID-19 declined. Physical distancing was particularly challenging upon arrival of patients, although efforts were made to support distancing in the waiting and consultation areas through word of mouth, spacing chairs or marking benches (Table 2). However, during facility visits, clients were seen to be crowding and failing to maintain an appropriate physical distance. Frontline workers felt patients failed to physically distance from each other in the queues because patients wanted to be seen "rapidly". This behaviour is likely to be shaped in part by long waiting periods commonly reported in primary health facilities in Malawi.

> As you know people are very difficult to deal with, they just maintain it for a short period of time then they get closer to each other again, because they all want to receive treatment quickly. **[Security guard, IDI02]**

Behavioural barriers for implementing COVID-19 prevention

In addition to the limitations associated with infrastructure and consumables, we also considered how behaviour evolved throughout this period of the pandemic.

The COVID-19 pandemic in Malawi has been very dynamic. Reflecting the unpredictable nature of the pandemic, reported behaviour change has been both dynamic and

heterogenous. Some frontline workers perceived a relaxation of precautionary measures by patients as the number of reported cases went down. As noted below:

> People think that COVID-19 has vanished. I don't know where they're getting that information from. They have stopped wearing masks and they are no longer washing their hands on their own as before. So, I would say people are reckless now and are back to their normal life **[Clinical Officer, IDI09]**

Whereas some frontline workers reported better uptake in prevention behaviours by patients. They felt patients were being cautious about prevention and cooperative when it came to mask wearing and hand washing for instance:

> Yes, there have been some changes. People are now wearing masks and they are also washing their hands. People are observing social distance. **[Clinical officer, IDI04]**

Healthcare workers believed the change in patient behaviours was helped by the government legislating that everyone must wear a mask when visiting public offices. Some health facilities refused to treat patients who were not wearing masks which meant patients modified their behaviour:

> People […] now obey all the measures that have been put in place at the facility such as wearing a face mask, [which] is mandatory either at the facility or when travelling. It has brought a great change because when we send them back, they inform others in their community. And now people prepare when coming to the hospital because they are afraid of being sent back without treatment […] **[Ground labourer, IDI01]**

However, some frontline workers felt such punitive measures had unintended consequences. They reported that once patients started to be turned away, mask sharing became far more common undermining prevention efforts:

> We have however stopped sending them back because people were borrowing mask from each other which is a big problem. So now we just inform the village chiefs to inform their people to stop being reckless **[Clinical officer, IDI09]**

Frontline workers felt public behaviour had changed as communities started working together with community and religious leaders. Healthcare workers felt this helped both in disseminating COVID-19 information and encouraging people to use a mask:

> The number of people that are wearing masks has now increased a lot. The change has resulted from the meeting we had at the hospital here with the village chiefs, where we explained to them that everyone should comply with the preventive measures being implemented at the hospital when coming to the hospital. Church leaders have also been encouraging people to wear masks. So our village chiefs and church leaders have also played a major part. **[Nurse, IDI12]**

Impact of COVID-19 on routine health services

Frontline workers felt that the COVID-19 pandemic had negatively impacted provision of healthcare services. They cited cancellation of routine services such as screening for cervical cancer and HIV viral load as two of the most significant impacts.

> It is very challenging. Actually, the entire system came to a halt because we are all focused on COVID-19. **[DHO representative]**

> […] recently some services have been stopped due to COVID-19, [e.g.] growth monitoring services, cervical cancer screening and [HIV] viral load services. **[Clinical officer, IDI13]**

We found a reduction in the number of patients attending outpatient services from April onwards, which corresponds with the first confirmed cases of COVID-19 in Blantyre District (Figure 1). However, the facilities did not suspend all services, rather adapted strategies for providing healthcare. For instance, people with HIV or TB normally received a three-month dosage but were getting prescriptions for six months. As one District Health Office representative narrated the reason for the modification was to reduce in-person consultations and decongest the clinics.

> Review clinics for HIV and TB patients have been extended, so instead of giving them medical supplies for 3 months we are giving them medicine supplies of 6 months so that we should try to reduce congestion and minimize time of contact with these patients. **[DHO representative]**

Patients attendance reduced for TB services (Figure 2) could therefore reflect the extended period for which clients received drugs as opposed to reduced attendance and should be assessed over a more prolonged period to determine if service delivery was affected.

We also found modifications in the way child vaccination was offered. Rather than following the immunisation calendar, mothers were grouped and assigned new vaccination dates.

> Those [in need of vaccination] have been divided into several groups and each group is told to come on their own specific day. **[Hospital attendant, IDI18]**

Despite these efforts, and overall reduction in immunisation was seen in attendance records, particularly in relation to facilities located in urban areas. This may reflect the higher perceived risk of COVID-19 in urban contexts (Figure 3).

Similarly, delivery of reproductive health services was altered, with women accessing family planning given instructions to self-administer the injection at home. However, this strategy raised important questions about disposal and safety of used syringes and needles in the community.

> And when it comes to family planning; women are being trained to inject themselves at home so when they come here we just give them all the required materials. **[Clinical officer, IDI21]**

Adaptation of existing services may explain some of the reduction in access to family planning services as cases of COVID-19 were seen to increase (Figure 4).

The pandemic interrupted the way daily facility data was being recorded. Data entry clerks, the staff responsible for completing daily registers, were not included in the risk allowance provided by the government. This led to long absences by this cadre from some of the facilities.

> Our department is still not receiving the risk allowances […] data officers were not working due to the same issue, but they have just accepted the situation and have resumed their work. **[Security guard, IDI02]**

As part of managing the risk of exposure, health workers reduced their days and the amount of time spent at the health care facility, alternating between the different weeks. Consequently, facilities closed earlier than normal, and this further impacted on patients travelling long distances to access care:

> The other thing is that we are told to work for a limited time which is less time than before, but that is challenging for the patients that can't make it to the hospital on time **[Hospital attendant, IDI05]**

It is difficult to assess the impact the lack of data clerks may have had on the records maintained within health care facilities and reported here.

Improved work practices

Health workers also reflected on the positive lessons drawn from responding to COVID-19, reflecting that prevention measures had shaped their work practices in ways that could be useful for preventing other diseases in future:

> It has encouraged us to observe hygiene; previously we used to wash our hands only when we wanted to eat but now, we wash our hands regularly, after meeting each patient. We also wear PPE such as masks, aprons and gloves which we never used to do before COVID-19. We now observe social distancing. Social distancing protects us from a lot of other diseases such as TB and others that transmit through droplets. We will use masks even when COVID-19 is over. **[Medical assistant, IDI01]**

The impact of COVID-19 on frontline workers

Frontline workers reported severe impacts on their well-being from working during the pandemic. They faced constant anxiety about the risk of exposure, which appeared to be two-fold. For non-clinicians, frontline workers articulated their concerns around regular contact with clinicians who were seeing the patients:

> I have worries because of the way things are right now […] I work at the clinic and sometimes I come into contact with the doctors and that worries me because you wonder if all the patients that were in contact with the doctors have the disease. **[Ground labourer, IDI03]**

Secondly, they saw themselves as potentially exposing others to the same risk they were experiencing, and felt particularly concerned for their family members about this:

> I feel worried that I may infect my little child and my whole family should I be infected because it takes time for a person to notice if they have COVID-19. **[Clinical officer, IDI04]**

Stress and helplessness

There was a deep sense of helplessness among frontline workers about continuing to work during the pandemic. Some frontline workers narrated their desire for a break from work but felt powerless to act. Their lack of agency stemmed from a sense of social responsibility to work but also the need to provide for their families. For most frontline workers they continued to work because they could not afford to stop:

> I cannot quit my job despite having so many worries because the job is what gives me money for food. People are just going to work because they want to earn some money for food, but everybody is worried. **[Medical Assistant, IDI16]**

Some frontline workers also drew inspiration to continue to work from the principles of humanitarianism and sacrifice. Responding to 'What motivates you to continue working despite the situation?' one said, 'The desire to assist people.' This demonstrates that facility workers felt an ethical duty to serve their communities despite the perceived risk:

> There is no way I can say we will stop going to work due to COVID-19, because that's our job, assisting people. So, there is no way the hospital would be closed because of the pandemic. **[Nurse, IDI10]**

During July and August 2020, the Ministry of Health required all health workers to be tested for COVID-19. This led to a significant proportion of health care workers being diagnosed. The requirement for these health workers to self-isolate placed pressure and stress on staff in health care facilities who still needed to deliver services.

> We are working more than before the start of COVID-19 [...] because if say three workers test positive to the virus, they go on quarantine, leaving behind more work for their colleagues. **[Clinical officer, IDI21]**

Wider community stigma

Across the dataset, we found consistent testimonies of frontline workers experiencing stigma within the wider community because they were perceived to be the ones spreading the virus. This may have been a result of the mass testing programme initiated by the government. In this quote, one front-line worker shared his experience of being ostracized by bus operators and fellow passengers simply because they were from the health service.

> We fail to board a minibus when going to work because people say we will infect them with the disease on the bus. […] this other day I was in my work uniform standing at the bus stop waiting to catch a minibus, but none of the buses stopped and other people at the bus stop started accusing me that I was the reason why the buses were not stopping." **[Ground labourer, IDI14]**

To mitigate this situation the district health officer reported providing health workers with additional buses allowing them to get to work. Although only health workers were provided access to the buses with other frontline workers left to find their own way to work.

> They reported [the discrimination on public transport] to the head office and the office hired staff buses which were carrying only health workers. But after sometime, the buses stopped carrying them. **[Clinical officer, IDI14]**

Tension between health workers at the healthcare facility was also reported. Fear of infection led to mistrust between health workers, particularly for those who were diagnosed having COVID-19.

> Some health workers diagnosed with COVID-19 were being ignored by fellow health workers, saying they will infect them, and that was affecting them psychologically. **[Clinical officer, IDI12]**

Discussion

This mixed methods study took place during the first wave of COVID-19, capturing real-time data around how primary health care facilities prepared for, and then responded to the pandemic. Exploring in-depth with a range of frontline workers how the COVID-19 pandemic affected their work practices and lives more broadly. Initial modelling predicted that Malawi would have a high rate of hospitalizations and deaths, but this did not materialise at the

time of this study. In Blantyre, the COVID-19 pandemic and response took place in the context of severe resource constraints, where health service even before the pandemic were strained. Our research found that despite this challenging context, primary healthcare facilities remained open and patients continued to seek care. The DHO led the rapid roll out of COVID-19 related training to frontline health workers, implementing key COVID-19 measures but this was inhibited both by the absence of materials and limited infrastructure. The numbers of people attending health care facilities was radically reduced, particularly during the first peak and some key services were also suspended.

Although pragmatic guidance has been published for low and middle income countries (27), case management at health care facilities was challenging, with limited staff available for patient consultations, and the layout of health care facilities making it challenging manage patients arriving. This was compounded by inadequate resourcing (e.g. thermometers, isolation rooms) to facilitate screening upon arrival and isolation of suspected cases. There was heavy reliance on the centralised team from the District Health Office to respond and handle all suspected cases, which overburdened this team.

In some health facilities an authoritarian approach to increase patient's adherence to mask wearing had a detrimental impact on prevention measures. We found that despite frontline health workers reported stress and anxiety of contracting COVID-19, the uptake of preventative measures including mask wearing was low, suggesting a complex relationship between knowledge and behaviour of health care workers. Frontline workers reported significant stigmatisation and increased stress during work that impacted their lives.

The fear, stress and anxiety reported by frontline workers in our study reflects trends across the globe. Studies undertaken in a wide range of high-, middle-, and low-income contexts speak to devastating impact COVID-19 is having on health care workers' psychosocial well-being (28,29). In sub-Saharan Africa, where health systems are more fragile, referral pathways are more complex and access to PPE challenging; these are all factors that contribute further stress for health care workers. By including a wider cadre of staff including guards and patient attendants, we demonstrated that the psychosocial impact is

not limited to frontline health care workers. Our work speaks to the urgent need to provide psychosocial support for all frontline workers.

The importance of hand hygiene in the prevention of communicable diseases, including respiratory infections cannot be overemphasized, particularly with regard to COVID-19 (30–32). Prior to this pandemic, WASH campaigns were emphasising the importance of hand washing with soap after toilet use and during consultations in healthcare facilities (33–35). However, opportunities for hand washing in this setting were rarely found, with reasons cited as lack of hand washing facilities, access to water, and the need for constant maintenance (33–35). Nevertheless, our results indicate that despite the provision of the necessary hand washing facilities and regular access to water, few health facilities made adequate hand washing stations with soap or sanitisers available at either toilets or other areas of the health care setting. Where they were available, their presence was intermittent implying that recommended hand hygiene practice (hand washing with soap or use of hand sanitizer) was limited. By failing to utilise the handwashing facilities available to them (i.e., keeping provided buckets and soap in storage) health facility staff are indicating that they are either overburdened, or do not understand the value of hand washing with soap in COVID-19 prevention. This was a missed opportunity to promote effective hand washing with soap to the community members utilising the health care facilitates, as lack of proper hand hygiene in the healthcare facilities has been found to reflect inadequate handwashing at the household level (36,37), as WASH norms are shared in community settings (38). Research as demonstrated that the availability of WASH infrastructure (e.g. hand washing facility with soap) in accessible locations motivates behaviour performance, acts as a cue for action and enhances social norms (39). As such it is imperative that hand washing facilities are made accessible to all staff and patients to promote their effective use, and where possible supported with supervision, nudges and appropriate behaviour change techniques to improve hand hygiene in healthcare settings both for the short and long term (40–42).

Overall clinical waste management was found to be well managed in the majority of health care facilities, with incineration of used masks being undertaken on a regular basis. However, as found in previous reports in Blantyre, some masks were disposed of into open pits which were potentially exposing community members to infection (43). A consistent

and context appropriate response to clinical waste management is needed for all health care facilities to reduce the risk of infection transmission while taking into consideration the environmental impacts of disposal in the long term (43).

Limitations

Our study has a number of limitations. As we were collecting data during the pandemic, we limited the time the study team was in the health care facilities. In-depth interviews were conducted over the phone, which may have made it more challenging for the interviewer to build rapport with participants and inhibited their responses. The study focused on frontline workers, and we did not conduct interviews with patients, this means that findings around patient behaviour was filtered through frontline workers perspectives. Collecting data from health care facility registers was challenging and required efforts to compare registers to centralised health management information records to ensure they were consistent. Longer term attendance data comparisons are also recommended to assess the impacts on key services.

Conclusion

Despite the significant challenges placed on health care facilities, they remained open and managed to maintain the majority of key services, albeit with reduced attendance. Although efforts were made to supply health care facilities with resources for COVID-19 prevention, there were limitations to their implementation (e.g. hand washing facility use with soap, mask wearing, etc). Complex factors seem to shape staff behaviours and knowledge did not always translate into practice. Providing additional supervision, support and training may lead to better adherence to preventative measures. Our study also speaks to the need to provide psychosocial support for all those working on the frontline in health facilities.

Acknowledgements

Thanks for Stevie Amos for the support in data management and analysis. This work was supported by the University of Strathclyde through the SFC GCRF Escalator Fund.

Author Contribution statement

Author	Contribution/Role in the study
Mackwellings Phiri	Data collection, analysis, paper writing
Eleanor MacPherson	Study design, lead, paper writing support
Mindy Penulo	Data collection, paper review
Kondwani Chidziwisano	Data analysis, paper writing support
Khumbo Kalua	Study lead, paper review
Chawanangwa Mahebere Chirambo	Data collection, paper review
Gift Kawalazira	Study lead, paper review
Zuziwe Gundah	Study lead, paper review
Penjani Chunda	Study lead, paper review
Tracy Morse	Study design, lead, paper writing support

Declaration of competing interest

The authors declare that there is no conflict of interest.

Data sharing

The data supporting results of this study are available on request from the Department of Civil and Environmental Engineering, University of Strathclyde (tracy.thomson@strath.ac.uk). For the qualitative research, we can provide second order summaries of transcripts to ensure anonymity of participants.

Figure 1

Outpatient service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

Figure 2

TB service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

Figure 3

Child health (including immunisation) service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

Figure 4

Family planning service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

References

1. Ahmed SAS, Ajisola M, Azeem K, Bakibinga P, Chen Y-F, Choudhury NN, et al. Impact of the societal response to COVID-19 on access to healthcare for non-COVID-19 health issues in slum communities of Bangladesh, Kenya, Nigeria and Pakistan: results of pre-COVID and COVID-19 lockdown stakeholder engagements. BMJ global health. 2020;5(8):e003042.

2. Chersich MF, Gray G, Fairlie L, Eichbaum Q, Mayhew S, Allwood B, et al. COVID-19 in Africa: care and protection for frontline healthcare workers. Globalization and Health. 2020;16:1–6.

3. Blanchet K, Alwan A, Antoine C, Cros MJ, Feroz F, Guracha TA, et al. Protecting essential health services in low-income and middle-income countries and humanitarian settings while responding to the COVID-19 pandemic. BMJ global health. 2020;5(10):e003675.

4. Wadvalla B-A. How Africa has tackled covid-19. bmj. 2020;370.

5. McGriff JA, Denny L. What COVID-19 Reveals about the Neglect of WASH within Infection Prevention in Low-Resource Healthcare Facilities. The American journal of tropical medicine and hygiene. 2020;103(5):1762–4.

6. WHO, UNICEF,. WASH in Health Care Facilities Global Baseline Report [Internet]. WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.; 2020. Available from: https://www.washdata.org/sites/default/files/documents/reports/2019-05/jmp-2019-wash-hcf-highlights-1.pdf

7. WHO,. Infection Prevention and Control during Health Care when Coronavirus Disease (COVID-19) Is Suspected or Confirmed. Geneva: World Health Organization; 2020. Report No.: WHO/2019-nCoV/IPC/2020.4.

8. Burki T. Global shortage of personal protective equipment. The Lancet Infectious Diseases. 2020;20(7):785–6.

9. Talisuna A, Yoti Z, Lee C, Frieden TR, Moeti MR. The urgent need for a global commitment to protect healthcare workers. BMJ Glob Health. 2020 Nov;5(11):e004077.

10. Rodríguez-Rey R, Garrido-Hernansaiz H, Bueno-Guerra N. Working in the Times of COVID-19. Psychological Impact of the Pandemic in Frontline Workers in Spain. International journal of environmental research and public health. 2020;17(21):8149.

11. Khanal P, Devkota N, Dahal M, Paudel K, Joshi D. Mental health impacts among health workers during COVID-19 in a low resource setting: a cross-sectional survey from Nepal. Globalization and health. 2020;16(1):1–12.

12. Roberton T, Carter ED, Chou VB, Stegmuller AR, Jackson BD, Tam Y, et al. Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: a modelling study. The Lancet Global Health. 2020;8(7):e901–8.

13. WHO,. COVID-19 hits life-saving health services in Africa [Internet]. WHO | Regional Office for Africa. [cited 2021 Jan 6]. Available from: https://www.afro.who.int/news/covid-19-hits-life-saving-health-services-africa

14. Beloved Kaunga S. How have Malawi's courts affected the country's epidemic response? [Internet]. How have Malawi's courts affected the country's epidemic response? 2020 [cited 2020 Jan 21]. Available from: https://blogs.lse.ac.uk/africaatlse/2020/11/13/how-have-malawis-courts-law-affected-epidemic-response/

15. Kuunika. Mathematical Modeling of COVID-19 in Malawi. Lilongwe: Kuunkia;

16. Nordling L. The pandemic appears to have spared Africa so far. Scientists are struggling to explain why. Science [Internet]. 2020 Aug 20; Available from: https://www.sciencemag.org/news/2020/08/pandemic-appears-have-spared-africa-so-far-scientists-are-struggling-explain-why

17. Malawi: WHO Coronavirus Disease (COVID-19) Dashboard [Internet]. [cited 2021 Feb 9]. Available from: https://covid19.who.int

18. Chibwana MG, Jere KC, Kamn'gona R, Mandolo J, Katunga-Phiri V, Tembo D, et al. High SARS-CoV-2 seroprevalence in Health Care Workers but relatively low numbers of deaths in urban Malawi. medRxiv. 2020;

19. World Bank,. GDP per capita (current US$) - Malawi | Data [Internet]. 2020 [cited 2020 Jul 7]. Available from: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=MW

20. Khuluza F, Haefele-Abah C. The availability, prices and affordability of essential medicines in Malawi: A cross-sectional study. Thet Wai K, editor. PLoS ONE. 2019 Feb 12;14(2):e0212125.

21. Zeng W, Sun D, Mphwanthe H, Huan T, Nam JE, Saint-Firmin P, et al. The impact and cost-effectiveness of user fee exemption by contracting out essential health package services in Malawi. BMJ Global Health. 2019 Apr 1;4(2):e001286.

22. Makwero MT. Delivery of primary health care in Malawi. Afr j prim health care fam med [Internet]. 2018 Jun 21 [cited 2020 Oct 7];10(1). Available from: https://phcfm.org/index.php/phcfm/article/view/1799

23. Ministry of Health Malawi,. Health Care System [Internet]. [cited 2020 Nov 3]. Available from: https://www.health.gov.mw/index.php/2016-01-06-19-58-23/national-aids

24. Government of Malawi,. National COVID-19 Preparedness and Response Plan. Lilongwe, Malawi: Government of Malawi;

25. Pope C, Mays N. Qualitative Research: Reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research. BMJ. 1995 Jul 1;311(6996):42–5.

26. Green J, Thorogood N. Qualitative methods for health research. sage; 2018.

27. Cobb N, Papali A, Pisani L, Schultz MJ, Ferreira JC, COVID–LMIC Task Force. Pragmatic Recommendations for Infection Prevention and Control Practices for Healthcare Facilities in Low-and Middle-Income Countries during the COVID-19 Pandemic. The American journal of tropical medicine and hygiene. 2021;tpmd201009.

28. Semo B, Frissa SM. The Mental Health Impact of the COVID-19 Pandemic: Implications for Sub-Saharan Africa. Psychol Res Behav Manag. 2020 Sep 3;13:713–20.

29. Conti C, Fontanesi L, Lanzara R, Rosa I, Porcelli P. Fragile heroes. The psychological impact of the COVID-19 pandemic on health-care workers in Italy. PloS one. 2020;15(11):e0242538.

30. WHO,. Advice for the public on COVID-19 – World Health Organization [Internet]. World Health Organization. [cited 2021 Jan 15]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public

31. Rabie T, Curtis V. Handwashing and risk of respiratory infections: a quantitative systematic review. Tropical medicine & international health. 2006;11(3):258–67.

32. Prüss-Ustün A, Bartram J, Clasen T, Colford Jr JM, Cumming O, Curtis V, et al. Burden of disease from inadequate water, sanitation and hygiene in low-and middle-income settings: a retrospective analysis of data from 145 countries. Tropical Medicine & International Health. 2014;19(8):894–905.

33. Wichaidit W, Biswas S, Begum F, Yeasmin F, Nizame FA, Najnin N, et al. Effectiveness of a large-scale handwashing promotion intervention on handwashing behaviour in Dhaka, Bangladesh. Tropical Medicine & International Health. 2019;24(8):972–86.

34. Luby SP, Halder AK, Huda T, Unicomb L, Johnston RB. The effect of handwashing at recommended times with water alone and with soap on child diarrhea in rural Bangladesh: an observational study. PLoS Med. 2011;8(6):e1001052.

35. Morse T, Tilley E, Chidziwisano K, Malolo R, Musaya J. Health Outcomes of an Integrated Behaviour-Centred Water, Sanitation, Hygiene and Food Safety Intervention–A Randomised before and after Trial. International journal of environmental research and public health. 2020;17(8):2648.

36. Luby SP, Halder AK, Tronchet C, Akhter S, Bhuiya A, Johnston RB. Household characteristics associated with handwashing with soap in rural Bangladesh. The American journal of tropical medicine and hygiene. 2009;81(5):882–7.

37. Chidziwisano K, Tilley E, Malolo R, Kumwenda S, Musaya J, Morse T. Risk factors associated with feeding children under 2 years in rural Malawi—a formative study. International journal of environmental research and public health. 2019;16(12):2146.

38. Cialdini RB, Trost MR. Social influence: Social norms, conformity and compliance. 1998;

39. Contzen N, Meili IH, Mosler H-J. Changing handwashing behaviour in southern Ethiopia: a longitudinal study on infrastructural and commitment interventions. Social science & medicine. 2015;124:103–14.

40. Seimetz E, Boyayo A-M, Mosler H-J. The influence of contextual and psychosocial factors on handwashing. The American journal of tropical medicine and hygiene. 2016;94(6):1407–17.

41. Hashi A, Kumie A, Gasana J. Hand washing with soap and WASH educational intervention reduces under-five childhood diarrhoea incidence in Jigjiga District, Eastern Ethiopia: a community-based cluster randomized controlled trial. Preventive medicine reports. 2017;6:361–8.

42. Brown J, Cairncross S, Ensink JH. Water, sanitation, hygiene and enteric infections in children. Archives of disease in childhood. 2013;98(8):629–34.

43. Tilley E, Kalina M. "We Are Already Sick": Infectious Waste Management and Inequality in the Time of Covid-19, a Reflection from Blantyre, Malawi. Worldwide Waste: Journal of Interdisciplinary Studies. 2020;3(1).

Table 1: Summary of Qualitative Sampling

Health Facility	Location	First round	Second round	Third round
001clk	Rural	• Hospital Attendant • Medical Assistant (Clinic in charge) • Security Guard • Ground Labourer	• Medical Assistant (Clinic in charge) • Ground Labourer	• Medical Assistant (Clinic in charge)
002mpm	Rural	• Clinical Officer (Clinic in charge) • Pharmacy Assistant • Ground Labourer	• Clinical Officer (Clinic in charge) • Ground Labourer	• Clinical Officer (Clinic in charge)
003mdk	Rural	• Security Guard • Data clerk • Clinical Officer (Clinic in charge)	• Security Guard • Clinical Officer (Clinic in charge)	• Clinical Officer (Clinic in charge)
004nmk	Rural	• Medical Assistant (Clinic in charge) • Hospital attendant	• Medical Assistant (Clinic in charge) • Hospital attendant	• Medical Assistant (Clinical in charge)
005nrd	Urban	• Hospital Attendant • Security Guard • Nurse (Clinic in charge) • Data Clerk	• Hospital attendant • Nurse (Clinic in charge)	• Nurse (Clinic in charge)
006gty	Urban	• Clinical Officer (Clinic in charge) • Ground Labourer • Nurse	• Clinical Officer (Clinic in charge) • Ground Labourer	• Clinical Officer (Clinic in charge)
007slz	Urban	• Nurse (Clinic in charge) • Hospital Attendant • Security Guard	• Nurse (Clinic in charge) • Hospital attendant	• Nurse (Clinic in charge)
008bng	Urban	• Clinical Officer	• Clinical Officer (Clinic in charge)	• Clinical Officer (Clinic in charge)

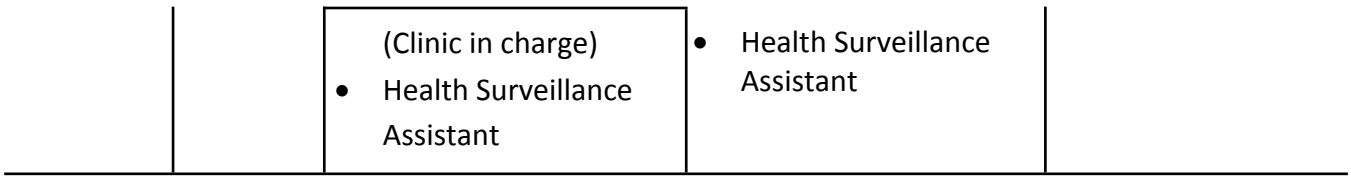
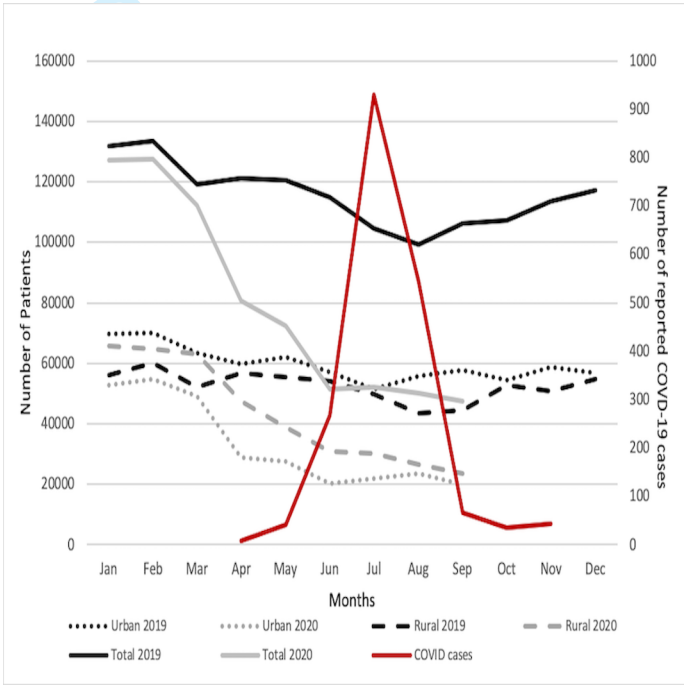


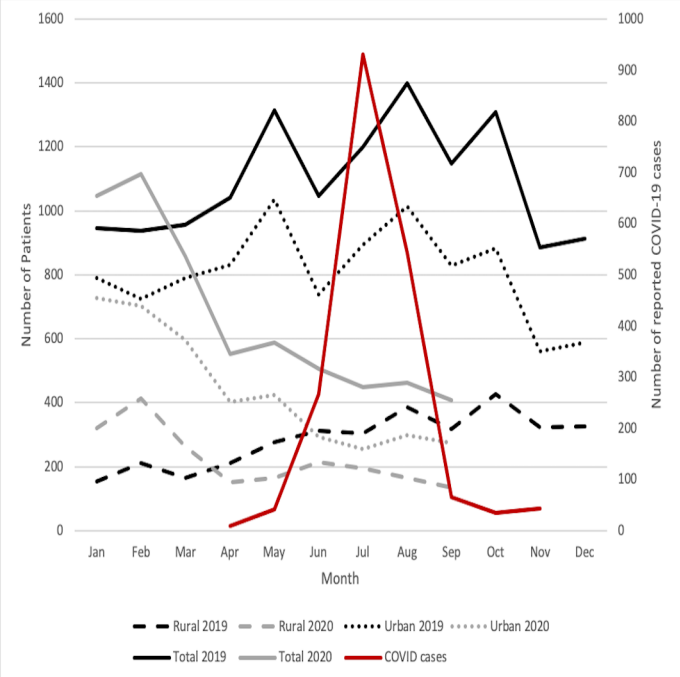
Table 2: Summary of COVID preparedness from 31 health facilities across Blantyre District from August – October 2020.

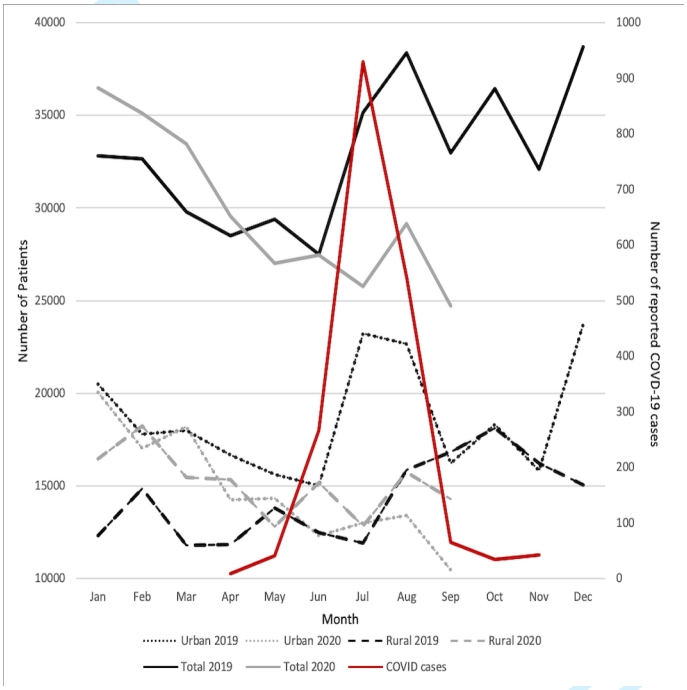
Staff training		August	September	October
All frontline workers	Percentage trained in COVID-19	51.6%	69.6%	80.4%
Hand washing		August	September	October
HWF at entrance	Percentage of facilities	32.3%	32.3%	32.3%
HWF at OPD	Percentage of facilities	71.0%	58.1%	54.8%
HWF HIV	Percentage of facilities	25.81%	22.58%	19.35%
HWF at EPI	Percentage of facilities	19.35%	6.45%	3.23%
HWF at Maternity / antenatal	Percentage of facilities	32.26%	32.26%	29.03%
HWF at toilets	Percentage of facilities	3.23%	0.00%	0.00%
HWF in consultation room	Percentage of facilities	32.26%	25.81%	9.68%
No. HWF per facility	Average number per facility	2.4	2.1	1.7
HWF with soap and water	Percentage with	32.0	29.5	14.9
HWF with water only	Percentage with	61.8	51.8	66.5
Hand sanitiser	Number with access (from 31)	3.0	2.0	0.0
Temperature checks		August	September	October
Thermometer available	Number with access (from 31)	9.0	8.0	4.0
Checks at entrance	Number of the 31 health facilities	0.0	1.0	0.0
Checks at waiting area	Number of the 31 health facilities	0.0	0.0	1.0
Checks in consultation room	Number of the 31 health facilities	8.0	7.0	0.0
Masks		August	September	October
Surgical masks available	Percentage of facilities with available	83.87%	100.00%	90.32%
N95 masks available	Percentage of facilities with available	38.71%	38.71%	35.48%
Mask wearing				
Health workers (non nursing)	Always wearing	25.8%	51.6%	19.4%
	Sometimes wearing	48.4%	45.2%	64.5%
	Not wearing	25.8%	3.2%	16.1%
Nurses	Always wearing	29.0%	51.6%	22.6%
	Sometimes wearing	38.7%	29.0%	54.8%
	Not wearing	32.3%	19.4%	22.6%
Auxiliary staff	Always wearing	6.5%	41.9%	12.9%
	Sometimes wearing	48.4%	35.5%	67.7%
	Not wearing	45.2%	22.6%	19.4%
Patients	Always wearing	0.0%	16.1%	3.2%
	Sometimes wearing	25.8%	64.5%	67.7%
	Not wearing	74.2%	19.4%	29.0%
Guardians	Always wearing	0.0%	19.4%	3.2%

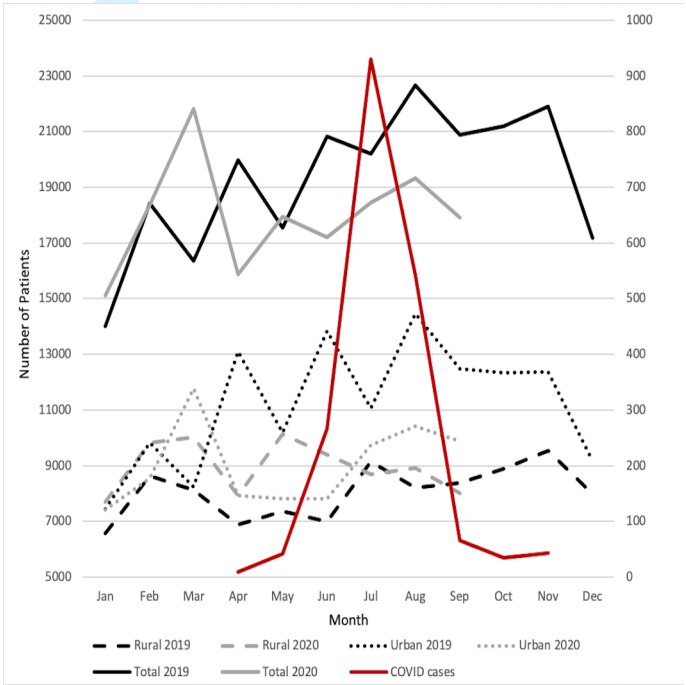
	Sometimes wearing	3.2%	58.1%	67.7%
	Not wearing	96.8%	22.6%	29.0%
Mask type				
Health workers (general)	Surgical	68.97%	76.9%	92.9%
	N95	27.59%	15.4%	7.1%
	Cloth	3.45%	7.7%	0.0%
Nurses	Surgical	80.8%	85.2%	96.0%
	N95	19.2%	14.8%	4.0%
	Cloth	0.0%	0.0%	0.0%
Auxiliary staff	Surgical	81.8%	85.2%	88.9%
	N95	18.2%	11.1%	3.7%
	Cloth	0.0%	3.7%	7.4%
Patients	Surgical	53.3%	41.0%	35.9%
	N95	0.0%	2.6%	7.7%
	Cloth	46.7%	56.4%	56.4%
Guardians	Surgical	50.0%	44.4%	36.8%
	N95	0.0%	2.8%	5.3%
	Cloth	50.0%	52.8%	57.9%
Waste management				
Pit	Number of the 31 health facilities	9	5	7
Incinerator	Number of the 31 health facilities	19	21	19
Open burning	Number of the 31 health facilities	3	5	5
Physical distancing		August	September	October
Physical distancing on arrival	Number of the 31 health facilities	9	14	6
	Word of mouth	54%	69.2%	100%
	Chairs spaced	38%	15.4%	0%
	Floor markings	8%	15.4%	0%
Physical distancing in waiting area	Number of the 31 health facilities	13	18	13
	Word of mouth	41%	45.0%	52.9%
	Chairs spaced	41%	30.0%	41.2%
	Floor markings	18%	25.0%	5.9%
Physical distancing in consultation area	Number of the 31 health facilities	16	17	14
	Word of mouth	50%	33.3%	0.0%
	Chairs spaced	50%	66.7%	91.7%
	Floor markings	0%	0.0%	8.3%
Physical distancing in wards	Number of the 31 health facilities	6	2	1
	Word of mouth	37.50%	0.0%	0.0%
	Chairs spaced	62.50%	100.0%	100.0%
	Floor markings	0%	0.0%	0.0%
Case management		August	September	October

Isolation room	Number of the 31 health facilities	3	4	4
Presence of suspected cases	Number of the 31 health facilities	12	15	19
Action to take when case is available	Give a mask	11.11%	17.24%	17.07%
	Isolation	37.04%	31.03%	29%
	Call covid-19 team at DHO	40.74%	44.83%	29%
	Call hotline number	3.70%	0.00%	0%
	Other	7.41%	6.90%	24%


160000
140000
120000
100000
80000
60000
40000
20000
0
Number of Patients
1000
900
800
700
600
500
400
300
200
100
0
Number of reported COVD-19 cases
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Months
Urban 2019
Urban 2020
Rural 2019
Rural 2020
Total 2019
Total 2020
COVID cases


1600
1400
1200
1000
800
600
400
200
0
Number of Patients
1000
900
800
700
600
500
400
300
200
100
0
Number of reported COVID-19 cases
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Rural 2019
Rural 2020
Urban 2019
Urban 2020
Total 2019
Total 2020
COVID cases


40000
35000
30000
25000
20000
15000
10000
Number of Patients
1000
900
800
700
600
500
400
300
200
100
0
Number of reported COVD-19 cases
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Urban 2019
Urban 2020
Rural 2019
Rural 2020
Total 2019
Total 2020
COVID cases


25000
23000
21000
19000
17000
15000
13000
11000
9000
7000
5000
Number of Patients
1000
900
800
700
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Rural 2019
Rural 2020
Urban 2019
Urban 2020
Total 2019
Total 2020
COVID cases

Summary of COVID preparedness from 31 health facilities across Blantyre District (Urban vs Rural) from August – October 2020

		Urban			Rural		
Staff training		August	September	October	August	September	October
All frontline workers	Percentage trained in COVID-19	41.10%	67.10%	80.70%	63.10%	73.80%	84.70%
Hand washing		August	September	October	August	September	October
HWF at entrance	Percentage of facilities	33.33%	33.3%	25.0%	36.8%	37%	42.1%
HWF at OPD	Percentage of facilities	67%	33.3%	41.7%	68.4%	74%	78.9%
HWF HIV	Percentage of facilities	8%	16.67%	8.33%	31.58%	26%	31.58%
HWF at EPI	Percentage of facilities	8%	0.00%	0.00%	26.32%	11%	5.26%
HWF at Maternity / antenatal	Percentage of facilities	17%	8.33%	33.33%	73.68%	68%	47%
HWF at toilets	Percentage of facilities	0%	0.00%	0.00%	10.53%	0%	0%
HWF in consultation room	Percentage of facilities	25%	33.33%	8.33%	36.84%	26%	11%
No. HWF per facility	Average number per facility	1.58	1.25	1.27	2.54	2.22	2.11
HWF with soap and water	Percentage with	31.58%	28.57%	28.57%	46.00%	44.44%	33.33%
HWF with water only	Percentage with	68.42%	64.29%	71.43%	52.00%	55.56%	66.67%
Hand sanitiser	Number with access (from 31)	2	1	0	1	1	0
Temperature checks		August	September	October	August	September	October
Thermometer available	Number with access (from 31)	1	4	2	8	4	2
Checks at entrance	Number of the 31 health facilities	0	1	0	0	0	0
Checks at waiting area	Number of the 31 health facilities	0	0	0	0	0	1
Checks in consultation room	Number of the 31 health facilities	1	3	0	7	4	0
Masks		August	September	October	August	September	October
Surgical masks available	Percentage of facilities with available	91.67%	100.00%	83.33%	84.21%	100.00%	89.47%
N95 masks available	Percentage of facilities with available	16.67%	25.00%	66.67%	52.63%	42.11%	42.11%

Mask wearing							
Health workers (non nursing)	Always wearing	41.67%	50.00%	8.33%	15.79%	47.37%	26.32%
	Sometimes wearing	58.33%	50.00%	83.33%	42.11%	47.37%	57.89%
	Not wearing	0.00%	0.00%	8.33%	42.11%	5.26%	15.79%
Nurses	Always wearing	27.27%	50.00%	25.00%	26.32%	42.11%	26.32%
	Sometimes wearing	63.64%	16.67%	66.67%	31.58%	36.84%	47.37%
	Not wearing	9.09%	33.33%	8.33%	42.11%	21.05%	26.32%
Auxiliary staff	Always wearing	16.67%	50.00%	0.00%	5.26%	36.84%	21.05%
	Sometimes wearing	50.00%	41.67%	25.00%	47.37%	31.58%	63.16%
	Not wearing	33.33%	8.33%	75.00%	47.37%	31.58%	15.79%
Patients	Always wearing	0.00%	33.33%	0.00%	0.00%	5.26%	5.26%
	Sometimes wearing	41.67%	66.67%	91.67%	21.05%	57.89%	57.89%
	Not wearing	58.33%	0.00%	8.33%	78.95%	36.84%	36.84%
Guardians	Always wearing	0.00%	41.67%	0.00%	0.00%	5.26%	5.26%
	Sometimes wearing	8.33%	41.67%	91.67%	5.26%	57.89%	57.89%
	Not wearing	91.67%	16.67%	8.33%	94.74%	36.84%	36.84%
Mask type							
Health workers (general)	Surgical	74.43%	80.00%	84.62%	76.92%	66.67%	94.12%
	N95	28.57%	13.33%	15.38%	23.08%	22.22%	5.88%
	Cloth	0.00%	6.67%	0.00%	0.00%	11.11%	0.00%
Nurses	Surgical	76.92%	88.89%	91.67%	84.62%	78.95%	93.33%
	N95	23.08%	11.11%	8.33%	15.38%	21.05%	6.67%
	Cloth	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Auxiliary staff	Surgical	77.78%	83.33%	75.00%	84.62%	86.67%	100.00%
	N95	22.22%	8.33%	8.33%	15.38%	13.33%	0.00%
	Cloth	0.00%	8.33%	16.67%	0.00%	0.00%	0.00%
Patients	Surgical	42.86%	40.91%	35.00%	80.00%	42.86%	38.10%
	N95	0.00%	4.55%	10.00%	0.00%	0.00%	4.76%
	Cloth	57.14%	54.55%	55.00%	20.00%	57.14%	57.14%

Guardians	Surgical	50.00%	50.00%	40.00%	50.00%	42.86%	36.84%
	N95	0.00%	0.00%	5.00%	0.00%	4.76%	5.26%
	Cloth	50.00%	50.00%	55.00%	50.00%	52.38%	57.89%
Waste management		August	September	October	August	September	October
Pit	Number of the 31 health facilities	6	4	2	3	1	5
Incinerator	Number of the 31 health facilities	6	13	10	3	8	9
Open burning	Number of the 31 health facilities	0	3	0	3	2	5
Physical distancing		August	September	October	August	September	October
Physical distancing on arrival	Number of the 31 health facilities	5	6	3	4	8	3
	Word of mouth	50%	66.67%	25.00%	40.00%	75.00%	66.67%
	Chairs spaced	38%	16.67%	0.00%	60.00%	0.00%	0.00%
	Floor markings	13%	16.67%	0.00%	0.00%	25.00%	33.33%
Physical distancing in waiting area	Number of the 31 health facilities	7	9	6	6	9	7
	Word of mouth	45.46%	33.33%	42.67%	28.57%	50.00%	55.56%
	Chairs spaced	27.27%	16.67%	8.33%	74.43%	25.00%	0.00%
	Floor markings	27.27%	41.67%	33.33%	0.00%	25.00%	44.44%
Physical distancing in consultation area	Number of the 31 health facilities	9	6	5	7	11	9
	Word of mouth	54.55%	25.00%	0.00%	50.00%	26.67%	20.00%
	Chairs spaced	45.46%	50.00%	41.67%	50.00%	73.33%	70.00%
	Floor markings	0.00%	0.00%	0.00%	0.00%	0.00%	10.00%
Physical distancing in wards	Number of the 31 health facilities	1	0	0	2	2	1
	Word of mouth	100.00%	0.0%	0.0%	33.33%	0.00%	0%
	Chairs spaced	0.00%	0.0%	0.0%	66.67%	100.00%	100%
	Floor markings	0.00%	0.0%	0.0%	0.00%	0.00%	0%
Case management		August	September	October	August	September	October
Isolation room	Number of the 31 health facilities	1	2	2	2	2	2
Presence of suspected cases	Number of the 31 health facilities	8	8	8	4	7	11

Action to take when case is available	Give a mask	11.11%	0.00%	11.11%	16%	8.70%	10.53%
	Isolation	33.33%	16.67%	44%	32%	30.43%	31.58%
	Call covid-19 team at DHO	33.33%	50.00%	33%	39%	34.78%	31.58%
	Call hotline number	0.00%	16.67%	0%	10%	13.04%	5.26%
	Other	22.22%	16.67%	11%	3%	13.04%	21.05%

Research Checklist

#1	**Title** Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g. ethnography, grounded theory) or data collection methods (e.g. interview, focus group) is recommended.	Page 1
#2	**Abstract** Summary of the key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results and conclusions.	Page 3
#3	**Introduction** **Problem formulation** Description and signifcance of the problem / phenomenon studied: review of relevant theory and empirical work; problem statement.	Pages 4, 5
#4	**Purpose or research question** Purpose of the study and specific objectives or questions.	Page 6
#5	**Methods** **Qualitative approach and research paradigm** Qualitative approach (e.g. ethnography, grounded theory, case study, phenomenolgy, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g. postpositivist, constructivist / interpretivist) is also recommended; rationale. The	Pages 6, 7

	rationale should briefly discuss the justification for choosing that theory, approach, method or technique rather than other options available; the assumptions and limitations implicit in those choices and how those choices influence study conclusions and transferability. As appropriate the rationale for several items might be discussed together.	
#6	**Researcher characteristics and reflexivity** Researchers' characteristics that may influence the research, including personal attributes, qualifications / experience, relationship with participants, assumptions and / or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results and / or transferability.	
#7	**Context** **Setting / site and salient contextual factors; rationale.**	Page 5
#8	**Sampling strategy** How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g. sampling saturation); rationale.	Pages 6, 7
#9	**Ethical issues pertaining to human subjects**	Page 8

	Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues.	
#10	**Data collection methods** Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources / methods, and modification of procedures in response to evolving study findings; rationale.	Pages 6, 7
#11	**Data collection instruments and technologies** Description of instruments (e.g. interview guides, questionnaires) and devices (e.g. audio recorders) used for data collection; if / how the instruments(s) changed over the course of the study.	Page 6,7
#12	**Units of study** Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results).	Pages 6,7
#13	**Data processing** Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymisation / deidentification of excerpts.	Page 7,8

#14	**Data analysis** Process by which inferences, themes, etc. were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale.	Page 7,8
#15	**Techniques to enhance trustworthiness** Techniques to enhance trustworthiness and credibility of data analysis (e.g. member checking, audit trail, triangulation); rationale.	Page 7
#16	**Results/findings** **Syntheses and interpretation** Main findings (e.g. interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory.	Pages 9-19
#17	**Links to empirical data** Evidence (e.g. quotes, field notes, text excerpts, photographs) to substantiate analytic findings.	Pages 9-19
#18	**Discussion** **Intergration with prior work, implications, transferability and contribution(s) to the field**	Pages 19-21

	Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application / generalizability; identification of unique contributions(s) to scholarship in a discipline or field.	
#19	**Study strength and Limitations** Trustworthiness and limitations of findings.	Page 21
#20	**Other** **Conflicts of interest** Potential sources of influence of perceived influence on study conduct and conclusions; how these were managed.	Page 22
#21	**Funding** Sources of funding and other support; role of funders in data collection, interpretation and reporting.	Page 22
#22	**Author contributions** Role of each other in the study and their contributions	Page

BMJ Open

Preparedness for and impact of COVID-19 on primary health care delivery in urban and rural Malawi: a mixed methods study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-051125.R1
Article Type:	Original research
Date Submitted by the Author:	20-Apr-2022
Complete List of Authors:	Phiri, Mackwellings; Malawi-Liverpool-Wellcome Trust Clinical Research Programme, MacPherson, Eleanor; Malawi-Liverpool-Wellcome Trust Clinical Research Programme; Liverpool School of Tropical Medicine Panulo, Mindy; Polytechnic, University of Malawi, Department of Enviromental Health and WASHTED centre Chidziwisano, Kondwani; Malawi Polytechnic, Environmental Health; University of Strathclyde, Department of Civil and Environmental Engineering Kalua, Khumbo; Blantyre Institute for Community Outreach Chirambo, Chawanangwa; Blantyre Institute for Community Outreach Kawalazira, Gift; Blantyre District Health Office Gundah, Zaziwe; Blantyre District Health Office Chunda, Penjani; Blantyre District Health Office Morse, Tracy; University of Strathclyde, Civil and Environmental Engineering; WASHTED center, Polytechnic, University of Malawi
Primary Subject Heading:	Infectious diseases
Secondary Subject Heading:	Public health, Qualitative research
Keywords:	COVID-19, Public health < INFECTIOUS DISEASES, QUALITATIVE RESEARCH, Infection control < INFECTIOUS DISEASES

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Title: Preparedness for and impact of COVID-19 on primary health care delivery in urban and rural Malawi: a mixed methods study

Mackwellings Phiri[1], Eleanor MacPherson[1,2], Mindy Panulo[3,4], Kondwani Chidziwisano[3,4,5], Khumbo Kalua[6], Chawanangwa Mahebere Chirambo[6], Gift Kawalazira[7], Zuziwe Gundah[7], Penjani Chunda[7], Tracy Morse[3,4,5]

1. Malawi-Liverpool-Wellcome Trust
2. Liverpool School of Tropical Medicine
3. Department of Environmental Health and WASHTED Centre
4. Polytechnic, University of Malawi, Blantyre, Malawi
5. Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, UK
6. Blantyre Institute for Community Outreach, Blantyre, Malawi
7. Blantyre District Health Office, Blantyre, Malawi

Corresponding author's email address: mackwellingsphiri@gmail.com/mmphiri@mlw.mw

Abstract

Objective Across Africa, the impact of COVID-19 continues to be acutely felt. This includes Malawi, where a key component of health service delivery to mitigate against COVID-19 are the primary health care facilities, strategically placed throughout districts to offer primary and maternal health care. These facilities have limited infrastructure and capacity but are the most accessible and play a crucial role in responding to the COVID-19 pandemic. This study assessed health facility preparedness for COVID-19 and the impact of the pandemic on health service delivery and frontline workers.

Setting Primary and maternal health care in Blantyre District, Malawi.

Participants We conducted regular visits to 31 health care facilities and a series of telephone-based qualitative interviews with frontline workers (n=81 with 38 participants) between August 2020 and May 2021.

Results Despite significant financial and infrastructural constraints health centres continued to remain open. The majority of frontline health workers received training and access to preventative COVID-19 materials. Nevertheless, we found disruptions to key services and a reduction in clients attending facilities. Key barriers to implementing COVID-19 prevention measures included periodic shortages of resources (soap, hand sanitizer, water, masks, staff). Frontline workers reported challenges in managing physical distancing and in handling suspected COVID-19 cases. We found discrepancies between reported behaviour and practice, particularly with consistent use of masks, despite being provided. Frontline workers felt COVID-19 had negatively impacted their lives. They experienced fatigue and stress due to heavy workloads, stigma in the community, and worries about becoming infected with and transmitting COVID-19.

Conclusion Resource (human and material) inadequacy shaped the health facility capacity for support and response to COVID-19, and frontline workers may require psychosocial support to manage the impacts of the COVID-19 pandemic.

Summary box

Study strengths and limitations

- Using a mixed method approach allowed us to capture data in real time from across the district and gain and an in-depth understanding of the findings.
- Qualitative interviews allowed participants to express their lived realities through conducting interviews at different time points, we were able to capture changes in risk perception across the pandemic.
- Quantitative structured data collection tools enabled data to be captured through direct observations at each health care facility allowing for triangulation of findings captured through the qualitative interviews.
- Collecting data from health care facility registers was challenging and required efforts to compare registers to centralised health management information records which due to staff shortages were not always consistent.
- We only interviewed frontline workers, meaning that findings around patient behaviour were filtered through frontline workers perspectives.

Introduction

Since COVID-19 was identified in Wuhan, China in late 2019, this highly infectious respiratory disease has spread across the world causing a complex global health crisis. The devastating impact of the pandemic has been felt both within and beyond the health sector (1). Research has demonstrated the extreme pressure on health workers to both treat patients with COVID-19, and also to maintain essential services (2). In low-and-middle income contexts, where health systems are often fragile and care-seeking pathways for patients more challenging, the ramifications of the pandemic are being felt in complex ways (3).

The global response to the pandemic has seen development and roll-out of vaccines to prevent severe disease and hospitalisation at an unprecedented speed. However, the global distribution of vaccines has seen significant inequalities with low-income countries, particularly those in sub-Saharan African having some of the lowest vaccine coverage (4).

Prior to COVID-19, sub-Saharan African health systems have often been under-resourced and faced critical shortages of health care-workers. Recent studies have demonstrated that water, sanitation, and hygiene (WASH) infrastructure, a crucial component of good hygiene and infection control, is significantly constrained in the region (5). Only half of health facilities have basic access to water, and even less to soap or alcohol based hand sanitizer (6–8). During the COVID-19 pandemic, the situation has been further exacerbated by global shortages in access to Personal Protective Equipment (PPE) increasing the risk to health care workers and patients (9,10). Psychosocial well-being of health care workers across the globe has been detrimentally impacted both by overwhelming workloads and providing patient care with inadequate PPE (11,12).

Disruptions to health services have had both a direct and indirect impact on mortality, as care for all patients is affected (13). Recent work from the World Health Organization (WHO) analysed data on attendance for five key essential services (outpatient and inpatient admission, skilled birth attendance, treatment of confirmed malaria cases and provision of the combination pentavalent vaccine) from 14 countries in Africa, and found a reduction of

50% in May, June and July 2020 (14). This work speaks to the importance of capturing the impacts of COVID-19 on health service delivery in a wide range of contexts.

In April 2020, responding to the first confirmed cases of COVID-19 in Malawi, the government closed international borders, suspended all international flights, closed educational institutions, banned large gatherings and mandated face coverings (15). Legal injunctions prevented the implementation of any other restrictions of movement (16). In Sub-Saharan Africa, there was significantly lower recorded deaths and cases than initial models projected (17,18). However, testing capacity has been extremely limited meaning that an accurate picture of transmission has been challenging. Reflecting wider regional trends Malawi recorded lower than predicted deaths and hospitalisations. In May 2020, initial modelling work projected up to 435,000 hospitalisations with up to 50,000 deaths in the first year of the pandemic. However, the first wave (March-September 2020) saw 185 deaths with 6,049 and cases recorded (19). Subsequent immunological work has found that by July 2021 there was high seropositive (Blantyre, 81.7%; Mzuzu, 71.0%) suggesting a higher rate of cases than was reported in official statistics (20). Recent work in Malawi, has found that the COVID-19 pandemic impacted on TB case notification (21).

Primary health care facilities are central to Malawi's health service and provide a range of services including outpatient department (OPD), family planning (FP), maternal and child health (MCH), expanded programme of immunisation (EPI), tuberculosis (TB) testing and treatment, HIV testing, counselling and treatment, and cancer screening. The outpatient facilities are one of the most important entry points into the health system and where most suspected COVID-19 cases will present. Any changes to service delivery in these facilities is likely to have significant impacts on long term health outcomes. This study was guided by three research objectives: *(1)* to assess preparedness for the pandemic in health facilities in Blantyre District; *(2)* to understand front-line workers experiences of providing care during COVID-19; and *(3)* to create feedback loops for assessment results to the district health office to help inform COVID-19 action plans.

Methods

Study context

The Malawian health system is structured around three levels, tertiary (large referral hospitals situated in major urban centres), secondary (district hospital) and primary (health facilities, community, and home-based services). Funding for the health sector is heavily dependent on international donors (22). Health services are provided by government, private and faith-based organisations; government services are the only ones provided without fees and recent estimates suggest they provide approximately 60% of services accessed (23,24). Despite policies being well-designed, key challenges faced in the health sector include chronic underfunding, shortage of staff and fragmentation of services (24). The District Health Office is mandated to provide management and oversight of primary health care facilities (25). This study was situated in Blantyre district in the Southern region, which is serviced by 31 government and faith based primary health care facilities (n=14 urban; n=17 rural)(see supplementary 1 for further characteristics of the facilities). The district has a total population of 1.25 million including Blantyre city (64%), the second largest city in Malawi. The study ran from April 2020 – August 2021. This encompassed the first and second waves of the COVID-19 pandemic in Malawi and the national rollout of the preventative vaccine.

Study Design

To understand the impact of COVID-19 on primary health care provision we used a mixed method approach. Combining qualitative and quantitative research methods allowed us to capture data from across the district and gain a deeper understanding of the findings through qualitative interviews. All data collection tools were developed in consultation with the Blantyre District Health Office and were reviewed regularly through feedback loops to help inform service delivery improvements. Field work was conducted in two phases:

Phase 1: July – November 2020

For this phase we aligned qualitative and quantitative approaches to understand the impact of the first wave of the pandemic. Quantitative structured data collection tools were selected to enable real time data to be captured through direct observations at each health care facility. Tools focused on the key components of the National COVID-19 Preparedness and Response Plan (26), reporting on preparedness proxies (e.g. hand washing facilities, soap, thermometers), and observed behaviour of frontline workers (inclusive of health care workers and auxiliary staff) and clients (e.g. mask wearing, physical distancing)(see

supplementary 2). Qualitative interviews were selected because they allowed frontline workers to express their lived realities and explore a range of themes flexibly (27). Conducting interviews at different time points allowed us to capture health workers changing perceptions and experiences across the dynamic period of the pandemic. To reduce the risk of COVID-19 transmission with prolonged contact with participants we conducted qualitative interviews over the telephone.

Phase 2: April - August 2021

Following the second wave of the pandemic and the national roll out of the COVID-19 vaccine, we conducted a second phase of qualitative interviews. These interviews sought to understand the perception of, and response to, the vaccine within primary health care clinics.

Data collection

Quantitative methods

Quantitative assessments were only conducted during the first phase of the study (July – Nov 2020). Working in all 31 rural and urban health facilities in Blantyre District, we collected structured data at three-time points (August, September, and October 2020). Experienced researchers administered a questionnaire with the clinician responsible for managing the health facility or their representative. All quantitative data were collected using a pre-programmed questionnaire on KoboCollect (https://www.kobotoolbox.org)(see supplementary 3). The questions included data on patient management, physical distancing, water, sanitation and hygiene (WASH) provision and practices, the presence and use of personal protective equipment (PPE) and patient attendance at routine health services. The team photographed clinic registers (without any identifying patient data) for OPD, EPI, TB, FP, HIV and cancer screening services; this data was collected from January 2019 to September 2020 to allow for comparison of patient numbers pre-COVID.

Following analysis of each round of data collection, “score cards” were generated for each health facility. The score cards summarised how the health care facilities were implementing COVID-19 preventative measures, including training of frontline staff and WASH materials. This included the location and presence of hand washing facilities (including soap and water), stock and use of PPE including face masks and thermometers,

waste management, and case management of suspected COVID-19 cases. These scorecards were then provided to the District Health Office team through monthly feedback loops, to provide guidance on which health care facilities had managed to adapt their practices, and which facilities required further support.

Qualitative research

Qualitative assessments were undertaken across both phases of the study. Following the generation of the scorecards from initial quantitative data collection, eight health care facilities were purposively sampled to be included in the qualitative component. In the sample, we included both rural (n=4) and urban facilities (n=4). In these health care facilities, we conducted a total of 81 interviews with 38 participants, all frontline workers. In Table 1, we provide a breakdown of the participants included in each round of the interviews and the number conducted at each time point. Semi-structured qualitative interviews were conducted over the telephone and guided by a discussion guide (see supplementary 4). These interviews happened at five-time points (July-August, September, October-November 2020, and April-May and August 2021) to allow us to capture the dynamic nature of the pandemic and the rollout of the vaccine programme.

For each round of the interviews, we used a purposive sampling approach which aimed to sample a wide range of frontline workers including those employed in support and operations at the health facilities. In July/August, we included auxiliary staff (guards, ground staff, patient attendants and cleaners) recruiting up to four participants in each health care facility. In September 2020, due to time and resource constraints, we repeated interviews with 2 participants per healthcare facility, this sample included both a health worker and an auxiliary worker. In October/November 2020, we conducted a third set of interviews with the healthcare facility in-charges, those who manage the clinic (or their representative), these interviews focused more on broader changes to care provision. Between April and August 2021, we undertook a second phase of interviews with in-charges (or their representative). Key themes included experiences delivering care during the COVID-19 pandemic. Participants were asked during the interviews to reflect on the pandemic including preparedness of clinics and training on COVID-19, changes in the provision of care as well as perceived changes in patient behaviour. Finally, the impact of working during the

pandemic on frontline workers' well-being and lives. The second phase of interviews explored the rollout of the COVID-19 vaccination programme and its impacts on patient attendance. We took a pragmatic approach to sampling, constrained by conducting fieldwork during the pandemic and financial limitations and did not seek to achieve data saturation. However, we did generate a significant of data through the 81 interviews from a range of participants which was triangulated with quantitative data and structured observations.

Data analysis

Quantitative discrete data related to COVID preparedness within the facility was downloaded from KoboCollect (https://www.kobotoolbox.org) as a .csv file, cleaned and analysed using Microsoft Excel V16 (Microsoft Corporation, Redmond, WA). Continuous data related to the department and attendance from health records were abstracted from photographs to Microsoft Excel V16 (Microsoft Corporation, Redmond, WA) for comparative analysis between 2019 and 2020 attendance across specific services. All data were analysed for Blantyre as a whole, and as a comparison between urban and rural facilities.

For the qualitative data we used thematic content analysis (28)(see supplementary 5 for coding strategy). All transcripts were transcribed and imported into NVIVO 12 (QSR, International) to facilitate data management and analysis. Initial themes were identified and key gaps were included in subsequent rounds of data collection. The study team (drawing together the quantitative and qualitative researchers) held weekly debriefing sessions to allow for discussion of findings from each week's data collection. Any new avenues of inquiry were incorporated into the data collection. Halfway through the study, we presented initial findings to the District Health Office to gain feedback and participant checking.

Ethical approval

Ethical approval was granted from the National Health Science Research Committee (#20/06/2534). For the qualitative interviews, the participant information sheet and consent form were shared on WhatsApp before the interview to allow participants to review the information. Before the research began, the information was reviewed again, and oral

consent was taken from the participants. No data collected from the clinic, including clinic registers contained patient's personal information.

Patient and Public Involvement

This study was developed in partnership with the Blantyre District Health Office (DHO), specifically the team leading the COVID-19 preparedness and response for primary health care within Blantyre District. Halfway through the project we presented our initial findings to the District Health COVID-19 Task Force during their weekly meetings for direct feedback, incorporating their suggestions into the qualitative data collection.

Results

We present the qualitative and quantitative results concurrently around three themes: (1) implementation of COVID response policies and practices; (2) impacts of COVID on health service provision: and (3) the well-being of frontline workers. Table 2 illustrates a summary of quantitative measures implemented in the healthcare facilities across the three-month monitoring period. A breakdown of urban versus rural coverage is available as supplementary material (S1) although no significant differences were noted.

Implementation of COVID-19 response policies and practices

We found that clinics remained open throughout the pandemic. The District Health Office (DHO) team were quick to implement training and provide new protocols to be followed to reduce patient numbers. Over the initial three-month period of the pandemic there was a steady increase in the number of facilities which had over 90% of frontline staff trained (Month 1: 35%; Month 2: 48%; Month 3: 70%). However, infrastructure and resource limitations meant implementing COVID-19 prevention measures, such as good hand hygiene and social distancing was challenging. Limitations included lack of access to reliable running water, over-crowded waiting areas and small consulting rooms. The provision of PPE was limited particularly during the early part of the pandemic.

WASH

There was an average of two moveable hand washing facilities (HWF) (e.g. buckets with taps) available per facility. Despite this provision the uptake and use was low with only 33%

adequately set up and used during the visits (Table 2). The limited use of HWF was attributed by health workers to lack of time and support to manage and refill these buckets. HWF access and use appeared to drop off as the three months progressed (Table 2), in line with the reduced number of positive COVID-19 cases (Figure 1). It was difficult for the health care facilities to channel clients through one entrance to ensure hand washing on arrival, due to the open design of the facility. The location of HWF varied from clinic to clinic, and there was little consistency in the provision and location of HWFs over the three-month period in each facility. The highest concentration of consistent provision (i.e. available all three months) was found at OPD service areas (Month 1: 71%; Month 2: 58.1%; Month 3: 54.8%). A relatively small proportion of HWFs were found with no soap or water available over the three-month period (5.2%; 8.7%; 18.6%). This may be attributed to the fact that 77% of facilities had a tapped water supply within the facility compound, with only two having to access water from a borehole in the community outside the facility. Intermittent water cuts severely affected the ability of people in the facility spaces to implement good handwashing. Staff at one facility reported having no access to potable water, which left them relying on hand sanitiser, a scarce resource (Table 2). In this situation there was insufficient sanitiser to share with patients, which meant patients were unable to wash their hands during visits to the health facilities.

> …we are facing a challenge of water, which is making it difficult for us to wash our hands. We just depend on hand sanitisers. We can't share them with the patients because there isn't enough. **[Health Surveillance Assistant, IDI20, August 2020]**

Of concern, was the low provision of soap at available hand washing facilities throughout the study period, with this reducing to under 15% by October (Table 2); this was attributed to several factors including stockouts, theft by clients, and lack of understanding by both health workers and patients of the importance of soap in the reduction of COVID-19 transmission. Clients were more likely to follow social norms in washing hands with water only. In the absence of water and soap, particularly in consultation rooms, it was concerning to note low access to hand sanitiser for frontline workers, as a means of protecting both themselves and clients from transmission between consultations. During health care facility visits, there were times when the HWFs were only put out when the research team began the assessment, indicating that there may have been some reflexive bias in observed

practices. The team also noted that HWFs were often empty of water at the time of client arrival and were only filled once patients were asked to collect water from communal water points.

Client screening and isolation

Access to and use of thermometers for temperature checks was inconsistent with only 25% of facilities having thermometers available at any given time (Table 2). Indication of fever was established by visual assessment of patients during consultation, and no pre-consultation checks were conducted to isolate potential cases from others in the waiting areas. Sixty-one percent of the health care facilities had reported a suspected COVID-19 case by October 2020, with the main response being to provide the patient with a mask, isolate where possible, and call the COVID-19 response team led by the DHO office for advice and action.

PPE

The provision of PPE to health care facilities, particularly surgical masks, for frontline workers was high (Table 2), although in early visits and interviews healthcare workers reported shortages of PPE such as gloves, aprons, and masks. Of the PPE available, a small amount initially supplied had expired and staff were reluctant to use it. As one medical assistant commented:

> We didn't have PPE. The PPE we were given had expired, so we were forced to move consultations outside. Yes, for example the date of the face masks that we had at the hospital had expired a long time ago **[Medical Assistant, IDI04, July 2020].**

However, supply improved in the later stages of the data collection, with healthcare workers reporting more stable stock. For example, one Pharmacy Assistant reflected:

> Previously, it was hard to work because we didn't have enough personal protective equipment and as you know we reached a point of starting strikes. But as of now we have the PPEs" **[Pharmacy Assistant IDI06, August 2020].**

Despite availability, we observed intermittent mask use. During the qualitative interviews, frontline workers reported adhering to the mask wearing regulations, however even in

facilities where masks were available (83.9 – 100% of facilities in August 2020) the quantitative team observed far less uptake than was reported, with less than 52% of health and frontline workers wearing masks during periods of observation (Table 2). To understand this, qualitative interviews conducted in September 2020, explored why frontline workers may not wear masks. We asked this question in the third person to ensure that frontline workers did not feel we were accusing them. The most common reason provided during these interviews was that masks were uncomfortable and impacted health:

> Some of the health workers that are not wearing a mask complain that the mask gives them a headache, others say the reason why they don't wear a mask is because they want free circulation of oxygen when breathing **[Clinical Officer, IDI13, September 2020]**

Mask wearing (primarily cloth) by patients and guardians (family members taking care of patients) was seen to increase from August 2020 (Patients not wearing: 74.2%; Guardians not wearing: 96.8%) to September 2020 (Patients not wearing: 19.4%; Guardians not wearing: 22.6%) with a slight decline again in October 2020 (Table 2). Across the dataset, frontline workers reported some patients were reluctant to wear masks. They attributed this behaviour to the uncomfortableness in wearing a mask.

> Some people [patients] have been complaining that they suffocate when breathing through a mask and other people don't even know how to properly wear the masks. So those could be some of the reasons. **[Clinical Officer, IDI09, September 2020]**

Disposal of PPE was relatively consistent, with 77% of facilities burning materials in either an incinerator or open fire. Although, seven facilities were still disposing of PPE and clinical waste in an open pit which may expose others to infection and did not follow good clinical practice.

Physical distancing

Up to 58% of health facilities attempted to implement some level of physical distancing (Table 2), which reduced as the months progressed, and reported cases of COVID-19 declined. Physical distancing was particularly challenging upon arrival of patients, although efforts were made to support distancing in the waiting and consultation areas through

directives from a frontline worker, spacing chairs or marking benches (Table 2). However, during facility visits, clients were crowding with little maintainance of physical distance. Frontline workers felt patients failed to physically distance from each other in the queues because they wanted to be seen rapidly. This behaviour is likely to be shaped in part by long waiting periods commonly reported in primary health facilities in Malawi.

> As you know people are very difficult to deal with, they just maintain it for a short period of time then they get closer to each other again, because they all want to receive treatment quickly. **[Security guard, IDI02, July 2020]**

Behavioural barriers for implementing COVID-19 prevention

In addition to the limitations associated with infrastructure and consumables, we also considered how behaviour of patients evolved throughout this period of the pandemic shaping the ways people behaved at the health centre. At the start of the pandemic, health workers reported patients feeling fearful, distrustful, and questioning whether COVID-19 was a hoax as well as making links to satanism. They felt this shaped treatment seeking practices with patients staying away from the facilities (a point we return to in the next theme) particularly in the early stages of the pandemic when there was a great deal of uncertainty and fears patients may end up in isolation facilities. However, for those patients who did attend the facilities, health workers felt they were initially cautious, but as time went on, they saw a change in behaviour with less adherence to preventative measures. As noted below:

> People think that COVID-19 has vanished. I don't know where they're getting that information from. They have stopped wearing masks and they are no longer washing their hands on their own as before. So, I would say people are reckless now and are back to their normal life **[Clinical Officer, IDI09 October 2020]**

Although not all health workers agreed with this, some reported patients were more cautious about prevention and cooperative when it came to mask wearing and hand washing for instance:

> Yes, there have been some changes. People are now wearing masks and they are also washing their hands. People are observing social distance. **[Clinical officer, IDI04, October 2020]**

Healthcare workers believed the change in patient behaviours was helped by the government mandating mask wearing in public spaces. Some health facilities refused to treat patients who were not wearing masks which meant patients modified their behaviour:

> People […] now obey all the measures that have been put in place at the facility such as wearing a face mask, [which] is mandatory either at the facility or when travelling. It has brought a great change because when we send them back, they inform others in their community. And now people prepare when coming to the hospital because they are afraid of being sent back without treatment […] **[Ground labourer, IDI01, August 2020]**

However, some frontline workers felt such punitive measures had unintended consequences. They reported that once patients started to be turned away, mask sharing became far more common undermining prevention efforts:

> We have however stopped sending them back because people were borrowing mask from each other which is a big problem. So now we just inform the village chiefs to inform their people to stop being reckless **[Clinical officer, IDI09, August 2020]**

Frontline workers felt public behaviour changed as community and religious leaders began to spread public health messages that dispelled rumours and encouraged people to use a mask:

> The number of people that are wearing masks has now increased a lot [From April 2020]. The change has resulted from the meeting we had at the hospital here with the village chiefs, where we explained to them that everyone should comply with the preventive measures being implemented at the hospital when coming to the hospital. Church leaders have also been encouraging people to wear masks. So our village chiefs and church leaders have also played a major part. **[Nurse, IDI12, August 2020]**

By September 2020, frontline workers reported rumours about COVID-19 vaccines being developed in the Global North that could cause harm to Malawians, which persisted when

vaccines became available. Rumours linked serious vaccine side effects including death, blood clots, losing fertility, or causing people to turn into animals. As noted here:

> Some people were saying that the vaccine is associated with 666 and some were saying that the vaccine is causing blood clotting, and some were saying that if you receive the vaccine you may turn into some animal. **[Health Surveillance Assistant, IDI15, Sept 2020]**
>
> I have heard rumours that getting the vaccine will shorten your life span. Some say that the vaccine will make you infertile. Others have been saying that the vaccine causes blood clot. These rumours have been circulating through social media, patients, and ordinary members of the public. **[Medical Assistant, IDI01, May 2021]**

As the vaccines were rolled out in March and April 2021, health workers reported widespread reluctance of both health workers and the wider community to vaccinate. Safety concerns and trust issues between the public and health care facilities administering the COVID-19 vaccine were reported, with rural facilities most affected. This impacted the provision of services such as of injectable contraceptives, which women felt were COVID-19 vaccine in disguise.

> What I have observed is that people are still finding it hard to understand this disease. And because of the COVID-19 vaccine people have been refusing to receive injection treatments, fearing they [health workers] might inject them with the COVID-19 vaccine. The turn up of patients coming for other services such as family planning services has decreased, and I would say that trust between health workers and the villagers when it comes to injections has declined. **[Clinical officer, IDI05, May 2021]**

However, over time, health workers did report changes in attitudes with people becoming more trusting and accepting towards the COVID-19 vaccine. This was linked to evidence of limited side effects through those that had vaccinated first. Additionally, working jointly with influential people such as chiefs and church leaders also made communities more receptive of the public health education that health workers were giving to encourage vaccine uptake.

People were encouraged to vaccinate after seeing that health workers and other government officials received the vaccine, and nothing happened to them. **[Nurse, IDI14, May 2021**.

We are working hand in hand with community leaders such as chiefs, and health advisory committees and churches, so that people get enough messages on COVID-19, and now they understand and accept. The health advisory committees act as a bridge between the health workers and the communities. **[Medical Assistant, IDI01, May 2021]**

In terms of gender, heath workers reported more men than women getting vaccinated:

'Who showed up more to vaccinate?' 'All the people I found there were men. (Medical assistant IDI26, August 2020).

Health workers linked this to some workplaces (including government offices) requiring all their staff to be vaccinated. This may reflect the fact less women are employed in these roles.

The number of people coming for the vaccine is increasing. We are hearing that some companies are demanding that their employees vaccinate if they want to keep their job. Some government companies are doing the same. That's perhaps why people are vaccinating more than before. **[Clinical officer, IDI06, May 2021]**

Impact of COVID-19 on routine health services

Frontline workers felt that the COVID-19 pandemic had negatively impacted provision of healthcare services. They cited cancellation of routine services such as screening for cervical cancer and HIV viral load as two of the most significant impacts.

It is very challenging. Actually, the entire system came to a halt because we are all focused on COVID-19. **[DHO representative, IDI August 2020]**

[…] recently some services have been stopped due to COVID-19, [e.g.] growth monitoring services, cervical cancer screening and [HIV] viral load services. **[Clinical Officer, IDI13, August 2020]**

We found a reduction in the number of patients attending outpatient services from April onwards, which corresponds with the first confirmed cases of COVID-19 in Blantyre District (Figure 1). However, the facilities did not suspend all services, rather adapted strategies for providing healthcare. For instance, people with HIV or TB normally received a three-month dosage but were getting prescriptions for six months. As one District Health Office representative narrated the reason for the modification was to reduce in-person consultations and decongest the clinics.

> Review clinics for HIV and TB patients have been extended, so instead of giving them medical supplies for 3 months we are giving them medicine supplies of 6 months so that we should try to reduce congestion and minimize time of contact with these patients. **[DHO representative IDI August 2020]**

Patients' attendance reduced for TB services (Figure 2) could therefore reflect the extended period for which clients received drugs as opposed to reduced attendance and should be assessed over a more prolonged period to determine if service delivery was affected.
We also found modifications in the way child vaccination was offered. Rather than following the immunisation calendar, mothers were grouped and assigned new vaccination dates.

> Those [in need of vaccination] have been divided into several groups and each group is told to come on their own specific day. **[Hospital attendant, IDI18, August 2020]**

Despite these efforts, and overall reduction in immunisation was seen in attendance records, particularly in relation to facilities located in urban areas. This may reflect the higher perceived risk of COVID-19 in urban contexts (Figure 3).
Similarly, delivery of reproductive health services was altered, with women accessing family planning given instructions to self-administer the injection at home. However, this strategy raised important questions about disposal and safety of used syringes and needles in the community.

> And when it comes to family planning; women are being trained to inject themselves at home so when they come here, we just give them all the required materials.
> **[Clinical officer, IDI21, August 2020]**

Adaptation of existing services may explain some of the reduction in access to family planning services as cases of COVID-19 were seen to increase (Figure 4). The pandemic interrupted the way daily facility data was being recorded. Data entry clerks, the staff responsible for completing daily registers, were not included in the risk allowance provided by the government. This led to long absences by this cadre from some of the facilities.

> Our department is still not receiving the risk allowances […] data officers were not working due to the same issue, but they have just accepted the situation and have resumed their work. **[Ground labour, IDI14. September 2020]**

As part of managing the risk of exposure, health workers reduced their days and the amount of time spent at the health care facility, alternating between the different weeks. Consequently, facilities closed earlier than normal, and this further impacted on patients travelling long distances to access care:

> The other thing is that we are told to work for a limited time which is less time than before, but that is challenging for the patients that can't make it to the hospital on time **[Hospital attendant, IDI04, August 2020]**

It is difficult to assess the impact the lack of data clerks may have had on the records maintained within health care facilities and reported here.

Improved work practices

Health workers also reflected on the positive lessons drawn from responding to COVID-19, reflecting that prevention measures had shaped their work practices in ways that could be useful for preventing other diseases in future:

> It has encouraged us to observe hygiene; previously we used to wash our hands only when we wanted to eat but now, we wash our hands regularly, after meeting each patient. We also wear PPE such as masks, aprons and gloves which we never used to do before COVID-19. We now observe social distancing. Social distancing protects us from a lot of other diseases such as TB and others that transmit through droplets. We will use masks even when COVID-19 is over. **[Medical assistant, IDI01, November 2020]**

The impact of COVID-19 on frontline workers

Frontline workers reported severe impacts on their well-being from working during the pandemic. They faced constant anxiety about the risk of exposure, which appeared to be two-fold. For non-clinicians, frontline workers articulated their concerns around regular contact with clinicians who were seeing the patients:

> I have worries because of the way things are right now […] I work at the clinic and sometimes I come into contact with the doctors and that worries me because you wonder if all the patients that were in contact with the doctors have the disease. **[Ground labourer, IDI03, September 2020]**

Secondly, they saw themselves as potentially exposing others to the same risk they were experiencing, and felt particularly concerned for their family members about this:

> I feel worried that I may infect my little child and my whole family should I be infected because it takes time for a person to notice if they have COVID-19. **[Clinical Officer, IDI04, September 2020]**

Stress and helplessness

There was a deep sense of helplessness among frontline workers about continuing to work during the pandemic. Some frontline workers narrated their desire for a break from work but felt powerless to act. Their lack of agency stemmed from a sense of social responsibility to work but also the need to provide for their families. For most frontline workers they continued to work because they could not afford to stop:

> I cannot quit my job despite having so many worries because the job is what gives me money for food. People are just going to work because they want to earn some money for food, but everybody is worried. **[Medical Assistant, IDI16, September 2020]**

Some frontline workers also drew inspiration to continue to work from the principles of humanitarianism and sacrifice. Responding to 'What motivates you to continue working despite the situation?' one said, 'The desire to assist people.' This demonstrates that facility workers felt an ethical duty to serve their communities despite the perceived risk:

> There is no way I can say we will stop going to work due to COVID-19, because that's our job, assisting people. So, there is no way the hospital would be closed because of the pandemic. **[Nurse, IDI10, August 2020]**

During July and August 2020, the Ministry of Health required all health workers to be tested for COVID-19. This led to a significant proportion of health care workers being diagnosed. The requirement for these health workers to self-isolate placed pressure and stress on staff in health care facilities who still needed to deliver services.

> We are working more than before the start of COVID-19 [...] because if say three workers test positive to the virus, they go on quarantine, leaving behind more work for their colleagues. **[Clinical officer, IDI21, September 2020]**

Wider community stigma

Across the dataset, we found consistent testimonies of frontline workers experiencing stigma within the wider community because they were perceived to be the ones spreading the virus. This may have been a result of the mass testing programme initiated by the government. In this quote, one front-line worker shared his experience of being ostracized by bus operators and fellow passengers simply because they were from the health service.

> We fail to board a minibus when going to work because people say we will infect them with the disease on the bus. […] this other day I was in my work uniform standing at the bus stop waiting to catch a minibus, but none of the buses stopped and other people at the bus stop started accusing me that I was the reason why the buses were not stopping." **[Ground labourer, IDI14, August 2020]**

To mitigate this situation the district health officer reported providing health workers with additional buses allowing them to get to work. Although only health workers were provided access to the buses with other frontline workers left to find their own way to work.

> They reported [the discrimination on public transport] to the head office and the office hired staff buses which were carrying only health workers. But after sometime, the buses stopped carrying them. **[Clinical officer, IDI13, September 2020]**

Tension between health workers at the healthcare facility was also reported. Fear of infection led to mistrust between health workers, particularly for those who were diagnosed having COVID-19.

> Some health workers diagnosed with COVID-19 were being ignored by fellow health workers, saying they will infect them, and that was affecting them psychologically. **[Clinical officer, IDI21, September 2020]**

Discussion

This mixed methods study took place during the COVID-19 pandemic, capturing real-time data around how primary health care facilities (a critical access point for patients) prepared for, and then responded to the pandemic. Exploring in-depth with a range of frontline workers how the COVID-19 pandemic affected their work practices and lives more broadly. Initial modelling predicted that Malawi would have a high rate of hospitalizations (up to 435,000) and deaths (with up to 50,000 deaths), but this did not materialise at the time of this study (17). As a low-income country, the COVID-19 pandemic and response took place in the context of severe resource constraints in terms of both health service delivery and infection prevention and control infrastructure. Our research found that despite this challenging context, primary healthcare facilities remained open, and patients continued to seek care, albeit in lower numbers. Notable we did not find significant differences between rural and urban facilities across either the availability and use of preventative measures, or the uptake of routine services. The DHO led the rapid roll out of COVID-19 related training to frontline health workers, implementing key COVID-19 preventative measures but this was inhibited both by the absence of materials and limited infrastructure. Nevertheless, across the interviews it was evident that the training improved awareness and understanding of health workers in relation to COVID-19 prevention and management of suspected cases. The numbers of people attending health care facilities was radically reduced, particularly during the first peak with some key services suspended. Frontline workers reported that patients were fearful and distrusting of the health system, particularly at the start of the pandemic. From October, there were concerns around the safety of the COVID-19 vaccine. Once vaccines were rolled-out health workers perceived that there was an impact on uptake of vaccines and fear from patients when they did present. Health care workers reported a gendered difference, with more men presenting for vaccination.

Although pragmatic guidance was published for low and middle income countries (29), case management of suspected COVID-19 cases at health care facilities was challenging, with limited staff available for patient consultations. The layout of health care facilities made managing patients, and reducing over-crowding while maintaining high hygiene standards throughout the clinic difficult. This was compounded by inadequate resourcing (including a lack of thermometers and access to isolation rooms). There was heavy reliance on the centralised team from the District Health Office to respond and handle all suspected cases, which overburdened this team.

In some health care facilities, an authoritarian approach to increase patient's adherence to mask wearing had a detrimental impact on prevention measures. We found that despite frontline health workers reported stress and anxiety of contracting COVID-19, the uptake of preventative measures including mask wearing was low, suggesting a complex relationship between knowledge and behaviour. Frontline workers reported significant stigmatisation and increased stress during work that impacted their lives.

The fear, stress and anxiety reported by frontline workers in our study reflects trends across the globe. Studies undertaken in a wide range of high-, middle-, and low-income contexts speak to devastating impact COVID-19 had on health care workers' psychosocial well-being (30,31). In sub-Saharan Africa, where health systems are more fragile, referral pathways are more complex and access to PPE challenging; all contributed further stress to health care workers. By including a wider cadre of staff including guards and patient attendants, we demonstrated that the psychosocial impact was not limited to frontline health care workers. Our work speaks to the urgent need to provide psychosocial support for all frontline and auxiliary workers.

Our findings on the reductions in patient attendance and the disruptions to routine health services reflect wider global trends. In Malawi, the pandemic has also seen increases in teenage pregnancies, as well as reductions in TB case detection (21,32,33). This has both immediate and future impacts on patient outcomes from preventable and treatable diseases leading to wider implications for wider economic and social development.

Malawi currently has vaccine coverage of 5.6% one of the lowest in the world (34). In Malawi, men are generally more likely to be employed than women (35), meaning mandatory workplace vaccination may have made men more likely to access the vaccine than women. Women's hesitancy to vaccinate was also centred around rumours related to both fertility and complications associated with contraceptives.

The importance of hand hygiene in the prevention of communicable diseases, including respiratory infections cannot be overemphasized, particularly with regard to COVID-19 and wider IPC interventions (36–38). Prior to this pandemic, WASH campaigns were emphasising the importance of hand washing with soap after toilet use and during consultations in healthcare facilities (39–41). However, opportunities for hand washing in this setting were rarely found, with reasons cited as lack of hand washing facilities, access to water, and the need for constant maintenance (39–41). Nevertheless, our results indicate that despite the provision of the necessary hand washing facilities and regular access to water, few health facilities made adequate hand washing stations with soap or sanitisers available at either toilets or other areas of the health care setting. Where they were available, their presence was intermittent meaning that adherence to recommended hand hygiene practice (hand washing with soap or use of hand sanitizer) was limited by patients, HCWs and auxiliary staff. By failing to utilise the handwashing facilities available to them (i.e., keeping provided buckets and soap in storage) health facility staff are indicating that they are either overburdened, or do not understand the value of hand washing with soap in COVID-19 prevention and IPC practices. This was a missed opportunity to promote effective hand washing with soap to the community members utilising the health care facilitates, as lack of proper hand hygiene in the healthcare facilities has been found to reflect inadequate handwashing at the household level (42,43), as WASH norms are shared in community settings (44). Research has demonstrated that the availability of WASH infrastructure (e.g. hand washing facility with soap) in accessible locations motivates behaviour performance, acts as a cue for action and enhances social norms (45). As such it is imperative that hand washing facilities are made accessible to all staff and patients to promote their effective use, and where possible supported with supervision, nudges and appropriate behaviour

change techniques to improve hand hygiene in healthcare settings both for the short and long term (46–48).

Overall clinical waste management was found to be well managed in the majority of health care facilities, with incineration of used masks being undertaken on a regular basis. However, as found in previous reports in Blantyre, some masks were disposed of into open pits which were potentially exposing community members to infection (49). A consistent and context appropriate response to clinical waste management is needed for all health care facilities to reduce the risk of infection transmission while taking into consideration the environmental impacts of disposal in the long term (49).

Despite the limited resource in these settings, the findings of our study indicate an effective cross sectoral approach over the ten month period of the pandemic, enabling the rapid deployment of materials to support preventative measures (e.g. masks, HWF) and vaccination, alongside structured guidance and training. However, we also expose the limitations of providing these resources and expecting their immediate implementation and sustained practice, where basic IPC practices were not already in place. Policy and programming should take advantage of the tipping point created by the pandemic to ensure long term sustained support and resource to these instrumental primary health care facilities, to facilitate the maintenance of effective IPC practices for not only COVID-19 but other communicable diseases as well.

Limitations

Our study has several limitations. As we were collecting data during the pandemic, we limited the time the study team was in the health care facilities. Qualitative interviews were conducted over the phone, which may have made it more challenging for the interviewer to build rapport with participants and inhibited their responses. The study focused on frontline workers, and we did not conduct interviews with patients, this means that findings around patient behaviour was filtered through frontline workers perspectives. Due to time and resource constraints, we only interviewed frontline workers at two time points, and only interviewed HC facilities in-charges for the last two time point. The views of HC facilities in charge may not be the same as frontline workers' experiences. Collecting data from health

care facility registers was challenging and required efforts to compare registers to centralised health management information records to ensure they were consistent. Longer term attendance data comparisons are also recommended to assess the impacts on key services.

Conclusion

Despite the significant challenges placed on health care facilities, they remained open and managed to maintain the majority of key services, albeit with reduced attendance. Although efforts were made to supply health care facilities with resources for COVID-19 prevention, there were limitations to their implementation (e.g. hand washing facility use with soap, mask wearing, etc). Complex factors seem to shape staff behaviours and knowledge did not always translate into practice. Providing additional supervision, support and training may lead to sustained adherence to preventative measures in the long term. Our study also speaks to the need to provide psychosocial support for all those working on the frontline in health facilities.

Acknowledgements

Thanks for Stevie Amos for the support in data management and analysis. This work was supported by the University of Strathclyde through the SFC GCRF Escalator Fund.

Author Contribution statement

Author	Contribution/Role in the study
Mackwellings Phiri	Data collection, analysis, paper writing
Eleanor MacPherson	Study design, lead, paper writing support
Mindy Penulo	Data collection, paper review
Kondwani Chidziwisano	Data analysis, paper writing support
Khumbo Kalua	Study lead, paper review
Chawanangwa Mahebere Chirambo	Data collection, paper review
Gift Kawalazira	Study lead, paper review
Zuziwe Gundah	Study lead, paper review
Penjani Chunda	Study lead, paper review
Tracy Morse	Study design, lead, paper writing support

Declaration of competing interest

The authors declare that there is no conflict of interest.

Data sharing

The data supporting results of this study are available on request from the Department of Civil and Environmental Engineering, University of Strathclyde (tracy.thomson@strath.ac.uk). For the qualitative research, we can provide second order summaries of transcripts to ensure anonymity of participants.

Figure 1

Outpatient service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

Figure 2

TB service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

Figure 3

Child health (including immunisation) service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

Figure 4

Family planning service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

References

1. Ahmed SAS, Ajisola M, Azeem K, Bakibinga P, Chen Y-F, Choudhury NN, et al. Impact of the societal response to COVID-19 on access to healthcare for non-COVID-19 health issues in slum communities of Bangladesh, Kenya, Nigeria and Pakistan: results of pre-COVID and COVID-19 lockdown stakeholder engagements. BMJ global health. 2020;5(8):e003042.

2. Chersich MF, Gray G, Fairlie L, Eichbaum Q, Mayhew S, Allwood B, et al. COVID-19 in Africa: care and protection for frontline healthcare workers. Globalization and Health. 2020;16:1–6.

3. Blanchet K, Alwan A, Antoine C, Cros MJ, Feroz F, Guracha TA, et al. Protecting essential health services in low-income and middle-income countries and humanitarian settings while responding to the COVID-19 pandemic. BMJ global health. 2020;5(10):e003675.

4. Pai M, Olatunbosun-Alakija A. Vax the world. Science. 2021;374(6571):1031–1031.

5. Wadvalla B-A. How Africa has tackled covid-19. bmj. 2020;370.

6. McGriff JA, Denny L. What COVID-19 Reveals about the Neglect of WASH within Infection Prevention in Low-Resource Healthcare Facilities. The American journal of tropical medicine and hygiene. 2020;103(5):1762–4.

7. WHO, UNICEF,. WASH in Health Care Facilities Global Baseline Report [Internet]. WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.; 2020. Available from: https://www.washdata.org/sites/default/files/documents/reports/2019-05/jmp-2019-wash-hcf-highlights-1.pdf

8. WHO,. Infection Prevention and Control during Health Care when Coronavirus Disease (COVID-19) Is Suspected or Confirmed. Geneva: World Health Organization; 2020. Report No.: WHO/2019-nCoV/IPC/2020.4.

9. Burki T. Global shortage of personal protective equipment. The Lancet Infectious Diseases. 2020;20(7):785–6.

10. Talisuna A, Yoti Z, Lee C, Frieden TR, Moeti MR. The urgent need for a global commitment to protect healthcare workers. BMJ Glob Health. 2020 Nov;5(11):e004077.

11. Rodríguez-Rey R, Garrido-Hernansaiz H, Bueno-Guerra N. Working in the Times of COVID-19. Psychological Impact of the Pandemic in Frontline Workers in Spain. International journal of environmental research and public health. 2020;17(21):8149.

12. Khanal P, Devkota N, Dahal M, Paudel K, Joshi D. Mental health impacts among health workers during COVID-19 in a low resource setting: a cross-sectional survey from Nepal. Globalization and health. 2020;16(1):1–12.

13. Roberton T, Carter ED, Chou VB, Stegmuller AR, Jackson BD, Tam Y, et al. Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: a modelling study. The Lancet Global Health. 2020;8(7):e901–8.

14. WHO,. COVID-19 hits life-saving health services in Africa [Internet]. WHO | Regional Office for Africa. [cited 2021 Jan 6]. Available from: https://www.afro.who.int/news/covid-19-hits-life-saving-health-services-africa

15. Mzumara GW, Chawani M, Sakala M, Mwandira L, Phiri E, Milanzi E, et al. The health policy response to COVID-19 in Malawi. BMJ global health. 2021;6(5):e006035.

16. Beloved Kaunga S. How have Malawi's courts affected the country's epidemic response? [Internet]. How have Malawi's courts affected the country's epidemic response? 2020

[cited 2020 Jan 21]. Available from: https://blogs.lse.ac.uk/africaatlse/2020/11/13/how-have-malawis-courts-law-affected-epidemic-response/

17. Kuunika. Mathematical Modeling of COVID-19 in Malawi. Lilongwe: Kuunkia;

18. Nordling L. The pandemic appears to have spared Africa so far. Scientists are struggling to explain why. Science [Internet]. 2020 Aug 20; Available from: https://www.sciencemag.org/news/2020/08/pandemic-appears-have-spared-africa-so-far-scientists-are-struggling-explain-why

19. Malawi: WHO Coronavirus Disease (COVID-19) Dashboard [Internet]. [cited 2021 Feb 9]. Available from: https://covid19.who.int

20. Mandolo J, Msefula J, Henrion MY, Brown C, Moyo B, Samon A, et al. SARS-CoV-2 exposure in Malawian blood donors: an analysis of seroprevalence and variant dynamics between January 2020 and July 2021. BMC medicine. 2021;19(1):1–10.

21. Soko RN, Burke RM, Feasey HR, Sibande W, Nliwasa M, Henrion MY, et al. Effects of coronavirus disease pandemic on tuberculosis notifications, Malawi. Emerging infectious diseases. 2021;27(7):1831.

22. Khuluza F, Haefele-Abah C. The availability, prices and affordability of essential medicines in Malawi: A cross-sectional study. Thet Wai K, editor. PLoS ONE. 2019 Feb 12;14(2):e0212125.

23. Zeng W, Sun D, Mphwanthe H, Huan T, Nam JE, Saint-Firmin P, et al. The impact and cost-effectiveness of user fee exemption by contracting out essential health package services in Malawi. BMJ Global Health. 2019 Apr 1;4(2):e001286.

24. Makwero MT. Delivery of primary health care in Malawi. Afr j prim health care fam med [Internet]. 2018 Jun 21 [cited 2020 Oct 7];10(1). Available from: https://phcfm.org/index.php/phcfm/article/view/1799

25. Ministry of Health Malawi,. Health Care System [Internet]. [cited 2020 Nov 3]. Available from: https://www.health.gov.mw/index.php/2016-01-06-19-58-23/national-aids

26. Government of Malawi,. National COVID-19 Preparedness and Response Plan. Lilongwe, Malawi: Government of Malawi;

27. Pope C, Mays N. Qualitative Research: Reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research. BMJ. 1995 Jul 1;311(6996):42–5.

28. Green J, Thorogood N. Qualitative methods for health research. sage; 2018.

29. Cobb N, Papali A, Pisani L, Schultz MJ, Ferreira JC, COVID–LMIC Task Force. Pragmatic Recommendations for Infection Prevention and Control Practices for Healthcare Facilities in Low-and Middle-Income Countries during the COVID-19 Pandemic. The American journal of tropical medicine and hygiene. 2021;tpmd201009.

30. Semo B, Frissa SM. The Mental Health Impact of the COVID-19 Pandemic: Implications for Sub-Saharan Africa. Psychol Res Behav Manag. 2020 Sep 3;13:713–20.

31. Conti C, Fontanesi L, Lanzara R, Rosa I, Porcelli P. Fragile heroes. The psychological impact of the COVID-19 pandemic on health-care workers in Italy. PloS one. 2020;15(11):e0242538.

32. UNICEF,. Malawi COVID-19 Situation Report [Internet]. Lilongwe, Malawi: UNICEF Malawi; 2020 Oct [cited 2022 Mar 25]. Available from: https://www.unicef.org/media/84831/file/Malawi-COVID-19-SitRep-21-October-2020.pdf

33. Thekkur P, Tweya H, Phiri S, Mpunga J, Kalua T, Kumar A, et al. Assessing the Impact of COVID-19 on TB and HIV Programme Services in Selected Health Facilities in Lilongwe, Malawi: Operational Research in Real Time. Tropical Medicine and Infectious Disease. 2021;6(2):81.

34. Reuters,. Reuters COVID-19 Tracker. Available from: https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/malawi/

35. Unlocking Malawi's Economic Growth by Bridging the Widening Gender Gaps in the labour workforce [Internet]. World Bank. [cited 2022 Mar 14]. Available from: https://www.worldbank.org/en/country/malawi/publication/unlocking-malawi-s-economic-growth-by-bridging-the-widening-gender-gaps-in-the-labour-workforce

36. WHO,. Advice for the public on COVID-19 – World Health Organization [Internet]. World Health Organization. [cited 2021 Jan 15]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public

37. Rabie T, Curtis V. Handwashing and risk of respiratory infections: a quantitative systematic review. Tropical medicine & international health. 2006;11(3):258–67.

38. Prüss-Ustün A, Bartram J, Clasen T, Colford Jr JM, Cumming O, Curtis V, et al. Burden of disease from inadequate water, sanitation and hygiene in low-and middle-income settings: a retrospective analysis of data from 145 countries. Tropical Medicine & International Health. 2014;19(8):894–905.

39. Wichaidit W, Biswas S, Begum F, Yeasmin F, Nizame FA, Najnin N, et al. Effectiveness of a large-scale handwashing promotion intervention on handwashing behaviour in Dhaka, Bangladesh. Tropical Medicine & International Health. 2019;24(8):972–86.

40. Luby SP, Halder AK, Huda T, Unicomb L, Johnston RB. The effect of handwashing at recommended times with water alone and with soap on child diarrhea in rural Bangladesh: an observational study. PLoS Med. 2011;8(6):e1001052.

41. Morse T, Tilley E, Chidziwisano K, Malolo R, Musaya J. Health Outcomes of an Integrated Behaviour-Centred Water, Sanitation, Hygiene and Food Safety Intervention–A Randomised before and after Trial. International journal of environmental research and public health. 2020;17(8):2648.

42. Luby SP, Halder AK, Tronchet C, Akhter S, Bhuiya A, Johnston RB. Household characteristics associated with handwashing with soap in rural Bangladesh. The American journal of tropical medicine and hygiene. 2009;81(5):882–7.

43. Chidziwisano K, Tilley E, Malolo R, Kumwenda S, Musaya J, Morse T. Risk factors associated with feeding children under 2 years in rural Malawi—a formative study. International journal of environmental research and public health. 2019;16(12):2146.

44. Cialdini RB, Trost MR. Social influence: Social norms, conformity and compliance. 1998;

45. Contzen N, Meili IH, Mosler H-J. Changing handwashing behaviour in southern Ethiopia: a longitudinal study on infrastructural and commitment interventions. Social science & medicine. 2015;124:103–14.

46. Seimetz E, Boyayo A-M, Mosler H-J. The influence of contextual and psychosocial factors on handwashing. The American journal of tropical medicine and hygiene. 2016;94(6):1407–17.

47. Hashi A, Kumie A, Gasana J. Hand washing with soap and WASH educational intervention reduces under-five childhood diarrhoea incidence in Jigjiga District, Eastern Ethiopia: a community-based cluster randomized controlled trial. Preventive medicine reports. 2017;6:361–8.

48. Brown J, Cairncross S, Ensink JH. Water, sanitation, hygiene and enteric infections in children. Archives of disease in childhood. 2013;98(8):629–34.

49. Tilley E, Kalina M. “We Are Already Sick”: Infectious Waste Management and Inequality in the Time of Covid-19, a Reflection from Blantyre, Malawi. Worldwide Waste: Journal of Interdisciplinary Studies. 2020;3(1).

Table 1: Summary of Qualitative Sampling

Health Facility	Location	Phase 1			Phase 2	
		July-August 2020	September 2020	November 2020	April-May 2021	August 2021
001clk	Rural	• Hospital Attendant (IDI04) • Medical Assistant (Clinic in charge) (IDI01) • Security Guard (IDI02) • Ground Labourer IDI03)	• Medical Assistant (Clinic in charge) (IDI01) • Ground Labourer (IDI03)	• Medical Assistant (Clinic in charge) (IDI01)	• Medical Assistant (Clinic in charge) IDI01) • Nurse (IDI28) • Clinician (IDI29)	• Medical Assistant (Clinic in charge) (IDI01
002mpm	Rural	• Clinical Officer (Clinic in charge) (IDI08) • Pharmacy Assistant (IDI06) • Ground Labourer (IDI14) • Health Surveillance Assistant (IDI15)	• Clinical Officer (Clinic in charge) (IDI08) • Ground Labourer (IDI14)	• Clinical Officer (Clinic in charge) (IDI08)	• Clinical Officer (Clinic in charge) (IDI08) • Nurse (IDI30) • Health Surveillance Assistant (IDI31)	• Clinical Officer (Clinic in charge) (IDI08)
003mdk	Rural	• Security Guard (IDI10) • Clinical Officer (Clinic in charge) (IDI23)	• Security Guard (IDI10) • Clinical Officer (Clinic in charge) (IDI23)	• Clinical Officer (Clinic in charge) (IDI23)	• Clinical Officer (Clinic in charge) (IDI23) • Nurse (IDI31) • Health Surveillance Assistant (IDI32)	• Clinical Officer (Clinic in charge) (IDI23)
004nmk	Rural	• Medical Assistant (Clinic in charge) (IDI26) • Hospital attendant (IDI25)	• Medical Assistant (Clinic in charge) (IDI26) • Hospital attendant (IDI25)	• Medical Assistant (Clinical in charge) (IDI26)	• Medical Assistant (Clinical in charge) (IDI26) • Nurse (IDI27) • Health Surveillance Assistant (IDI33)	• Nurse (IDI27)
005nrd	Urban	• Hospital Attendant (IDI18) • Security Guard (IDI2) • Nurse (Clinic in charge) (IDI11)	• Hospital attendant (IDI18) • Nurse (Clinic in charge) (IDI11)	• Nurse (Clinic in charge) (IDI11)	• Nurse (Clinic in-charge) (IDI11) • Health Surveillance Assistant (IDI34)	• Nurse (Clinic in-charge) (IDI11)

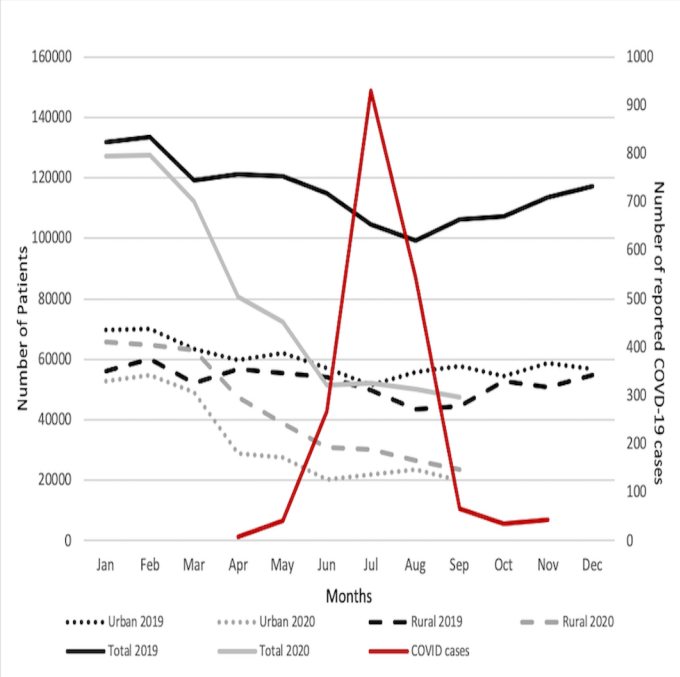
		• Data Clerk (IDI07)			• Nurse (IDI35)	
006gty	Urban	• Clinical Officer (Clinic in charge) (IDI19) • Ground Labourer (IDI09) • Nurse (IDI13)	• Clinical Officer (Clinic in charge) (IDI19) • Ground Labourer (IDI09)	• Clinical Officer (Clinic in charge) (IDI19)	• Clinical Officer (Clinic in-charge) (IDI19) • Nurse (IDI13) • Health Surveillance Assistant (IDI36)	• Nurse (IDI13)
007slz	Urban	• Nurse (Clinic in charge) (IDI12) • Hospital Attendant (IDI17) • Security Guard (IDI16)	• Nurse (Clinic in charge) (IDI12) • Hospital attendant (IDI17)	• Nurse (Clinic in charge) (IDI12)	• Nurse (Clinic in charge) (IDI12) • Clinical Officer (IDI37) • Nurse (IDI38)	• Nurse (Clinic in charge) (IDI12)
008bng	Urban	• Clinical Officer (Clinic in charge) (IDI21) • Clinician (IDI24) • Health Surveillance Assistant (IDI20)	• Clinical Officer (Clinic in charge) (IDI21) • Health Surveillance Assistant (IDI20)	• Clinical Officer (Clinic in charge) (IDI21)	• Clinical Officer (Clinic in-charge) (IDI21) • Clinician (IDI24) • Health Surveillance Assistant (IDI20)	• Clinical Officer (Clinic in charge) (IDI21)

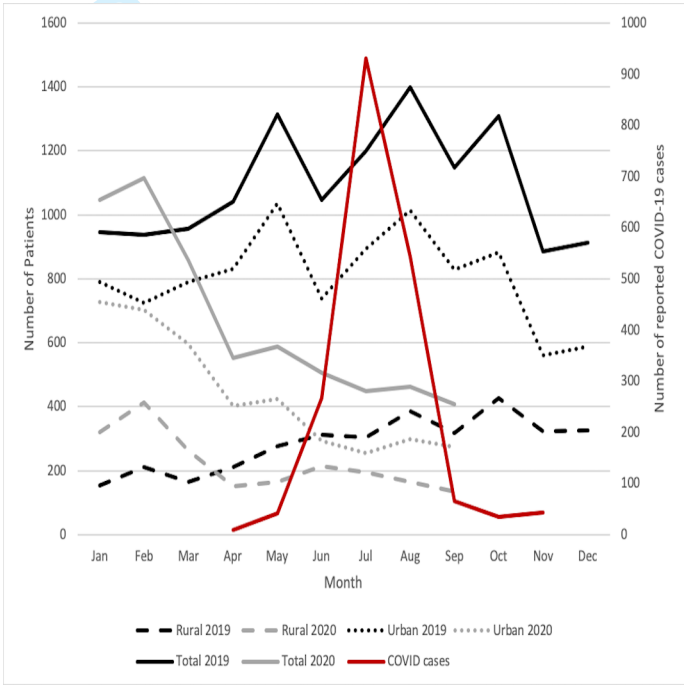
Table 2: Summary of COVID preparedness from 31 health facilities across Blantyre District from August – October 2020.

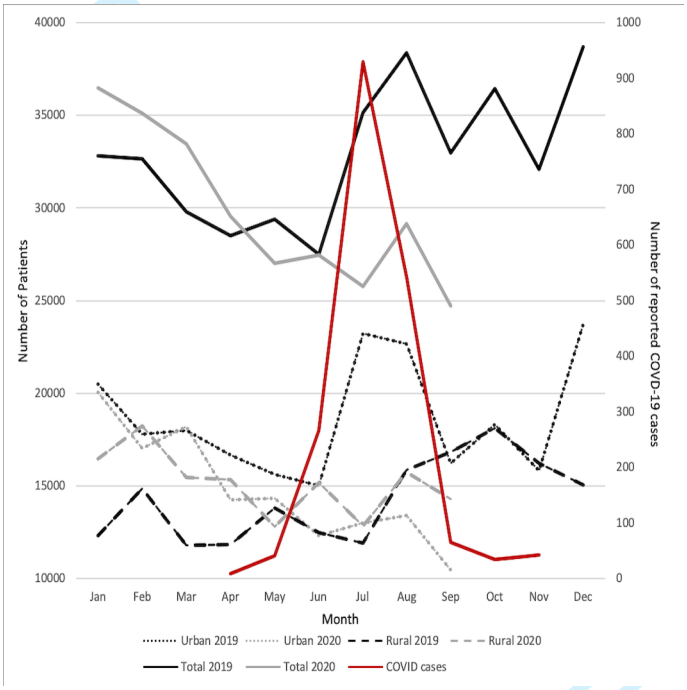
Staff training		August	September	October
All frontline workers	Percentage trained in COVID-19	51.6%	69.6%	80.4%
Hand washing		August	September	October
HWF at entrance	Percentage of facilities	32.3%	32.3%	32.3%
HWF at OPD	Percentage of facilities	71.0%	58.1%	54.8%
HWF HIV	Percentage of facilities	25.81%	22.58%	19.35%
HWF at EPI	Percentage of facilities	19.35%	6.45%	3.23%
HWF at Maternity / antenatal	Percentage of facilities	32.26%	32.26%	29.03%
HWF at toilets	Percentage of facilities	3.23%	0.00%	0.00%
HWF in consultation room	Percentage of facilities	32.26%	25.81%	9.68%
No. HWF per facility	Average number per facility	2.4	2.1	1.7
HWF with soap and water	Percentage with	32.0	29.5	14.9
HWF with water only	Percentage with	61.8	51.8	66.5
Hand sanitiser	Number with access (from 31)	3.0	2.0	0.0
Temperature checks		August	September	October
Thermometer available	Number with access (from 31)	9.0	8.0	4.0
Checks at entrance	Number of the 31 health facilities	0.0	1.0	0.0
Checks at waiting area	Number of the 31 health facilities	0.0	0.0	1.0
Checks in consultation room	Number of the 31 health facilities	8.0	7.0	0.0
Masks		August	September	October
Surgical masks available	Percentage of facilities with available	83.87%	100.00%	90.32%
N95 masks available	Percentage of facilities with available	38.71%	38.71%	35.48%
Mask wearing				
Health workers (non nursing)	Always wearing	25.8%	51.6%	19.4%
	Sometimes wearing	48.4%	45.2%	64.5%
	Not wearing	25.8%	3.2%	16.1%
Nurses	Always wearing	29.0%	51.6%	22.6%
	Sometimes wearing	38.7%	29.0%	54.8%
	Not wearing	32.3%	19.4%	22.6%
Auxiliary staff	Always wearing	6.5%	41.9%	12.9%
	Sometimes wearing	48.4%	35.5%	67.7%
	Not wearing	45.2%	22.6%	19.4%
Patients	Always wearing	0.0%	16.1%	3.2%
	Sometimes wearing	25.8%	64.5%	67.7%
	Not wearing	74.2%	19.4%	29.0%

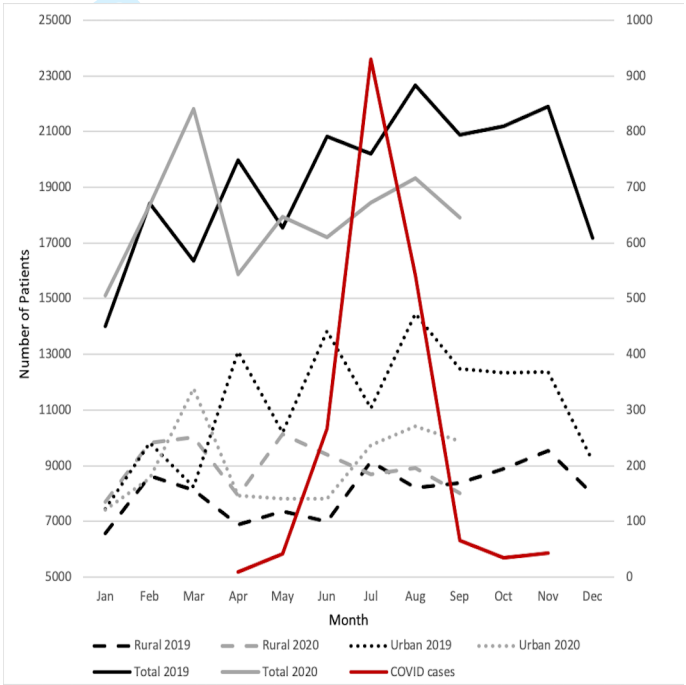
Guardians	Always wearing	0.0%	19.4%	3.2%
	Sometimes wearing	3.2%	58.1%	67.7%
	Not wearing	96.8%	22.6%	29.0%
Mask type				
Health workers (general)	Surgical	68.97%	76.9%	92.9%
	N95	27.59%	15.4%	7.1%
	Cloth	3.45%	7.7%	0.0%
Nurses	Surgical	80.8%	85.2%	96.0%
	N95	19.2%	14.8%	4.0%
	Cloth	0.0%	0.0%	0.0%
Auxiliary staff	Surgical	81.8%	85.2%	88.9%
	N95	18.2%	11.1%	3.7%
	Cloth	0.0%	3.7%	7.4%
Patients	Surgical	53.3%	41.0%	35.9%
	N95	0.0%	2.6%	7.7%
	Cloth	46.7%	56.4%	56.4%
Guardians	Surgical	50.0%	44.4%	36.8%
	N95	0.0%	2.8%	5.3%
	Cloth	50.0%	52.8%	57.9%
Waste management				
Pit	Number of the 31 health facilities	9	5	7
Incinerator	Number of the 31 health facilities	19	21	19
Open burning	Number of the 31 health facilities	3	5	5
Physical distancing		August	September	October
Physical distancing on arrival	Number of the 31 health facilities	9	14	6
	Word of mouth	54%	69.2%	100%
	Chairs spaced	38%	15.4%	0%
	Floor markings	8%	15.4%	0%
Physical distancing in waiting area	Number of the 31 health facilities	13	18	13
	Word of mouth	41%	45.0%	52.9%
	Chairs spaced	41%	30.0%	41.2%
	Floor markings	18%	25.0%	5.9%
Physical distancing in consultation area	Number of the 31 health facilities	16	17	14
	Word of mouth	50%	33.3%	0.0%
	Chairs spaced	50%	66.7%	91.7%
	Floor markings	0%	0.0%	8.3%
Physical distancing in wards	Number of the 31 health facilities	6	2	1
	Word of mouth	37.50%	0.0%	0.0%
	Chairs spaced	62.50%	100.0%	100.0%
	Floor markings	0%	0.0%	0.0%

Case management		August	September	October
Isolation room	Number of the 31 health facilities	3	4	4
Presence of suspected cases	Number of the 31 health facilities	12	15	19
Action to take when case is available	Give a mask	11.11%	17.24%	17.07%
	Isolation	37.04%	31.03%	29%
	Call covid-19 team at DHO	40.74%	44.83%	29%
	Call hotline number	3.70%	0.00%	0%
	Other	7.41%	6.90%	24%


160000
140000
120000
100000
80000
60000
40000
20000
0
Number of Patients
1000
900
800
700
600
500
400
300
200
100
0
Number of reported COVD-19 cases
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Months
Urban 2019
Urban 2020
Rural 2019
Rural 2020
Total 2019
Total 2020
COVID cases


1600
1400
1200
1000
800
600
400
200
0
Number of Patients
1000
900
800
700
600
500
400
300
200
100
0
Number of reported COVID-19 cases
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Rural 2019
Rural 2020
Urban 2019
Urban 2020
Total 2019
Total 2020
COVID cases


40000
35000
30000
25000
20000
15000
10000
Number of Patients
1000
900
800
700
600
500
400
300
200
100
0
Number of reported COVD-19 cases
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Urban 2019
Urban 2020
Rural 2019
Rural 2020
Total 2019
Total 2020
COVID cases


25000
23000
21000
19000
17000
15000
13000
11000
9000
7000
5000
1000
900
800
700
600
500
400
300
200
100
0
Number of Patients
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Rural 2019
Rural 2020
Urban 2019
Urban 2020
Total 2019
Total 2020
COVID cases

HEALTH FACILITY CHARACTERISTICS

Health facility name	Health facility Location	number of healthcare workers		Number of auxiliary staff	Population of catchment area
		Number of nurses	Number of clinicians		
Mpemba	Rural	7	2	19	20,619
Dziwe	Rural	5	3	32	18,886
Chabvala	Rural	3	2	25	13,746
Chileka SDA	Rural	3	2	26	17,240
Lundu	Rural	5	3	26	27,164
Namikoko	Rural	3	2	19	9,675
Makata	Rural	2	2	27	36,213
Kadidi	Rural	4	4	21	20,414
Gateway	Urban	15	10	43	No records available
Mbayani	Urban	6	2	49	74,102
Chirimba	Urban	6	5	45	61,093
Ndirande	Urban	31	11	80	131,353
Malabada	Rural	6	3	42	No records available
Chikowa	Rural	6	6	36	36,174
Chileka	Rural	19	7	62	30,803
Mdeka	Rural	8	3	37	33,406
Lirangwe	Rural	9	3	40	28,896
Madziabango	Rural	6	2	33	9,901
South Lunzu	Urban	21	11	25	89,963
Pensulo	Rural	4	1	29	16,245
Mitsidi	Rural	5	2	40	No records available
Zingwangwa	Urban	21	9	71	141,123
Limbe	Urban	21	11	95	77,108
Ameca	Rural	6	3	20	No records available
Light House	Urban	0	1	10	No records available
Bangwe	Urban	21	10	98	203,022
Makhetha	Urban	7	3	37	62,919
Mpingo	Rural	3	0	16	9,780
Chimembe	Rural	5	2	16	20,088
Soche Maternity	Rural	3	2	33	15,948
Chilomoni	Urban	21	8	55	76,030

Summary of COVID preparedness from 31 health facilities across Blantyre District (Urban vs Rural) from August – October 2020

		Urban			Rural		
Staff training		August	September	October	August	September	October
All frontline workers	Percentage trained in COVID-19	41.10%	67.10%	80.70%	63.10%	73.80%	84.70%
Hand washing		August	September	October	August	September	October
HWF at entrance	Percentage of facilities	33.33%	33.3%	25.0%	36.8%	37%	42.1%
HWF at OPD	Percentage of facilities	67%	33.3%	41.7%	68.4%	74%	78.9%
HWF HIV	Percentage of facilities	8%	16.67%	8.33%	31.58%	26%	31.58%
HWF at EPI	Percentage of facilities	8%	0.00%	0.00%	26.32%	11%	5.26%
HWF at Maternity / antenatal	Percentage of facilities	17%	8.33%	33.33%	73.68%	68%	47%
HWF at toilets	Percentage of facilities	0%	0.00%	0.00%	10.53%	0%	0%
HWF in consultation room	Percentage of facilities	25%	33.33%	8.33%	36.84%	26%	11%
No. HWF per facility	Average number per facility	1.58	1.25	1.27	2.54	2.22	2.11
HWF with soap and water	Percentage with	31.58%	28.57%	28.57%	46.00%	44.44%	33.33%
HWF with water only	Percentage with	68.42%	64.29%	71.43%	52.00%	55.56%	66.67%
Hand sanitiser	Number with access (from 31)	2	1	0	1	1	0
Temperature checks		August	September	October	August	September	October
Thermometer available	Number with access (from 31)	1	4	2	8	4	2
Checks at entrance	Number of the 31 health facilities	0	1	0	0	0	0
Checks at waiting area	Number of the 31 health facilities	0	0	0	0	0	1
Checks in consultation room	Number of the 31 health facilities	1	3	0	7	4	0
Masks		August	September	October	August	September	October
Surgical masks available	Percentage of facilities with available	91.67%	100.00%	83.33%	84.21%	100.00%	89.47%
N95 masks available	Percentage of facilities with available	16.67%	25.00%	66.67%	52.63%	42.11%	42.11%

Mask wearing							
Health workers (non nursing)	Always wearing	41.67%	50.00%	8.33%	15.79%	47.37%	26.32%
	Sometimes wearing	58.33%	50.00%	83.33%	42.11%	47.37%	57.89%
	Not wearing	0.00%	0.00%	8.33%	42.11%	5.26%	15.79%
Nurses	Always wearing	27.27%	50.00%	25.00%	26.32%	42.11%	26.32%
	Sometimes wearing	63.64%	16.67%	66.67%	31.58%	36.84%	47.37%
	Not wearing	9.09%	33.33%	8.33%	42.11%	21.05%	26.32%
Auxiliary staff	Always wearing	16.67%	50.00%	0.00%	5.26%	36.84%	21.05%
	Sometimes wearing	50.00%	41.67%	25.00%	47.37%	31.58%	63.16%
	Not wearing	33.33%	8.33%	75.00%	47.37%	31.58%	15.79%
Patients	Always wearing	0.00%	33.33%	0.00%	0.00%	5.26%	5.26%
	Sometimes wearing	41.67%	66.67%	91.67%	21.05%	57.89%	57.89%
	Not wearing	58.33%	0.00%	8.33%	78.95%	36.84%	36.84%
Guardians	Always wearing	0.00%	41.67%	0.00%	0.00%	5.26%	5.26%
	Sometimes wearing	8.33%	41.67%	91.67%	5.26%	57.89%	57.89%
	Not wearing	91.67%	16.67%	8.33%	94.74%	36.84%	36.84%
Mask type							
Health workers (general)	Surgical	74.43%	80.00%	84.62%	76.92%	66.67%	94.12%
	N95	28.57%	13.33%	15.38%	23.08%	22.22%	5.88%
	Cloth	0.00%	6.67%	0.00%	0.00%	11.11%	0.00%
Nurses	Surgical	76.92%	88.89%	91.67%	84.62%	78.95%	93.33%
	N95	23.08%	11.11%	8.33%	15.38%	21.05%	6.67%
	Cloth	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Auxiliary staff	Surgical	77.78%	83.33%	75.00%	84.62%	86.67%	100.00%
	N95	22.22%	8.33%	8.33%	15.38%	13.33%	0.00%
	Cloth	0.00%	8.33%	16.67%	0.00%	0.00%	0.00%
Patients	Surgical	42.86%	40.91%	35.00%	80.00%	42.86%	38.10%
	N95	0.00%	4.55%	10.00%	0.00%	0.00%	4.76%
	Cloth	57.14%	54.55%	55.00%	20.00%	57.14%	57.14%

Guardians	Surgical	50.00%	50.00%	40.00%	50.00%	42.86%	36.84%
	N95	0.00%	0.00%	5.00%	0.00%	4.76%	5.26%
	Cloth	50.00%	50.00%	55.00%	50.00%	52.38%	57.89%
Waste management		August	September	October	August	September	October
Pit	Number of the 31 health facilities	6	4	2	3	1	5
Incinerator	Number of the 31 health facilities	6	13	10	3	8	9
Open burning	Number of the 31 health facilities	0	3	0	3	2	5
Physical distancing		August	September	October	August	September	October
Physical distancing on arrival	Number of the 31 health facilities	5	6	3	4	8	3
	Word of mouth	50%	66.67%	25.00%	40.00%	75.00%	66.67%
	Chairs spaced	38%	16.67%	0.00%	60.00%	0.00%	0.00%
	Floor markings	13%	16.67%	0.00%	0.00%	25.00%	33.33%
Physical distancing in waiting area	Number of the 31 health facilities	7	9	6	6	9	7
	Word of mouth	45.46%	33.33%	42.67%	28.57%	50.00%	55.56%
	Chairs spaced	27.27%	16.67%	8.33%	74.43%	25.00%	0.00%
	Floor markings	27.27%	41.67%	33.33%	0.00%	25.00%	44.44%
Physical distancing in consultation area	Number of the 31 health facilities	9	6	5	7	11	9
	Word of mouth	54.55%	25.00%	0.00%	50.00%	26.67%	20.00%
	Chairs spaced	45.46%	50.00%	41.67%	50.00%	73.33%	70.00%
	Floor markings	0.00%	0.00%	0.00%	0.00%	0.00%	10.00%
Physical distancing in wards	Number of the 31 health facilities	1	0	0	2	2	1
	Word of mouth	100.00%	0.0%	0.0%	33.33%	0.00%	0%
	Chairs spaced	0.00%	0.0%	0.0%	66.67%	100.00%	100%
	Floor markings	0.00%	0.0%	0.0%	0.00%	0.00%	0%
Case management		August	September	October	August	September	October
Isolation room	Number of the 31 health facilities	1	2	2	2	2	2
Presence of suspected cases	Number of the 31 health facilities	8	8	8	4	7	11

Action to take when case is available	Give a mask	11.11%	0.00%	11.11%	16%	8.70%	10.53%
	Isolation	33.33%	16.67%	44%	32%	30.43%	31.58%
	Call covid-19 team at DHO	33.33%	50.00%	33%	35%	34.78%	31.58%
	Call hotline number	0.00%	16.67%	0%	10%	13.04%	5.26%
	Other	22.22%	16.67%	11%	3%	13.04%	21.05%

Appendix 7: **Health Centre Assessment Questionnaire**

District:_____Date:_____

Dispensary/Health centre Name: _____

Facility ID NO: _____

GPS Coordinates:

Observations

No	Question	Responses
1	What is the distance (in kilometres) from the "district hospital" to this health facility?	☐☐☐ Kilometres
2	Type of road reaching the health facility	☐ Dirty small road ☐ Improved large road (paved)
3	Is there cell phone coverage at the health facility	☐ Yes ☐ No
4	Visible Hand washing facility at the health facility	☐ None ☐ Yes with Soap and water ☐ Yes with no soap
5	Temperature Check	☐ Yes present and working ☐ Thermometer present but not working ☐ Thermomter present but not used ☐ Not present
6	Type of masks HCW wearing	☐ Surgical Masks ☐ N95 ☐ Home made
7	Do they have COVID -19 leaflets (any other sensitisation messages) available	Yes/No
8	How are gloves, masks waste being disposed	BIN PIT Open Space

9	Observe if there are adhering to physical distance between a. Patient to patient b. Patient to attendant/health care worker c. Health care worker to health care worker	Yes/No
10	Staff wearing face masks /face shield	Nurses Yes /NO or some ---------- Medical assistants Yes/No or some ---------- HSAs Yes/No or some---------- Cleners Yes /No or some---------- Pharmamcy Yes /NO or some ---------- Security Patients assistants Ground labourers
11	Water source at the health facility	
12	Hand washing points	
13	Latrines att the facility	
14	Isolation space	

Collect monthly Total Number of Patients attended at the facility;

No	2019	Number of patients	2020	Number of patients
1	January		January	
2	February		February	
3	March		March	
4	April		April	
5	May		May	
6	June		June	
7	July		July	
8	August		August	
9	September		September	

10	October		October	
11	November		November	
12	December		December	

SECTION A: Human Resource

Ask for Number of total health workers at the health facility according tto cadre		**Total Number**	**Number present today**
1.	Clinical Officers		
2.	Nurses/midwives		
3.	Patients Attendants/		
4.	Health surveiallance assistants		
5	Hospital Attendant/Maid/Cleaners		
6	Security officers		
7	Medical Assistants		
8	Data clerk		
9	Pharmacy Assistant		
10	Ground Labourers		
11	Counsellors		

Training

Number of total health workers at the health facility who were trained in COVID-19

Cadre	**Number Trained**	**When were they trained**	**Who trained them**	**What areas were they trained**
Clinical Officers			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)

Nurses/midwives			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management
Patients Attendants/			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Health surveiallance assistants			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Hospital Attendant/maid/Cleaners			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Security officers			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Medical Assistants			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Data clerk			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Pharmacy Assistant			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)

Ground Labourers			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Counsellors			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)

Does the facility has a working shift schedule for diffèrent cadres

Cadre	**Yes/No**	**How many per shift**
Clinical Officers		
Nurses/midwives		
Patients Attendants/		
Health surveiallance assistants		
maid/Cleaners		
Security officers		
Medical Assistants		
Data clerk		
Pharmacy Assistant		
Counsellors		
Ground Labourers		

SECTION B : Disease Control

Question	**Options**	**How many (Qty) This should refer to in-Stock?**

Do you have the following Supplies; Soap Hand sanitizer Buckets Masks. 1. N95 2. Surgical Masks Maternity Aprons Plastic Aprons Face Shields Gloves Gumboots	Is it available (Yes/No)	_____
Do you do health talks about COVID-19		_____
If yes how frequent	Daily Once a Week More than once a week Other (Specify)	_____
If yes how is the health talk delivered	During morning sessions During consultation As we are waiting Using Mass Media (e.g. TV)	_____
How do you do contact tracing		_____
In the last month did you have patients you could not treat because your health facility run out of supplies		_____

If yes, which supplies were out of stock Soap Sanitizer Washing facilitlities Masks. 1. N95 2. Surgical Masks Maternity Aprons Plastic Aprons Face Shields Gloves Gumboots		_____
When you run out of stock of supplies, how long does it take for stock to be re-supplied.		_____
When are you expecting the other supplies?		_____
What further questions do you ask a suspected case	_____	
Then what do you do when you find a suspect	Give a mask Isolation Call the COVID-19 team at DHO Call HOTLINE Number Other (Specify)	
What is the hotline number for COVID 19		
Do you have a contact person for COVID19 at facility level? If yes, what is their name and phone number?	Name: Number :	

Which services do you provide as a facility;	- OPD (include malaria etc) - General Counseling - Family Planning - Sti Services - Ante-Natal, Delivery And Post-Natal Care Services - Prevention Of Mother To Child Transmission Of Hiv (Pmtct) - Treatment Of Sexual Abuse (Including Pep) - Post Abortion Care (Pac) - ART Services - HTC - Cancer Screening Other:_____	
In the last three months, which services were you not able to provide	- OPD (include malaria etc) - General Counseling - Family Planning - Sti Services - Ante-Natal, Delivery And Post-Natal Care Services - Prevention Of Mother To Child Transmission Of Hiv (Pmtct) - Treatment Of Sexual Abuse (Including Pep) - Post Abortion Care (Pac) - ART Services - HTC - Cancer Screening Other:_____	

Which service are you currently providing	- Opd - General Counseling - Family Planning - Sti Services - Ante-Natal, Delivery And Post-Natal Care Services - Prevention Of Mother To Child Transmission Of Hiv (Pmtct) - Treatment Of Sexual Abuse (Including Pep) - Post Abortion Care (Pac) - Art Services - Htc - Cancer Screening Other:_____	

What are the usual source of electricty at this health facility.	☐ ESCOM ☐ Functioning generator ☐ Solar ☐ Other (please specify) ☐ No reliable source of electricity
When the usual source of electricty is not available what supplemental source do you have? ***Please select only one answer***	☐ Generator ☐ IPS (rechargeable battery) ☐ Solar ☐ No supplemental source ☐ Other (specify)
What are the main sources of water at the health facility	☐ Tap ☐ Borehole ☐ Well must be fetched from elsewhere
Do you have latrines at the facility? If Yes, How are they distributed?	☐ At least 2 latrines (at least one each for men and women) ☐ 1 latrine ☐ No latrines

Impact of COVID-19 on health centre service delivery in urban and rural Malawi

Topic guides: In-depth Interviews (front-line health workers)

Due to the iterative nature of qualitative research, the interviews that we conduct with participants will be open-ended and iterative, limiting the extent to which the content and direction of interviews can be fully anticipated. However, the topic guide provides a guide to the themes and questions that will be discussed with front-line staff at health care clinics. We will refine and update the topic guides as new themes will be discussed with each group of participants, which will be refined in response to new themes and findings that emerge.

First round

Demographics
Role at the clinic:
Age:
Birth place:
Highest qualification:
Length of time in post:
Length of time working in health care:

Theme 1: Experiences of delivering care

- Can you tell me about your day to day work? (explore how many patients they normally see at the clinic, what are the most frequent illnesses they treat, any challenges with stockouts)
- If you think back over the two months, have you seen any changes at the clinic? (probe around the number of patients coming to the clinic, incorporating new practices into their work including new screening practices, length of day, changes in the illnesses they are seeing and any differences in stockouts)
- Looking forward what do you think is likely to change in the coming months in relation to delivering care to patients?

Theme 2: Provision of support

- Have you been provided with any specific support to work during COVID? (if they say yes, probe around what this is, and whether it has had any impact on day to day work practices)

Theme 3: Risk perception and COVID-19

- What do you think are the biggest risks in your life? (probe around inside and outside of work)
- If you look back two months to now, how do you feel about coming to work? (is there anything you feel more worried about? Anything you feel less worried about?)
- What do you know about COVID-19? (probe around how it is transmitted, whether they see any specific groups at risk, what practices people can put in place to avoid becoming infected)
- Do you see yourself as at risk of COVID-19? (if they do, where to they see this risk is coming from, does it link to any specific procedures)
- If they do see themselves at risk of COVID-19 are they doing anything to protect themselves?

Second round

Theme 1: Experiences of delivering care

- If you think back during the first wave of COVID, have you seen any changes at the clinic?
    - Explore whether the number of patients coming to the clinic has increased or reduced (probe what influences people to or not come)
- If at all, what is the impact of the second wave of COVID on health service delivery?
    - Probe whether health service delivery has been reduced or not, what changes have brought in reduction in service delivery or what has caused an increase in service delivery)
    - Probe on what services have been affected in the second wave and why?
      Probe whether there have been changes in the way patients are managed, what have brought in changes in patient management

Impact of COVID-19 on health centre service delivery in urban and rural Malawi

Topic guides: In-depth Interviews (front-line health workers)

- Explore whether there have been new practices incorporated into their work (including screening practices, changes in the ways patients are managed)

Theme 2: Infrastructural support for COVID response

WASH

- What type of hand washing facilities do you have in place at the moment at the HF
  - Buckets with taps:
    - Quantity (being used and in storage)
    - Location (multiple areas)
  - Piped water to permanent sinks:
    - Quantity (functioning)
    - Location
  - None
  - Other
- Has anything changed in terms of hand washing facilities since the first wave for example: now have piped water supply, piped water not working so using buckets?
  - Have any of these changes led to specific challenges at the clinic?
  - Have any of these changes led to improvements or benefits to the clinic?

- If you are using or have movable systems such as buckets with taps were they:
  - At the HF before COVID was an issue
  - Provided during the first wave of COVID and now not available – if no why not?
  - Provided during the first wave of COVID and still being used
  - Provided during the first wave of COVID and not being used – if not why not?
  - Not provided – why (already have piped supply, not known etc)
  - Do you have some of the buckets for handwashing stored in the storage room (if yes, probe for reasons).
- Do you have any soap available for hand washing?
  - Had during first wave but not now – why?
  - Yes have it available and being used now – why is it available now?
  - Yes have it available but not being used
- Who is the soap made available to:
  - Everyone
  - Staff only – if this is the case why?
  - Where is the soap from (personal, purchase, supplied etc)
  - Is the soap available all the time (if no, probe for reasons)
- Is the soap available even when the facility is closed for the patient guardians or support staff (e.g. security guards)
- Do they think that washing hands with water only is the same as washing hands with soap – in general and specifically related to COVID
- Do you have access to hand sanitiser at all?
  - Where is it from (personal purchase, supplied, etc)
  - Is the sanitizer available all the time (if no, probe for reasons)
  - Who has access to it? (clinical staff, all frontline workers, everyone)
  - Do you think hand sanitiser is the same, more or less effective than hand washing with soap? Why?

Client management

- Are there any checks on patients as they arrive at the clinic – what are they, what happens if someone fails the checks (e.g. temperature, clinical symptoms etc)
- What happens when there is suspected case of COVID?
- Is there any system of physical distancing at the facility? (arrival, waiting area)
  - What is it and how effective do you think it is?

Impact of COVID-19 on health centre service delivery in urban and rural Malawi

Topic guides: In-depth Interviews (front-line health workers)

- What are the challenges?
- If there is no distancing why is it not done?

- Are thermometers available to check the clients?
  - What type of thermometers are they?
  - Where at the facility is the temperature check conducted?

Masks

- Does the facility have masks available for frontline workers?
  - What type - explore for multiple types and whether they are different for different cadre of staff i.e. health workers, patient attendants or security guards
  - Are people using them – explore who is using what, why using and why not using
  - Are clients/patients arriving wearing masks? What type? What happens if they are not?
  - For those using masks, are they using them properly (i.e. cover nose and mouth).

Theme 3: Risk perceptions and COVID-19

Perceived danger about COVID-19

- What are your perceptions on COVID-19? (What do they think might happen to you or your family should you be infected? Are you concerned about disease complications? Are you worried about loss of income or job because of illness due to COVID-19?
- Have you changed any aspects of your work practice due to COVID-19?
- Have you ever missed work because of illness or testing COVID positive?
- Have you considered missing work because of fear of being exposed? (If they were COVID positive, what did that mean to them?)
- If you think back during the first wave of COVID, how do you feel about coming to work?
  - Is there anything you feel more worried about than before?
  - Anything you feel less worried about than before?

- What do you think are the patients' or people in the wider community's perceptions on COVID-19?
  - Have you seen an increase in fear from patients coming to the clinic? (probing around rumours about COVID?)
  - Have patients asked any questions around COVID-19 during their time at the clinic? If so what kinds of questions are they asking?
  - Are people in the wider community asking you about COVID-19, are you hearing any rumours around fear of getting infected?
  - Have you seen changes from the first and second wave?

Perceptions of the vaccine

- Have you accessed the vaccine?
  - If yes probe around whether this has impacted on feelings about going to work or work practice?
- Have you heard any rumours around the vaccine?
  - If yes can you describe what they relate to?
  - Who are you hearing these rumours from – patients, family members?
  - Do you think the rumours have impacted on people attending the clinic?
  - Is there anything you think can be done to address the rumours (only ask this if they report hearing rumours)

Third round

For this round of interviews we will be focusing on the in-charges of the 8 facilities we have sampled. Reviewing the transcripts we will ensure we follow up on any unanswered questions and target the guide to each in-charge (or clinician)

- How has your clinical practice changed with COVID-19? [probe around commitment to practicing safety (e.g. use of PPE), interaction with patients]
  - Looking to the future are there things you will continue to do?

Impact of COVID-19 on health centre service delivery in urban and rural Malawi

Topic guides: In-depth Interviews (front-line health workers)

- How have practices and procedures in the clinic changed? (probe around strategies for preventing overcrowding of patients e.g. opening the clinic earlier, alternative methods of delivering services e.g. women administering contraceptives themselves)
    - Looking to the future do you think these are likely to continue?
- How has the clinic been implementing the health communication about COVID-19?
    - What communication strategies the clinic used? (probe around community engagement and the role of chiefs/churches in disseminating COVID-19 information)
    - If any, what challenges they encountered with communication?
- What has been the impact of the health communication?
    - How has the communication shaped people's behaviours and practices?
- What do you think will be the long-term impacts of the health communication about COVID-19?
    - Looking to the future how do you think people will react should the virus resurface?

Fourth round

Changes in clinic responses to COVID-19

- Can you tell me if there have been any new developments at the clinic in terms of responding to the COVID-19 situation? (Probe whether clinic attendance, handwashing, use of PPEs/masks, social distancing has changed. What led to the change? What's the impact of the change?)

Health workers' job satisfaction and motivation during COVID-19

- What do you think about your current working conditions? (What motivates you or discourages you to work during this time? If at all, does it affect your behaviour towards your work? If yes, in what way?
- Do you get allowances on your job? If yes or no, how does it impact on your behaviour towards your work?)

Psychosocial impacts of COVID-19 on health workers and coping mechanisms

Perceived danger about COVID-19

- What are your perceptions on COVID-19? (What do they think might happen to you or your family should you be infected? Are you concerned about disease complications? Are you worried about loss of income or job because of illness due to COVID-19?
- If at all, does feeling at risk impact your behaviour towards your work? If yes, in what way?
- Have you ever missed work because of illness or testing COVID positive, or considered missing work because of fear of being exposed? (If they were COVID positive, what did that mean to them?)
- What do you think are the patients' or people's perceptions on COVID-19? (Do they feel at risk? If yes, in what way do they think they might get infected? Or who do they think might infect them? What are the consequences of them being infected? If no, why do they feel in this way?

Social stigma and self-stigma about COVID-19

- How does the perception of being at risk of COVID-19 make you feel? (Are you concerned about infecting other people? Do you feel you might infect others if you have the virus? If at all, does this affect how you interact with other people both at and outside of work (families, patients)?
- Based on your personal experiences, how do people perceive health workers with regards to COVID-19? (What reactions do you get from the public when it comes to COVID-19? Any changes in how people interact with you or other health workers in the community or at the clinic? How does this make you feel? [Probing in this one around whether they have experienced any abuse or anger from the community more broadly]

Social support for health workers during COVID-19

- Are you receiving any support to deal with the negative impacts of COVID-19? (If yes, what kind of support, where does the support come from?)

Is there any support you would like to receive regarding dealing with the negative impacts of COVID-19?

Impact of COVID-19 on health centre service delivery in urban and rural Malawi

Topic guides: In-depth Interviews (front-line health workers)

Fifth round

Focusing on the in-charges of the 8 facilities we have sampled, following up on any unanswered questions, and targeting the guide to each in-charge.

Theme 1: Impacts of COVID-19 on healthcare practices

- How has your clinical practice changed with COVID-19? [probe around commitment to practicing safety (e.g. use of PPE), interaction with patients]
    - Looking to the future are there things you will continue to do?
- How have practices and procedures in the clinic changed? (probe around strategies for preventing overcrowding of patients e.g. opening the clinic earlier, alternative methods of delivering services e.g. women administering contraceptives themselves)
    - Looking to the future do you think these are likely to continue?

Theme 2: Public health communication and long-term impacts

- How has the clinic been implementing the health communication about COVID-19?
    - What communication strategies the clinic used? (probe around community engagement and the role of chiefs/churches in disseminating COVID-19 information)
    - If any, what challenges they encountered with communication?
- What has been the impact of the health communication?
    - How has the communication shaped people's behaviours and practices?
- What do you think will be the long-term impacts of the health communication about COVID-19?
    - Looking to the future how do you think people will react should the virus resurface?

Theme 2: Gender differences in COVID-19 vaccine uptake

- Why are we seeing more men than women uptake? (explain that previous interviews showed this)
- Has this changed during the second vaccine?
- Access and challenges?

Theme 3: Uptake of COVID-19 vaccine among healthcare providers

- What is COVID vaccine uptake like amongst health centre staff?
- Have there been any challenges?

Impact of COVID on health service provision

- What is causing an increase in the uptake of family planning services? (Explain that previous interviews showed this)
- Has something changed?
- Why is there a drop in uptake of TB services? Has something changed?

Covid19 study: Coding strategy (NVIVO extract)

Nodes

Name		Description
1. Knowledge on COVID-19		Frontline workers knowledge on COVID-19: causes or risk factors; transmission; prevention or treatment; vulnerable groups; etc.
COVID-19 preparedness and response		
• **Prevention measures**	• **Restricting movement**	Emphasis on the need for people to stay in door
	• **Social distancing**	E.g. marking the floor/seat, or letting in only a number of clients at a time, or seeing patients in an open space rather than in a confined space of a consultation room
	• **Using PPEs**	Eg masks, aprons, gloves etc, including mandatory masking in public spaces
	• **Hand washing**	Washing hands mainly with soap and water, sanitizer irregularly provided
	• **Suggestions on COVID preparedness and response**	Improving supplies through engagement with corporate stakeholders Holding community outreach covid services to facilitate wide screening and case isolation Enforcing mandatory public use of masks Motivating hospital staff
	• **COVID communication and messaging**	Strategies for communicating COVID-19 information: through chiefs or church leaders; public health talks during service provision; radio or TV; etc.
2. COVID-19 prevention barriers		
	• **Behavioral barriers**	Noncompliant behaviours: distrust (COVID as a hoax); misconceptions (linking COVID to weather); spiritualism (associating COVID with satanism); lack of adherence (mask causing breathing discomfort, resumption of public activities, decline in cases); sharing masks (lack of money to buy); etc.
	• **Conditions at work**	Issues affecting staff: lacking COVID training; not receiving compensation or risk allowance;

Name		Description
		increased workload
	• **Underlying health system challenges**	Limits in resources: drug stockouts; early shortage of working materials; lack of hospital equipment; shortage of funding; shortage of space; staffing deficiencies; etc.
3. Case management		Explanation about management of COVID suspects or confirmed cases
	• **Communication between DHO and facility**	How the facility communicated with isolation centre or main district hospital regarding COVID suspects or cases
	• **Isolation/quarantine**	Referring cases to the isolation centre, or advising patients to self isolate at home
	• **Guidelines on case management**	
	• **Number of suspect cases**	
4. COVID -19 support		Supply of work materials (masks/PPEs/sanitary facilities, hospital equipment, financial support) from government, companies, and non-governmental organisations
	• **Impact of support**	Better case management, safety of health workers, improved hospital supplies
5. Impacts of COVID-19		
• **Impacts on health seeking**		Decrease in clinic attendance (e.g., due to fear of COVID-19)
• **Impacts on service provision**	• **Suspending service**	Temporarily stopping some services e.g., TB and HIV screening services
	• **Increased waiting hours**	Increased workload coupled with a shortage of staff making patients stay longer
	• **Adapting strategies for delivering care**	E.g., clients administering contraceptives on their own; community outreach clinics; extending ART/TB prescription duration; reducing clinic time; patients visiting on appointments; working in shifts; suspending services; etc.

Name		Description
• **Impacts on staff or patients**	• **Economic impacts**	Economic impacts: cost of managing COVID-19 illness; loss of income because absence from work/business due to COVID illness; etc.
	• **Physiological impacts**	Physical health impacts: abuse from patients; fatigue from increased workloads; illness from COVID
	• **Psychological impacts**	Anxiety about catching COVID due to frequent contact with patients; stress from increased workloads; helplessness (difficulties managing the need to work for income and the risk of COVID at work); concern for family (fear of infecting family members); sacrifice versus moral obligation (feeling compelled to work despite seeing themselves at risk because they promised to serve people); stigma/discrimination (unable to interact with others because of fear of being treated differently)
	• **Psychosocial support systems for negative impacts**	Counselling, social networks (seeking moral support from families, neighbors/friends, etc.), ombudsman (for support on verbal/physical abuse from patients/community members)
6. COVID-19 vaccine provision and public reaction		
	• **Early hesitancy**	Distrust: misconceptions and spiritual beliefs causing reluctance to vaccinate Vaccine safety concerns: fear of side effects; rumors of people becoming animals once vaccinated
	• **Public becoming willing over time**	Continuous awareness campaigns (in conjunction with local leaders) helping to improve public behaviours about COVID-19 vaccine; limited evidence of negative side effects also encouraging people to vaccine
	• **Vaccine and gender**	How men and women are responding to COVID-19 vaccine; more men getting vaccinated than women
7. Demographics		
	• **Daily routines**	What the frontline worker's work involve on daily basis
	• **Years in service**	How long they have been working in this position
	• **Education**	Their level of education

Name		Description
	• **Age**	

Research Checklist

#1	**Title** Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g. ethnography, grounded theory) or data collection methods (e.g. interview, focus group) is recommended.	Page 1
#2	**Abstract** Summary of the key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results and conclusions.	Page 2
#3	**Introduction** **Problem formulation** Description and signifcance of the problem / phenomenon studied: review of relevant theory and empirical work; problem statement.	Pages 4, 5
#4	**Purpose or research question** Purpose of the study and specific objectives or questions.	Page 5
#5	**Methods** **Qualitative approach and research paradigm** Qualitative approach (e.g. ethnography, grounded theory, case study, phenomenolgy, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g. postpositivist, constructivist / interpretivist) is also recommended; rationale. The rationale should briefly discuss the justification for choosing that theory, approach, method or technique rather than other options available; the assumptions and limitations implicit in those choices and how those choices influence study conclusions and transferability. As appropriate the rationale for several items might be discussed together.	Pages 5-9
#6	**Researcher characteristics and reflexivity**	

	Researchers' characteristics that may influence the research, including personal attributes, qualifications / experience, relationship with participants, assumptions and / or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results and / or transferability.	
#7	Context Setting / site and salient contextual factors; rationale.	Page 5-6
#8	Sampling strategy How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g. sampling saturation); rationale.	Pages 6, 7
#9	Ethical issues pertaining to human subjects Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues.	Page 8
#10	Data collection methods Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources / methods, and modification of procedures in response to evolving study findings; rationale.	Pages 6, 7
#11	Data collection instruments and technologies Description of instruments (e.g. interview guides, questionnaires) and devices (e.g. audio recorders) used for data collection; if / how the instruments(s) changed over the course of the study.	Page 6,7
#12	Units of study Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results).	Pages 6,7

#13	**Data processing** Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymisation / deidentification of excerpts.	Page 9
#14	**Data analysis** Process by which inferences, themes, etc. were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale.	Page 9
#15	**Techniques to enhance trustworthiness** Techniques to enhance trustworthiness and credibility of data analysis (e.g. member checking, audit trail, triangulation); rationale.	Page 9
#16	**Results/findings** **Syntheses and interpretation** Main findings (e.g. interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory.	Pages 10-22
#17	**Links to empirical data** Evidence (e.g. quotes, field notes, text excerpts, photographs) to substantiate analytic findings.	Pages 10-22
#18	**Discussion** **Intergration with prior work, implications, transferability and contribution(s) to the field** Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of	Pages 22-25

	earlier scholarship; discussion of scope of application / generalizability; identification of unique contributions(s) to scholarship in a discipline or field.	
#19	**Study strength and Limitations** Trustworthiness and limitations of findings.	Page 25
#20	**Other** **Conflicts of interest** Potential sources of influence of perceived influence on study conduct and conclusions; how these were managed.	Page 27
#21	**Funding** Sources of funding and other support; role of funders in data collection, interpretation and reporting.	Page 26
#22	**Author contributions** Role of each other in the study and their contributions	Page 26

BMJ Open

Preparedness for and impact of COVID-19 on primary health care delivery in urban and rural Malawi: a mixed methods study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-051125.R2
Article Type:	Original research
Date Submitted by the Author:	24-May-2022
Complete List of Authors:	Phiri, Mackwellings; Malawi-Liverpool-Wellcome Trust Clinical Research Programme, MacPherson, Eleanor; Malawi-Liverpool-Wellcome Trust Clinical Research Programme; Liverpool School of Tropical Medicine Panulo, Mindy; Polytechnic, University of Malawi, Department of Enviromental Health and WASHTED centre Chidziwisano, Kondwani; Malawi Polytechnic, Environmental Health; University of Strathclyde, Department of Civil and Environmental Engineering Kalua, Khumbo; Blantyre Institute for Community Outreach Chirambo, Chawanangwa; Blantyre Institute for Community Outreach Kawalazira, Gift; Blantyre District Health Office Gundah, Zaziwe; Blantyre District Health Office Chunda, Penjani; Blantyre District Health Office Morse, Tracy; University of Strathclyde, Civil and Environmental Engineering; WASHTED center, Polytechnic, University of Malawi
Primary Subject Heading:	Infectious diseases
Secondary Subject Heading:	Public health, Qualitative research
Keywords:	COVID-19, Public health < INFECTIOUS DISEASES, QUALITATIVE RESEARCH, Infection control < INFECTIOUS DISEASES

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

Title: Preparedness for and impact of COVID-19 on primary health care delivery in urban and rural Malawi: a mixed methods study

Mackwellings Phiri[1], Eleanor MacPherson[1,2], Mindy Panulo[3,4], Kondwani Chidziwisano[3,4,5], Khumbo Kalua[6], Chawanangwa Mahebere Chirambo[6], Gift Kawalazira[7], Zuziwe Gundah[7], Penjani Chunda[7], Tracy Morse[3,4,5]

1. Malawi-Liverpool-Wellcome Trust
2. Liverpool School of Tropical Medicine
3. Department of Environmental Health and WASHTED Centre
4. Polytechnic, University of Malawi, Blantyre, Malawi
5. Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, UK
6. Blantyre Institute for Community Outreach, Blantyre, Malawi
7. Blantyre District Health Office, Blantyre, Malawi

Corresponding author's email address: mackwellingsphiri@gmail.com/mmphiri@mlw.mw

Abstract

Objective Across Africa, the impact of COVID-19 continues to be acutely felt. This includes Malawi, where a key component of health service delivery to mitigate against COVID-19 are the primary health care facilities, strategically placed throughout districts to offer primary and maternal health care. These facilities have limited infrastructure and capacity but are the most accessible and play a crucial role in responding to the COVID-19 pandemic. This study assessed health facility preparedness for COVID-19 and the impact of the pandemic on health service delivery and frontline workers.

Setting Primary and maternal health care in Blantyre District, Malawi.

Participants We conducted regular visits to 31 health care facilities and a series of telephone-based qualitative interviews with frontline workers (n=81 with 38 participants) between August 2020 and May 2021.

Results Despite significant financial and infrastructural constraints health centres continued to remain open. The majority of frontline health workers received training and access to preventative COVID-19 materials. Nevertheless, we found disruptions to key services and a reduction in clients attending facilities. Key barriers to implementing COVID-19 prevention measures included periodic shortages of resources (soap, hand sanitizer, water, masks, staff). Frontline workers reported challenges in managing physical distancing and in handling suspected COVID-19 cases. We found discrepancies between reported behaviour and practice, particularly with consistent use of masks, despite being provided. Frontline workers felt COVID-19 had negatively impacted their lives. They experienced fatigue and stress due to heavy workloads, stigma in the community, and worries about becoming infected with and transmitting COVID-19.

Conclusion Resource (human and material) inadequacy shaped the health facility capacity for support and response to COVID-19, and frontline workers may require psychosocial support to manage the impacts of the COVID-19 pandemic.

Summary box

Study strengths and limitations

- Using a mixed method approach allowed us to capture data in real time from across the district and gain and an in-depth understanding of the findings.
- Qualitative interviews allowed participants to express their lived realities through conducting interviews at different time points, we were able to capture changes in risk perception across the pandemic.
- Quantitative structured data collection tools enabled data to be captured through direct observations at each health care facility allowing for triangulation of findings captured through the qualitative interviews.
- Collecting data from health care facility registers was challenging and required efforts to compare registers to centralised health management information records which due to staff shortages were not always consistent.
- We only interviewed frontline workers, meaning that findings around patient behaviour were filtered through frontline workers perspectives.

Introduction

Since COVID-19 was identified in Wuhan, China in late 2019, this highly infectious respiratory disease has spread across the world causing a complex global health crisis. The devastating impact of the pandemic has been felt both within and beyond the health sector (1). Research has demonstrated the extreme pressure on health workers to both treat patients with COVID-19, and also to maintain essential services (2). In low-and-middle income contexts, where health systems are often fragile and care-seeking pathways for patients more challenging, the ramifications of the pandemic are being felt in complex ways (3).

The global response to the pandemic has seen development and roll-out of vaccines to prevent severe disease and hospitalisation at an unprecedented speed. However, the global distribution of vaccines has seen significant inequalities with low-income countries, particularly those in sub-Saharan African having some of the lowest vaccine coverage (4).

Prior to COVID-19, sub-Saharan African health systems have often been under-resourced and faced critical shortages of health care-workers. Recent studies have demonstrated that water, sanitation, and hygiene (WASH) infrastructure, a crucial component of good hygiene and infection control, is significantly constrained in the region (5). Only half of health facilities have basic access to water, and even less to soap or alcohol based hand sanitizer (6–8). During the COVID-19 pandemic, the situation has been further exacerbated by global shortages in access to Personal Protective Equipment (PPE) increasing the risk to health care workers and patients (9,10). Psychosocial well-being of health care workers across the globe has been detrimentally impacted both by overwhelming workloads and providing patient care with inadequate PPE (11,12).

Disruptions to health services have had both a direct and indirect impact on mortality, as care for all patients is affected (13). Recent work from the World Health Organization (WHO) analysed data on attendance for five key essential services (outpatient and inpatient admission, skilled birth attendance, treatment of confirmed malaria cases and provision of the combination pentavalent vaccine) from 14 countries in Africa, and found a reduction of

50% in May, June and July 2020 (14). This work speaks to the importance of capturing the impacts of COVID-19 on health service delivery in a wide range of contexts.

In April 2020, responding to the first confirmed cases of COVID-19 in Malawi, the government closed international borders, suspended all international flights, closed educational institutions, banned large gatherings and mandated face coverings (15). Legal injunctions prevented the implementation of any other restrictions of movement (16). In Sub-Saharan Africa, there was significantly lower recorded deaths and cases than initial models projected (17,18). However, testing capacity has been extremely limited meaning that an accurate picture of transmission has been challenging. Reflecting wider regional trends Malawi recorded lower than predicted deaths and hospitalisations. In May 2020, initial modelling work projected up to 435,000 hospitalisations with up to 50,000 deaths in the first year of the pandemic. However, the first wave (March-September 2020) saw 185 deaths with 6,049 and cases recorded (19). Subsequent immunological work has found that by July 2021 there was high seropositive (Blantyre, 81.7%; Mzuzu, 71.0%) suggesting a higher rate of cases than was reported in official statistics (20). Recent work in Malawi, has found that the COVID-19 pandemic impacted on TB case notification (21).

Primary health care facilities are central to Malawi's health service and provide a range of services including outpatient department (OPD), family planning (FP), maternal and child health (MCH), expanded programme of immunisation (EPI), tuberculosis (TB) testing and treatment, HIV testing, counselling and treatment, and cancer screening. The outpatient facilities are one of the most important entry points into the health system and where most suspected COVID-19 cases will present. Any changes to service delivery in these facilities is likely to have significant impacts on long term health outcomes. This study was guided by two research objectives: *(1)* to assess preparedness for the pandemic in health facilities in Blantyre District; *(2)* to understand front-line workers' experiences of providing care during COVID-19

Methods

Study context

The Malawian health system is structured around three levels, tertiary (large referral hospitals situated in major urban centres), secondary (district hospital) and primary (health

facilities, community, and home-based services). Funding for the health sector is heavily dependent on international donors (22). Health services are provided by government, private and faith-based organisations; government services are the only ones provided without fees and recent estimates suggest they provide approximately 60% of services accessed (23,24). Despite policies being well-designed, key challenges faced in the health sector include chronic underfunding, shortage of staff and fragmentation of services (24). The District Health Office is mandated to provide management and oversight of primary health care facilities (25). This study was situated in Blantyre district in the Southern region, which is serviced by 31 government and faith based primary health care facilities (n=14 urban; n=17 rural)(see supplementary 1 for further characteristics of the facilities). The district has a total population of 1.25 million including Blantyre city (64%), the second largest city in Malawi. The study ran from April 2020 – August 2021. This encompassed the first and second waves of the COVID-19 pandemic in Malawi and the national rollout of the preventative vaccine.

Study Design

To understand the impact of COVID-19 on primary health care provision we used a mixed method approach. Combining qualitative and quantitative research methods allowed us to capture data from across the district and gain a deeper understanding of the findings through qualitative interviews. All data collection tools were developed in consultation with the Blantyre District Health Office and were reviewed regularly through feedback loops to help inform service delivery improvements. Field work was conducted in two phases:

Phase 1: July – November 2020

For this phase we aligned qualitative and quantitative approaches to understand the impact of the first wave of the pandemic. Quantitative structured data collection tools were selected to enable real time data to be captured through direct observations at each health care facility. Tools focused on the key components of the National COVID-19 Preparedness and Response Plan (26), reporting on preparedness proxies (e.g. hand washing facilities, soap, thermometers), and observed behaviour of frontline workers (inclusive of health care workers and auxiliary staff) and clients (e.g. mask wearing, physical distancing)(see supplementary 2). Qualitative interviews were selected because they allowed frontline workers to express their lived realities and explore a range of themes flexibly (27).

Conducting interviews at different time points allowed us to capture health workers changing perceptions and experiences across the dynamic period of the pandemic. To reduce the risk of COVID-19 transmission with prolonged contact with participants we conducted qualitative interviews over the telephone.

Phase 2: April - August 2021

Following the second wave of the pandemic and the national roll out of the COVID-19 vaccine, we conducted a second phase of qualitative interviews. These interviews sought to understand the perception of, and response to, the vaccine within primary health care clinics.

Data collection

Quantitative methods

Quantitative assessments were only conducted during the first phase of the study (July – Nov 2020). Working in all 31 rural and urban health facilities in Blantyre District, we collected structured data at three-time points (August, September, and October 2020). Experienced researchers administered a questionnaire with the clinician responsible for managing the health facility or their representative. All quantitative data were collected using a pre-programmed questionnaire on KoboCollect (https://www.kobotoolbox.org)(see supplementary 3). The questions included data on patient management, physical distancing, water, sanitation and hygiene (WASH) provision and practices, the presence and use of personal protective equipment (PPE) and patient attendance at routine health services. The team photographed clinic registers (without any identifying patient data) for OPD, EPI, TB, FP, HIV and cancer screening services; this data was collected from January 2019 to September 2020 to allow for comparison of patient numbers pre-COVID.

Following analysis of each round of data collection, “score cards” were generated for each health facility. The score cards summarised how the health care facilities were implementing COVID-19 preventative measures, including training of frontline staff and WASH materials. This included the location and presence of hand washing facilities (including soap and water), stock and use of PPE including face masks and thermometers, waste management, and case management of suspected COVID-19 cases. These scorecards were then provided to the District Health Office team through monthly feedback loops, to

provide guidance on which health care facilities had managed to adapt their practices, and which facilities required further support.

Qualitative research

Qualitative assessments were undertaken across both phases of the study. Following the generation of the scorecards from initial quantitative data collection, eight health care facilities were purposively sampled to be included in the qualitative component. In the sample, we included both rural (n=4) and urban facilities (n=4). In these health care facilities, we conducted a total of 81 interviews with 38 participants, all frontline workers. In Table 1, we provide a breakdown of the participants included in each round of the interviews and the number conducted at each time point. Semi-structured qualitative interviews were conducted over the telephone and guided by a discussion guide (see supplementary 4). These interviews happened at five-time points (July-August, September, October-November 2020, and April-May and August 2021) to allow us to capture the dynamic nature of the pandemic and the rollout of the vaccine programme.

For each round of the interviews, we used a purposive sampling approach which aimed to sample a wide range of frontline workers including those employed in support and operations at the health facilities. In July/August, we included auxiliary staff (guards, ground staff, patient attendants and cleaners) recruiting up to four participants in each health care facility. In September 2020, due to time and resource constraints, we repeated interviews with 2 participants per healthcare facility, this sample included both a health worker and an auxiliary worker. In October/November 2020, we conducted a third set of interviews with the healthcare facility in-charges, those who manage the clinic (or their representative), these interviews focused more on broader changes to care provision. Between April and August 2021, we undertook a second phase of interviews with in-charges (or their representative). Key themes included experiences delivering care during the COVID-19 pandemic. Participants were asked during the interviews to reflect on the pandemic including preparedness of clinics and training on COVID-19, changes in the provision of care as well as perceived changes in patient behaviour. Finally, the impact of working during the pandemic on frontline workers' well-being and lives. The second phase of interviews explored the rollout of the COVID-19 vaccination programme and its impacts on patient

attendance. We took a pragmatic approach to sampling, constrained by conducting fieldwork during the pandemic and financial limitations and did not seek to achieve data saturation. However, we did generate a significant of data through the 81 interviews from a range of participants which was triangulated with quantitative data and structured observations.

Data analysis

Quantitative discrete data related to COVID preparedness within the facility was downloaded from KoboCollect (https://www.kobotoolbox.org) as a .csv file, cleaned and analysed using Microsoft Excel V16 (Microsoft Corporation, Redmond, WA). Continuous data related to the department and attendance from health records were abstracted from photographs to Microsoft Excel V16 (Microsoft Corporation, Redmond, WA) for comparative analysis between 2019 and 2020 attendance across specific services. All data were analysed for Blantyre as a whole, and as a comparison between urban and rural facilities.

For the qualitative data we used thematic content analysis (28)(see supplementary 5 for coding strategy). All transcripts were transcribed and imported into NVIVO 12 (QSR, International) to facilitate data management and analysis. Initial themes were identified and key gaps were included in subsequent rounds of data collection. The study team (drawing together the quantitative and qualitative researchers) held weekly debriefing sessions to allow for discussion of findings from each week's data collection. Any new avenues of inquiry were incorporated into the data collection. Halfway through the study, we presented initial findings to the District Health Office to gain feedback and participant checking.

Ethical approval

Ethical approval was granted from the National Health Science Research Committee (#20/06/2534). For the qualitative interviews, the participant information sheet and consent form were shared on WhatsApp before the interview to allow participants to review the information. Before the research began, the information was reviewed again, and oral consent was taken from the participants. No data collected from the clinic, including clinic registers contained patient's personal information.

Patient and Public Involvement

This study was developed in partnership with the Blantyre District Health Office (DHO), specifically the team leading the COVID-19 preparedness and response for primary health care within Blantyre District. Halfway through the project we presented our initial findings to the District Health COVID-19 Task Force during their weekly meetings for direct feedback, incorporating their suggestions into the qualitative data collection.

Results

We present the qualitative and quantitative results concurrently around three themes: (1) implementation of COVID response policies and practices; (2) impacts of COVID on health service provision: and (3) the well-being of frontline workers. Table 2 illustrates a summary of quantitative measures implemented in the healthcare facilities across the three-month monitoring period. A breakdown of urban versus rural coverage is available as supplementary material (S1) although no significant differences were noted.

Implementation of COVID-19 response policies and practices

We found that clinics remained open throughout the pandemic. The District Health Office (DHO) team were quick to implement training and provide new protocols to be followed to reduce patient numbers. Over the initial three-month period of the pandemic there was a steady increase in the number of facilities which had over 90% of frontline staff trained (Month 1: 35%; Month 2: 48%; Month 3: 70%). However, infrastructure and resource limitations meant implementing COVID-19 prevention measures, such as good hand hygiene and social distancing was challenging. Limitations included lack of access to reliable running water, over-crowded waiting areas and small consulting rooms. The provision of PPE was limited particularly during the early part of the pandemic.

WASH

There was an average of two moveable hand washing facilities (HWF) (e.g. buckets with taps) available per facility. Despite this provision the uptake and use was low with only 33% adequately set up and used during the visits (Table 2). The limited use of HWF was attributed by health workers to lack of time and support to manage and refill these buckets. HWF access and use appeared to drop off as the three months progressed (Table 2), in line

with the reduced number of positive COVID-19 cases (Figure 1). It was difficult for the health care facilities to channel clients through one entrance to ensure hand washing on arrival, due to the open design of the facility. The location of HWF varied from clinic to clinic, and there was little consistency in the provision and location of HWFs over the three-month period in each facility. The highest concentration of consistent provision (i.e. available all three months) was found at OPD service areas (Month 1: 71%; Month 2: 58.1%; Month 3: 54.8%). A relatively small proportion of HWFs were found with no soap or water available over the three-month period (5.2%; 8.7%; 18.6%). This may be attributed to the fact that 77% of facilities had a tapped water supply within the facility compound, with only two having to access water from a borehole in the community outside the facility. Intermittent water cuts severely affected the ability of people in the facility spaces to implement good handwashing. Staff at one facility reported having no access to potable water, which left them relying on hand sanitiser, a scarce resource (Table 2). In this situation there was insufficient sanitiser to share with patients, which meant patients were unable to wash their hands during visits to the health facilities.

> …we are facing a challenge of water, which is making it difficult for us to wash our hands. We just depend on hand sanitisers. We can't share them with the patients because there isn't enough. **[Health Surveillance Assistant, IDI20, August 2020]**

Of concern, was the low provision of soap at available hand washing facilities throughout the study period, with this reducing to under 15% by October (Table 2); this was attributed to several factors including stockouts, theft by clients, and lack of understanding by both health workers and patients of the importance of soap in the reduction of COVID-19 transmission. Clients were more likely to follow social norms in washing hands with water only. In the absence of water and soap, particularly in consultation rooms, it was concerning to note low access to hand sanitiser for frontline workers, as a means of protecting both themselves and clients from transmission between consultations. During health care facility visits, there were times when the HWFs were only put out when the research team began the assessment, indicating that there may have been some reflexive bias in observed practices. The team also noted that HWFs were often empty of water at the time of client arrival and were only filled once patients were asked to collect water from communal water points.

Client screening and isolation

Access to and use of thermometers for temperature checks was inconsistent with only 25% of facilities having thermometers available at any given time (Table 2). Indication of fever was established by visual assessment of patients during consultation, and no pre-consultation checks were conducted to isolate potential cases from others in the waiting areas. Sixty-one percent of the health care facilities had reported a suspected COVID-19 case by October 2020, with the main response being to provide the patient with a mask, isolate where possible, and call the COVID-19 response team led by the DHO office for advice and action.

PPE

The provision of PPE to health care facilities, particularly surgical masks, for frontline workers was high (Table 2), although in early visits and interviews healthcare workers reported shortages of PPE such as gloves, aprons, and masks. Of the PPE available, a small amount initially supplied had expired and staff were reluctant to use it. As one medical assistant commented:

> We didn't have PPE. The PPE we were given had expired, so we were forced to move consultations outside. Yes, for example the date of the face masks that we had at the hospital had expired a long time ago **[Medical Assistant, IDI04, July 2020].**

However, supply improved in the later stages of the data collection, with healthcare workers reporting more stable stock. For example, one Pharmacy Assistant reflected:

> Previously, it was hard to work because we didn't have enough personal protective equipment and as you know we reached a point of starting strikes. But as of now we have the PPEs" **[Pharmacy Assistant IDI06, August 2020].**

Despite availability, we observed intermittent mask use. During the qualitative interviews, frontline workers reported adhering to the mask wearing regulations, however even in facilities where masks were available (83.9 – 100% of facilities in August 2020) the quantitative team observed far less uptake than was reported, with less than 52% of health and frontline workers wearing masks during periods of observation (Table 2). To understand

this, qualitative interviews conducted in September 2020, explored why frontline workers may not wear masks. We asked this question in the third person to ensure that frontline workers did not feel we were accusing them. The most common reason provided during these interviews was that masks were uncomfortable and impacted health:

> Some of the health workers that are not wearing a mask complain that the mask gives them a headache, others say the reason why they don't wear a mask is because they want free circulation of oxygen when breathing **[Clinical Officer, IDI13, September 2020]**

Mask wearing (primarily cloth) by patients and guardians (family members taking care of patients) was seen to increase from August 2020 (Patients not wearing: 74.2%; Guardians not wearing: 96.8%) to September 2020 (Patients not wearing: 19.4%; Guardians not wearing: 22.6%) with a slight decline again in October 2020 (Table 2). Across the dataset, frontline workers reported some patients were reluctant to wear masks. They attributed this behaviour to the uncomfortableness in wearing a mask.

> Some people [patients] have been complaining that they suffocate when breathing through a mask and other people don't even know how to properly wear the masks. So those could be some of the reasons. **[Clinical Officer, IDI09, September 2020]**

Disposal of PPE was relatively consistent, with 77% of facilities burning materials in either an incinerator or open fire. Although, seven facilities were still disposing of PPE and clinical waste in an open pit which may expose others to infection and did not follow good clinical practice.

Physical distancing

Up to 58% of health facilities attempted to implement some level of physical distancing (Table 2), which reduced as the months progressed, and reported cases of COVID-19 declined. Physical distancing was particularly challenging upon arrival of patients, although efforts were made to support distancing in the waiting and consultation areas through directives from a frontline worker, spacing chairs or marking benches (Table 2). However, during facility visits, clients were crowding with little maintainance of physical distance. Frontline workers felt patients failed to physically distance from each other in the queues

because they wanted to be seen rapidly. This behaviour is likely to be shaped in part by long waiting periods commonly reported in primary health facilities in Malawi.

> As you know people are very difficult to deal with, they just maintain it for a short period of time then they get closer to each other again, because they all want to receive treatment quickly. **[Security guard, IDI02, July 2020]**

Behavioural barriers for implementing COVID-19 prevention

In addition to the limitations associated with infrastructure and consumables, we also considered how behaviour of patients evolved throughout this period of the pandemic shaping the ways people behaved at the health centre. At the start of the pandemic, health workers reported patients feeling fearful, distrustful, and questioning whether COVID-19 was a hoax as well as making links to satanism. They felt this shaped treatment seeking practices with patients staying away from the facilities (a point we return to in the next theme) particularly in the early stages of the pandemic when there was a great deal of uncertainty and fears patients may end up in isolation facilities. However, for those patients who did attend the facilities, health workers felt they were initially cautious, but as time went on, they saw a change in behaviour with less adherence to preventative measures. As noted below:

> People think that COVID-19 has vanished. I don't know where they're getting that information from. They have stopped wearing masks and they are no longer washing their hands on their own as before. So, I would say people are reckless now and are back to their normal life **[Clinical Officer, IDI09 October 2020]**

Although not all health workers agreed with this, some reported patients were more cautious about prevention and cooperative when it came to mask wearing and hand washing for instance:

> Yes, there have been some changes. People are now wearing masks and they are also washing their hands. People are observing social distance. **[Clinical officer, IDI04, October 2020]**

Healthcare workers believed the change in patient behaviours was helped by the government mandating mask wearing in public spaces. Some health facilities refused to treat patients who were not wearing masks which meant patients modified their behaviour:

> People […] now obey all the measures that have been put in place at the facility such as wearing a face mask, [which] is mandatory either at the facility or when travelling. It has brought a great change because when we send them back, they inform others in their community. And now people prepare when coming to the hospital because they are afraid of being sent back without treatment […] **[Ground labourer, IDI01, August 2020]**

However, some frontline workers felt such punitive measures had unintended consequences. They reported that once patients started to be turned away, mask sharing became far more common undermining prevention efforts:

> We have however stopped sending them back because people were borrowing mask from each other which is a big problem. So now we just inform the village chiefs to inform their people to stop being reckless **[Clinical officer, IDI09, August 2020]**

Frontline workers felt public behaviour changed as community and religious leaders began to spread public health messages that dispelled rumours and encouraged people to use a mask:

> The number of people that are wearing masks has now increased a lot [From April 2020]. The change has resulted from the meeting we had at the hospital here with the village chiefs, where we explained to them that everyone should comply with the preventive measures being implemented at the hospital when coming to the hospital. Church leaders have also been encouraging people to wear masks. So our village chiefs and church leaders have also played a major part. **[Nurse, IDI12, August 2020]**

By September 2020, frontline workers reported rumours about COVID-19 vaccines being developed in the Global North that could cause harm to Malawians, which persisted when vaccines became available. Rumours linked serious vaccine side effects including death, blood clots, losing fertility, or causing people to turn into animals. As noted here:

> Some people were saying that the vaccine is associated with 666 and some were saying that the vaccine is causing blood clotting, and some were saying that if you receive the vaccine you may turn into some animal. **[Health Surveillance Assistant, IDI15, Sept 2020]**

> I have heard rumours that getting the vaccine will shorten your life span. Some say that the vaccine will make you infertile. Others have been saying that the vaccine causes blood clot. These rumours have been circulating through social media, patients, and ordinary members of the public. **[Medical Assistant, IDI01, May 2021]**

As the vaccines were rolled out in March and April 2021, health workers reported widespread reluctance of both health workers and the wider community to vaccinate. Safety concerns and trust issues between the public and health care facilities administering the COVID-19 vaccine were reported, with rural facilities most affected. This impacted the provision of services such as of injectable contraceptives, which women felt were COVID-19 vaccine in disguise.

> What I have observed is that people are still finding it hard to understand this disease. And because of the COVID-19 vaccine people have been refusing to receive injection treatments, fearing they [health workers] might inject them with the COVID-19 vaccine. The turn up of patients coming for other services such as family planning services has decreased, and I would say that trust between health workers and the villagers when it comes to injections has declined. **[Clinical officer, IDI05, May 2021]**

However, over time, health workers did report changes in attitudes with people becoming more trusting and accepting towards the COVID-19 vaccine. This was linked to evidence of limited side effects through those that had vaccinated first. Additionally, working jointly with influential people such as chiefs and church leaders also made communities more receptive of the public health education that health workers were giving to encourage vaccine uptake.

People were encouraged to vaccinate after seeing that health workers and other government officials received the vaccine, and nothing happened to them. **[Nurse, IDI14, May 2021**.

We are working hand in hand with community leaders such as chiefs, and health advisory committees and churches, so that people get enough messages on COVID-19, and now they understand and accept. The health advisory committees act as a bridge between the health workers and the communities. **[Medical Assistant, IDI01, May 2021]**

In terms of gender, heath workers reported more men than women getting vaccinated:

'Who showed up more to vaccinate?' 'All the people I found there were men. (Medical assistant IDI26, August 2020).

Health workers linked this to some workplaces (including government offices) requiring all their staff to be vaccinated. This may reflect the fact less women are employed in these roles.

The number of people coming for the vaccine is increasing. We are hearing that some companies are demanding that their employees vaccinate if they want to keep their job. Some government companies are doing the same. That's perhaps why people are vaccinating more than before. **[Clinical officer, IDI06, May 2021]**

Impact of COVID-19 on routine health services

Frontline workers felt that the COVID-19 pandemic had negatively impacted provision of healthcare services. They cited cancellation of routine services such as screening for cervical cancer and HIV viral load as two of the most significant impacts.

It is very challenging. Actually, the entire system came to a halt because we are all focused on COVID-19. **[DHO representative, IDI August 2020]**

[…] recently some services have been stopped due to COVID-19, [e.g.] growth monitoring services, cervical cancer screening and [HIV] viral load services. **[Clinical Officer, IDI13, August 2020]**

We found a reduction in the number of patients attending outpatient services from April onwards, which corresponds with the first confirmed cases of COVID-19 in Blantyre District (Figure 1). However, the facilities did not suspend all services, rather adapted strategies for providing healthcare. For instance, people with HIV or TB normally received a three-month dosage but were getting prescriptions for six months. As one District Health Office representative narrated the reason for the modification was to reduce in-person consultations and decongest the clinics.

> Review clinics for HIV and TB patients have been extended, so instead of giving them medical supplies for 3 months we are giving them medicine supplies of 6 months so that we should try to reduce congestion and minimize time of contact with these patients. **[DHO representative IDI August 2020]**

Patients' attendance reduced for TB services (Figure 2) could therefore reflect the extended period for which clients received drugs as opposed to reduced attendance and should be assessed over a more prolonged period to determine if service delivery was affected.
We also found modifications in the way child vaccination was offered. Rather than following the immunisation calendar, mothers were grouped and assigned new vaccination dates.

> Those [in need of vaccination] have been divided into several groups and each group is told to come on their own specific day. **[Hospital attendant, IDI18, August 2020]**

Despite these efforts, and overall reduction in immunisation was seen in attendance records, particularly in relation to facilities located in urban areas. This may reflect the higher perceived risk of COVID-19 in urban contexts (Figure 3).
Similarly, delivery of reproductive health services was altered, with women accessing family planning given instructions to self-administer the injection at home. However, this strategy raised important questions about disposal and safety of used syringes and needles in the community.

> And when it comes to family planning; women are being trained to inject themselves at home so when they come here, we just give them all the required materials.
> **[Clinical officer, IDI21, August 2020]**

Adaptation of existing services may explain some of the reduction in access to family planning services as cases of COVID-19 were seen to increase (Figure 4). The pandemic interrupted the way daily facility data was being recorded. Data entry clerks, the staff responsible for completing daily registers, were not included in the risk allowance provided by the government. This led to long absences by this cadre from some of the facilities.

> Our department is still not receiving the risk allowances […] data officers were not working due to the same issue, but they have just accepted the situation and have resumed their work. **[Ground labour, IDI14. September 2020]**

As part of managing the risk of exposure, health workers reduced their days and the amount of time spent at the health care facility, alternating between the different weeks. Consequently, facilities closed earlier than normal, and this further impacted on patients travelling long distances to access care:

> The other thing is that we are told to work for a limited time which is less time than before, but that is challenging for the patients that can't make it to the hospital on time **[Hospital attendant, IDI04, August 2020]**

It is difficult to assess the impact the lack of data clerks may have had on the records maintained within health care facilities and reported here.

Improved work practices

Health workers also reflected on the positive lessons drawn from responding to COVID-19, reflecting that prevention measures had shaped their work practices in ways that could be useful for preventing other diseases in future:

> It has encouraged us to observe hygiene; previously we used to wash our hands only when we wanted to eat but now, we wash our hands regularly, after meeting each patient. We also wear PPE such as masks, aprons and gloves which we never used to do before COVID-19. We now observe social distancing. Social distancing protects us from a lot of other diseases such as TB and others that transmit through droplets. We will use masks even when COVID-19 is over. **[Medical assistant, IDI01, November 2020]**

The impact of COVID-19 on frontline workers

Frontline workers reported severe impacts on their well-being from working during the pandemic. They faced constant anxiety about the risk of exposure, which appeared to be two-fold. For non-clinicians, frontline workers articulated their concerns around regular contact with clinicians who were seeing the patients:

> I have worries because of the way things are right now […] I work at the clinic and sometimes I come into contact with the doctors and that worries me because you wonder if all the patients that were in contact with the doctors have the disease. **[Ground labourer, IDI03, September 2020]**

Secondly, they saw themselves as potentially exposing others to the same risk they were experiencing, and felt particularly concerned for their family members about this:

> I feel worried that I may infect my little child and my whole family should I be infected because it takes time for a person to notice if they have COVID-19. **[Clinical Officer, IDI04, September 2020]**

Stress and helplessness

There was a deep sense of helplessness among frontline workers about continuing to work during the pandemic. Some frontline workers narrated their desire for a break from work but felt powerless to act. Their lack of agency stemmed from a sense of social responsibility to work but also the need to provide for their families. For most frontline workers they continued to work because they could not afford to stop:

> I cannot quit my job despite having so many worries because the job is what gives me money for food. People are just going to work because they want to earn some money for food, but everybody is worried. **[Medical Assistant, IDI16, September 2020]**

Some frontline workers also drew inspiration to continue to work from the principles of humanitarianism and sacrifice. Responding to 'What motivates you to continue working despite the situation?' one said, 'The desire to assist people.' This demonstrates that facility workers felt an ethical duty to serve their communities despite the perceived risk:

> There is no way I can say we will stop going to work due to COVID-19, because that's our job, assisting people. So, there is no way the hospital would be closed because of the pandemic. **[Nurse, IDI10, August 2020]**

During July and August 2020, the Ministry of Health required all health workers to be tested for COVID-19. This led to a significant proportion of health care workers being diagnosed. The requirement for these health workers to self-isolate placed pressure and stress on staff in health care facilities who still needed to deliver services.

> We are working more than before the start of COVID-19 [...] because if say three workers test positive to the virus, they go on quarantine, leaving behind more work for their colleagues. **[Clinical officer, IDI21, September 2020]**

Wider community stigma

Across the dataset, we found consistent testimonies of frontline workers experiencing stigma within the wider community because they were perceived to be the ones spreading the virus. This may have been a result of the mass testing programme initiated by the government. In this quote, one front-line worker shared his experience of being ostracized by bus operators and fellow passengers simply because they were from the health service.

> We fail to board a minibus when going to work because people say we will infect them with the disease on the bus. […] this other day I was in my work uniform standing at the bus stop waiting to catch a minibus, but none of the buses stopped and other people at the bus stop started accusing me that I was the reason why the buses were not stopping." **[Ground labourer, IDI14, August 2020]**

To mitigate this situation the district health officer reported providing health workers with additional buses allowing them to get to work. Although only health workers were provided access to the buses with other frontline workers left to find their own way to work.

> They reported [the discrimination on public transport] to the head office and the office hired staff buses which were carrying only health workers. But after sometime, the buses stopped carrying them. **[Clinical officer, IDI13, September 2020]**

Tension between health workers at the healthcare facility was also reported. Fear of infection led to mistrust between health workers, particularly for those who were diagnosed having COVID-19.

> Some health workers diagnosed with COVID-19 were being ignored by fellow health workers, saying they will infect them, and that was affecting them psychologically. **[Clinical officer, IDI21, September 2020]**

Discussion

This mixed methods study took place during the COVID-19 pandemic, capturing real-time data around how primary health care facilities (a critical access point for patients) prepared for, and then responded to the pandemic. Exploring in-depth with a range of frontline workers how the COVID-19 pandemic affected their work practices and lives more broadly. Initial modelling predicted that Malawi would have a high rate of hospitalizations (up to 435,000) and deaths (with up to 50,000 deaths), but this did not materialise at the time of this study (17). As a low-income country, the COVID-19 pandemic and response took place in the context of severe resource constraints in terms of both health service delivery and infection prevention and control infrastructure. Our research found that despite this challenging context, primary healthcare facilities remained open, and patients continued to seek care, albeit in lower numbers. Notable we did not find significant differences between rural and urban facilities across either the availability and use of preventative measures, or the uptake of routine services. The DHO led the rapid roll out of COVID-19 related training to frontline health workers, implementing key COVID-19 preventative measures but this was inhibited both by the absence of materials and limited infrastructure. Nevertheless, across the interviews it was evident that the training improved awareness and understanding of health workers in relation to COVID-19 prevention and management of suspected cases. The numbers of people attending health care facilities was radically reduced, particularly during the first peak with some key services suspended. Frontline workers reported that patients were fearful and distrusting of the health system, particularly at the start of the pandemic. From October, there were concerns around the safety of the COVID-19 vaccine. Once vaccines were rolled-out health workers perceived that there was an impact on uptake of vaccines and fear from patients when they did present. Health care workers reported a gendered difference, with more men presenting for vaccination.

Although pragmatic guidance was published for low and middle income countries (29), case management of suspected COVID-19 cases at health care facilities was challenging, with limited staff available for patient consultations. The layout of health care facilities made managing patients, and reducing over-crowding while maintaining high hygiene standards throughout the clinic difficult. This was compounded by inadequate resourcing (including a lack of thermometers and access to isolation rooms). There was heavy reliance on the centralised team from the District Health Office to respond and handle all suspected cases, which overburdened this team.

In some health care facilities, an authoritarian approach to increase patient's adherence to mask wearing had a detrimental impact on prevention measures. We found that despite frontline health workers reported stress and anxiety of contracting COVID-19, the uptake of preventative measures including mask wearing was low, suggesting a complex relationship between knowledge and behaviour. Frontline workers reported significant stigmatisation and increased stress during work that impacted their lives.

The fear, stress and anxiety reported by frontline workers in our study reflects trends across the globe. Studies undertaken in a wide range of high-, middle-, and low-income contexts speak to devastating impact COVID-19 had on health care workers' psychosocial well-being (30,31). In sub-Saharan Africa, where health systems are more fragile, referral pathways are more complex and access to PPE challenging; all contributed further stress to health care workers. By including a wider cadre of staff including guards and patient attendants, we demonstrated that the psychosocial impact was not limited to frontline health care workers. Our work speaks to the urgent need to provide psychosocial support for all frontline and auxiliary workers.

Our findings on the reductions in patient attendance and the disruptions to routine health services reflect wider global trends. In Malawi, the pandemic has also seen increases in teenage pregnancies, as well as reductions in TB case detection (21,32,33). This has both immediate and future impacts on patient outcomes from preventable and treatable diseases leading to wider implications for wider economic and social development.

Malawi currently has vaccine coverage of 5.6% one of the lowest in the world (34). In Malawi, men are generally more likely to be employed than women (35), meaning mandatory workplace vaccination may have made men more likely to access the vaccine than women. Women's hesitancy to vaccinate was also centred around rumours related to both fertility and complications associated with contraceptives.

The importance of hand hygiene in the prevention of communicable diseases, including respiratory infections cannot be overemphasized, particularly with regard to COVID-19 and wider IPC interventions (36–38). Prior to this pandemic, WASH campaigns were emphasising the importance of hand washing with soap after toilet use and during consultations in healthcare facilities (39–41). However, opportunities for hand washing in this setting were rarely found, with reasons cited as lack of hand washing facilities, access to water, and the need for constant maintenance (39–41). Nevertheless, our results indicate that despite the provision of the necessary hand washing facilities and regular access to water, few health facilities made adequate hand washing stations with soap or sanitisers available at either toilets or other areas of the health care setting. Where they were available, their presence was intermittent meaning that adherence to recommended hand hygiene practice (hand washing with soap or use of hand sanitizer) was limited by patients, HCWs and auxiliary staff. By failing to utilise the handwashing facilities available to them (i.e., keeping provided buckets and soap in storage) health facility staff are indicating that they are either overburdened, or do not understand the value of hand washing with soap in COVID-19 prevention and IPC practices. This was a missed opportunity to promote effective hand washing with soap to the community members utilising the health care facilitates, as lack of proper hand hygiene in the healthcare facilities has been found to reflect inadequate handwashing at the household level (42,43), as WASH norms are shared in community settings (44). Research has demonstrated that the availability of WASH infrastructure (e.g. hand washing facility with soap) in accessible locations motivates behaviour performance, acts as a cue for action and enhances social norms (45). As such it is imperative that hand washing facilities are made accessible to all staff and patients to promote their effective use, and where possible supported with supervision, nudges and appropriate behaviour

change techniques to improve hand hygiene in healthcare settings both for the short and long term (46–48).

Overall clinical waste management was found to be well managed in the majority of health care facilities, with incineration of used masks being undertaken on a regular basis. However, as found in previous reports in Blantyre, some masks were disposed of into open pits which were potentially exposing community members to infection (49). A consistent and context appropriate response to clinical waste management is needed for all health care facilities to reduce the risk of infection transmission while taking into consideration the environmental impacts of disposal in the long term (49).

Despite the limited resource in these settings, the findings of our study indicate an effective cross sectoral approach over the ten month period of the pandemic, enabling the rapid deployment of materials to support preventative measures (e.g. masks, HWF) and vaccination, alongside structured guidance and training. However, we also expose the limitations of providing these resources and expecting their immediate implementation and sustained practice, where basic IPC practices were not already in place. Policy and programming should take advantage of the tipping point created by the pandemic to ensure long term sustained support and resource to these instrumental primary health care facilities, to facilitate the maintenance of effective IPC practices for not only COVID-19 but other communicable diseases as well.

Limitations

Our study has several limitations. As we were collecting data during the pandemic, we limited the time the study team was in the health care facilities. Qualitative interviews were conducted over the phone, which may have made it more challenging for the interviewer to build rapport with participants and inhibited their responses. The study focused on frontline workers, and we did not conduct interviews with patients, this means that findings around patient behaviour was filtered through frontline workers perspectives. Due to time and resource constraints, we only interviewed frontline workers at two time points, and only interviewed HC facilities in-charges for the last two time point. The views of HC facilities in charge may not be the same as frontline workers' experiences. Collecting data from health

care facility registers was challenging and required efforts to compare registers to centralised health management information records to ensure they were consistent. Longer term attendance data comparisons are also recommended to assess the impacts on key services.

Conclusion

Health care facilities in the Blantyre district were initially unprepared to respond to the COVID-19 pandemic. However, despite significant resource limitations, the health care facilities were able to adapt their procedures to remain open and deliver the majority of key services. Although efforts were made to supply health care facilities with resources for COVID-19 prevention, there were limitations to their implementation (e.g. hand washing facility use with soap, mask wearing, etc). Complex factors seem to shape staff behaviours and knowledge did not always translate into practice. Providing additional supervision, support and training may lead to sustained adherence to preventative measures in the long term. Our study also speaks to the need to provide psychosocial support for all those working on the frontline in health facilities.

Acknowledgements

Thanks to Stevie Amos for the support in data management and analysis. This work was supported by the University of Strathclyde through the SFC GCRF Escalator Fund grant number SFC/AN/18/2020.

Author Contribution statement

Mackwellings Phiri led collection and analysis of qualitative data and paper writing. Mindy Penulo and Chawanangwa Mahebere Chirambo led collection of quantitative data and provided paper review support. Kondwani Chidziwisano led analysis of quantitative data and helped with paper writing. Khumbo Kalua, Gift Kawalazira, Zuziwe Gundah, and Penjani Chunda led the study and provided paper review support. Eleanor MacPherson and Tracy Morse designed and led the study and supported paper writing.

Declaration of competing interest

The authors declare that there is no conflict of interest.

Data sharing

The data supporting results of this study are available on request from the Department of Civil and Environmental Engineering, University of Strathclyde (tracy.thomson@strath.ac.uk). For the qualitative research, we can provide second order summaries of transcripts to ensure anonymity of participants.

Figure 1

Outpatient service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

Figure 2

TB service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

Figure 3

Child health (including immunisation) service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

Figure 4

Family planning service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities)

References

1. Ahmed SAS, Ajisola M, Azeem K, Bakibinga P, Chen Y-F, Choudhury NN, et al. Impact of the societal response to COVID-19 on access to healthcare for non-COVID-19 health issues in slum communities of Bangladesh, Kenya, Nigeria and Pakistan: results of pre-COVID and COVID-19 lockdown stakeholder engagements. BMJ global health. 2020;5(8):e003042.

2. Chersich MF, Gray G, Fairlie L, Eichbaum Q, Mayhew S, Allwood B, et al. COVID-19 in Africa: care and protection for frontline healthcare workers. Globalization and Health. 2020;16:1–6.

3. Blanchet K, Alwan A, Antoine C, Cros MJ, Feroz F, Guracha TA, et al. Protecting essential health services in low-income and middle-income countries and humanitarian settings while responding to the COVID-19 pandemic. BMJ global health. 2020;5(10):e003675.

4. Pai M, Olatunbosun-Alakija A. Vax the world. Science. 2021;374(6571):1031–1031.

5. Wadvalla B-A. How Africa has tackled covid-19. bmj. 2020;370.

6. McGriff JA, Denny L. What COVID-19 Reveals about the Neglect of WASH within Infection Prevention in Low-Resource Healthcare Facilities. The American journal of tropical medicine and hygiene. 2020;103(5):1762–4.

7. WHO, UNICEF,. WASH in Health Care Facilities Global Baseline Report [Internet]. WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene.; 2020. Available from: https://www.washdata.org/sites/default/files/documents/reports/2019-05/jmp-2019-wash-hcf-highlights-1.pdf

8. WHO,. Infection Prevention and Control during Health Care when Coronavirus Disease (COVID-19) Is Suspected or Confirmed. Geneva: World Health Organization; 2020. Report No.: WHO/2019-nCoV/IPC/2020.4.

9. Burki T. Global shortage of personal protective equipment. The Lancet Infectious Diseases. 2020;20(7):785–6.

10. Talisuna A, Yoti Z, Lee C, Frieden TR, Moeti MR. The urgent need for a global commitment to protect healthcare workers. BMJ Glob Health. 2020 Nov;5(11):e004077.

11. Rodríguez-Rey R, Garrido-Hernansaiz H, Bueno-Guerra N. Working in the Times of COVID-19. Psychological Impact of the Pandemic in Frontline Workers in Spain. International journal of environmental research and public health. 2020;17(21):8149.

12. Khanal P, Devkota N, Dahal M, Paudel K, Joshi D. Mental health impacts among health workers during COVID-19 in a low resource setting: a cross-sectional survey from Nepal. Globalization and health. 2020;16(1):1–12.

13. Roberton T, Carter ED, Chou VB, Stegmuller AR, Jackson BD, Tam Y, et al. Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: a modelling study. The Lancet Global Health. 2020;8(7):e901–8.

14. WHO,. COVID-19 hits life-saving health services in Africa [Internet]. WHO | Regional Office for Africa. [cited 2021 Jan 6]. Available from: https://www.afro.who.int/news/covid-19-hits-life-saving-health-services-africa

15. Mzumara GW, Chawani M, Sakala M, Mwandira L, Phiri E, Milanzi E, et al. The health policy response to COVID-19 in Malawi. BMJ global health. 2021;6(5):e006035.

16. Beloved Kaunga S. How have Malawi's courts affected the country's epidemic response? [Internet]. How have Malawi's courts affected the country's epidemic response? 2020 [cited 2020 Jan 21]. Available from: https://blogs.lse.ac.uk/africaatlse/2020/11/13/how-have-malawis-courts-law-affected-epidemic-response/

17. Kuunika. Mathematical Modeling of COVID-19 in Malawi. Lilongwe: Kuunkia;

18. Nordling L. The pandemic appears to have spared Africa so far. Scientists are struggling to explain why. Science [Internet]. 2020 Aug 20; Available from: https://www.sciencemag.org/news/2020/08/pandemic-appears-have-spared-africa-so-far-scientists-are-struggling-explain-why

19. Malawi: WHO Coronavirus Disease (COVID-19) Dashboard [Internet]. [cited 2021 Feb 9]. Available from: https://covid19.who.int

20. Mandolo J, Msefula J, Henrion MY, Brown C, Moyo B, Samon A, et al. SARS-CoV-2 exposure in Malawian blood donors: an analysis of seroprevalence and variant dynamics between January 2020 and July 2021. BMC medicine. 2021;19(1):1–10.

21. Soko RN, Burke RM, Feasey HR, Sibande W, Nliwasa M, Henrion MY, et al. Effects of coronavirus disease pandemic on tuberculosis notifications, Malawi. Emerging infectious diseases. 2021;27(7):1831.

22. Khuluza F, Haefele-Abah C. The availability, prices and affordability of essential medicines in Malawi: A cross-sectional study. Thet Wai K, editor. PLoS ONE. 2019 Feb 12;14(2):e0212125.

23. Zeng W, Sun D, Mphwanthe H, Huan T, Nam JE, Saint-Firmin P, et al. The impact and cost-effectiveness of user fee exemption by contracting out essential health package services in Malawi. BMJ Global Health. 2019 Apr 1;4(2):e001286.

24. Makwero MT. Delivery of primary health care in Malawi. Afr j prim health care fam med [Internet]. 2018 Jun 21 [cited 2020 Oct 7];10(1). Available from: https://phcfm.org/index.php/phcfm/article/view/1799

25. Ministry of Health Malawi,. Health Care System [Internet]. [cited 2020 Nov 3]. Available from: https://www.health.gov.mw/index.php/2016-01-06-19-58-23/national-aids

26. Government of Malawi,. National COVID-19 Preparedness and Response Plan. Lilongwe, Malawi: Government of Malawi;

27. Pope C, Mays N. Qualitative Research: Reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research. BMJ. 1995 Jul 1;311(6996):42–5.

28. Green J, Thorogood N. Qualitative methods for health research. sage; 2018.

29. Cobb N, Papali A, Pisani L, Schultz MJ, Ferreira JC, COVID–LMIC Task Force. Pragmatic Recommendations for Infection Prevention and Control Practices for Healthcare Facilities in Low-and Middle-Income Countries during the COVID-19 Pandemic. The American journal of tropical medicine and hygiene. 2021;tpmd201009.

30. Semo B, Frissa SM. The Mental Health Impact of the COVID-19 Pandemic: Implications for Sub-Saharan Africa. Psychol Res Behav Manag. 2020 Sep 3;13:713–20.

31. Conti C, Fontanesi L, Lanzara R, Rosa I, Porcelli P. Fragile heroes. The psychological impact of the COVID-19 pandemic on health-care workers in Italy. PloS one. 2020;15(11):e0242538.

32. UNICEF,. Malawi COVID-19 Situation Report [Internet]. Lilongwe, Malawi: UNICEF Malawi; 2020 Oct [cited 2022 Mar 25]. Available from: https://www.unicef.org/media/84831/file/Malawi-COVID-19-SitRep-21-October-2020.pdf

33. Thekkur P, Tweya H, Phiri S, Mpunga J, Kalua T, Kumar A, et al. Assessing the Impact of COVID-19 on TB and HIV Programme Services in Selected Health Facilities in Lilongwe, Malawi: Operational Research in Real Time. Tropical Medicine and Infectious Disease. 2021;6(2):81.

34. Reuters,. Reuters COVID-19 Tracker. Available from: https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/malawi/

35. Unlocking Malawi's Economic Growth by Bridging the Widening Gender Gaps in the labour workforce [Internet]. World Bank. [cited 2022 Mar 14]. Available from: https://www.worldbank.org/en/country/malawi/publication/unlocking-malawi-s-economic-growth-by-bridging-the-widening-gender-gaps-in-the-labour-workforce

36. WHO,. Advice for the public on COVID-19 – World Health Organization [Internet]. World Health Organization. [cited 2021 Jan 15]. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public

37. Rabie T, Curtis V. Handwashing and risk of respiratory infections: a quantitative systematic review. Tropical medicine & international health. 2006;11(3):258–67.

38. Prüss-Ustün A, Bartram J, Clasen T, Colford Jr JM, Cumming O, Curtis V, et al. Burden of disease from inadequate water, sanitation and hygiene in low-and middle-income settings: a retrospective analysis of data from 145 countries. Tropical Medicine & International Health. 2014;19(8):894–905.

39. Wichaidit W, Biswas S, Begum F, Yeasmin F, Nizame FA, Najnin N, et al. Effectiveness of a large-scale handwashing promotion intervention on handwashing behaviour in Dhaka, Bangladesh. Tropical Medicine & International Health. 2019;24(8):972–86.

40. Luby SP, Halder AK, Huda T, Unicomb L, Johnston RB. The effect of handwashing at recommended times with water alone and with soap on child diarrhea in rural Bangladesh: an observational study. PLoS Med. 2011;8(6):e1001052.

41. Morse T, Tilley E, Chidziwisano K, Malolo R, Musaya J. Health Outcomes of an Integrated Behaviour-Centred Water, Sanitation, Hygiene and Food Safety Intervention–A Randomised before and after Trial. International journal of environmental research and public health. 2020;17(8):2648.

42. Luby SP, Halder AK, Tronchet C, Akhter S, Bhuiya A, Johnston RB. Household characteristics associated with handwashing with soap in rural Bangladesh. The American journal of tropical medicine and hygiene. 2009;81(5):882–7.

43. Chidziwisano K, Tilley E, Malolo R, Kumwenda S, Musaya J, Morse T. Risk factors associated with feeding children under 2 years in rural Malawi—a formative study. International journal of environmental research and public health. 2019;16(12):2146.

44. Cialdini RB, Trost MR. Social influence: Social norms, conformity and compliance. 1998;

45. Contzen N, Meili IH, Mosler H-J. Changing handwashing behaviour in southern Ethiopia: a longitudinal study on infrastructural and commitment interventions. Social science & medicine. 2015;124:103–14.

46. Seimetz E, Boyayo A-M, Mosler H-J. The influence of contextual and psychosocial factors on handwashing. The American journal of tropical medicine and hygiene. 2016;94(6):1407–17.

47. Hashi A, Kumie A, Gasana J. Hand washing with soap and WASH educational intervention reduces under-five childhood diarrhoea incidence in Jigjiga District, Eastern Ethiopia: a community-based cluster randomized controlled trial. Preventive medicine reports. 2017;6:361–8.

48. Brown J, Cairncross S, Ensink JH. Water, sanitation, hygiene and enteric infections in children. Archives of disease in childhood. 2013;98(8):629–34.

49. Tilley E, Kalina M. “We Are Already Sick”: Infectious Waste Management and Inequality in the Time of Covid-19, a Reflection from Blantyre, Malawi. Worldwide Waste: Journal of Interdisciplinary Studies. 2020;3(1).

Table 1: Summary of Qualitative Sampling

Health Facility	Location	Phase 1			Phase 2	
		July-August 2020	September 2020	November 2020	April-May 2021	August 2021
001clk	Rural	• Hospital Attendant (IDI04) • Medical Assistant (Clinic in charge) (IDI01) • Security Guard (IDI02) • Ground Labourer IDI03)	• Medical Assistant (Clinic in charge) (IDI01) • Ground Labourer (IDI03)	• Medical Assistant (Clinic in charge) (IDI01)	• Medical Assistant (Clinic in charge) IDI01) • Nurse (IDI28) • Clinician (IDI29)	• Medical Assistant (Clinic in charge) (IDI01
002mpm	Rural	• Clinical Officer (Clinic in charge) (IDI08) • Pharmacy Assistant (IDI06) • Ground Labourer (IDI14) • Health Surveillance Assistant (IDI15)	• Clinical Officer (Clinic in charge) (IDI08) • Ground Labourer (IDI14)	• Clinical Officer (Clinic in charge) (IDI08)	• Clinical Officer (Clinic in charge) (IDI08) • Nurse (IDI30) • Health Surveillance Assistant (IDI31)	• Clinical Officer (Clinic in charge) (IDI08)
003mdk	Rural	• Security Guard (IDI10) • Clinical Officer (Clinic in charge) (IDI23)	• Security Guard (IDI10) • Clinical Officer (Clinic in charge) (IDI23)	• Clinical Officer (Clinic in charge) (IDI23)	• Clinical Officer (Clinic in charge) (IDI23) • Nurse (IDI31) • Health Surveillance Assistant (IDI32)	• Clinical Officer (Clinic in charge) (IDI23)
004nmk	Rural	• Medical Assistant (Clinic in charge) (IDI26) • Hospital attendant (IDI25)	• Medical Assistant (Clinic in charge) (IDI26) • Hospital attendant (IDI25)	• Medical Assistant (Clinical in charge) (IDI26)	• Medical Assistant (Clinical in charge) (IDI26) • Nurse (IDI27) • Health Surveillance Assistant (IDI33)	• Nurse (IDI27)
005nrd	Urban	• Hospital Attendant (IDI18) • Security Guard (IDI2) • Nurse (Clinic in charge) (IDI11)	• Hospital attendant (IDI18) • Nurse (Clinic in charge) (IDI11)	• Nurse (Clinic in charge) (IDI11)	• Nurse (Clinic in-charge) (IDI11) • Health Surveillance Assistant (IDI34)	• Nurse (Clinic in-charge) (IDI11)

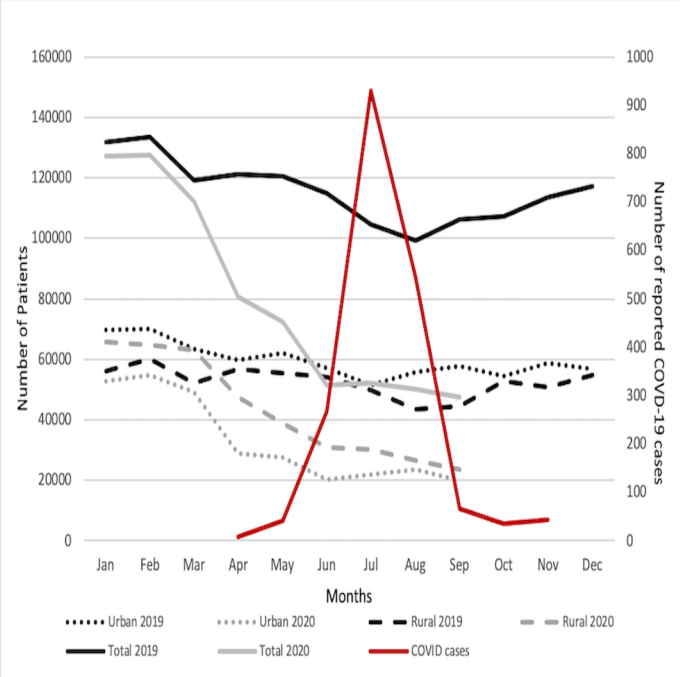
		• Data Clerk (IDI07)			• Nurse (IDI35)	
006gty	Urban	• Clinical Officer (Clinic in charge) (IDI19) • Ground Labourer (IDI09) • Nurse (IDI13)	• Clinical Officer (Clinic in charge) (IDI19) • Ground Labourer (IDI09)	• Clinical Officer (Clinic in charge) (IDI19)	• Clinical Officer (Clinic in-charge) (IDI19) • Nurse (IDI13) • Health Surveillance Assistant (IDI36)	• Nurse (IDI13)
007slz	Urban	• Nurse (Clinic in charge) (IDI12) • Hospital Attendant (IDI17) • Security Guard (IDI16)	• Nurse (Clinic in charge) (IDI12) • Hospital attendant (IDI17)	• Nurse (Clinic in charge) (IDI12)	• Nurse (Clinic in charge) (IDI12) • Clinical Officer (IDI37) • Nurse (IDI38)	• Nurse (Clinic in charge) (IDI12)
008bng	Urban	• Clinical Officer (Clinic in charge) (IDI21) • Clinician (IDI24) • Health Surveillance Assistant (IDI20)	• Clinical Officer (Clinic in charge) (IDI21) • Health Surveillance Assistant (IDI20)	• Clinical Officer (Clinic in charge) (IDI21)	• Clinical Officer (Clinic in-charge) (IDI21) • Clinician (IDI24) • Health Surveillance Assistant (IDI20)	• Clinical Officer (Clinic in charge) (IDI21)

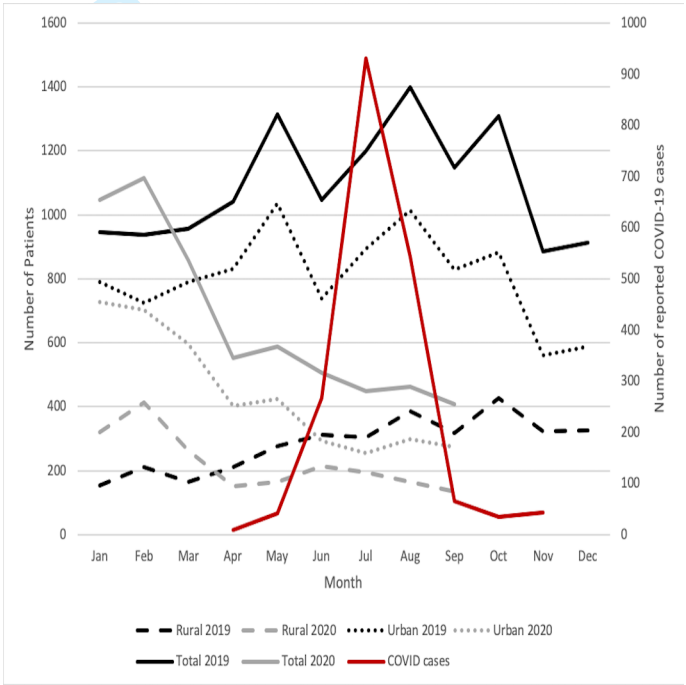
Table 2: Summary of COVID preparedness from 31 health facilities across Blantyre District from August – October 2020.

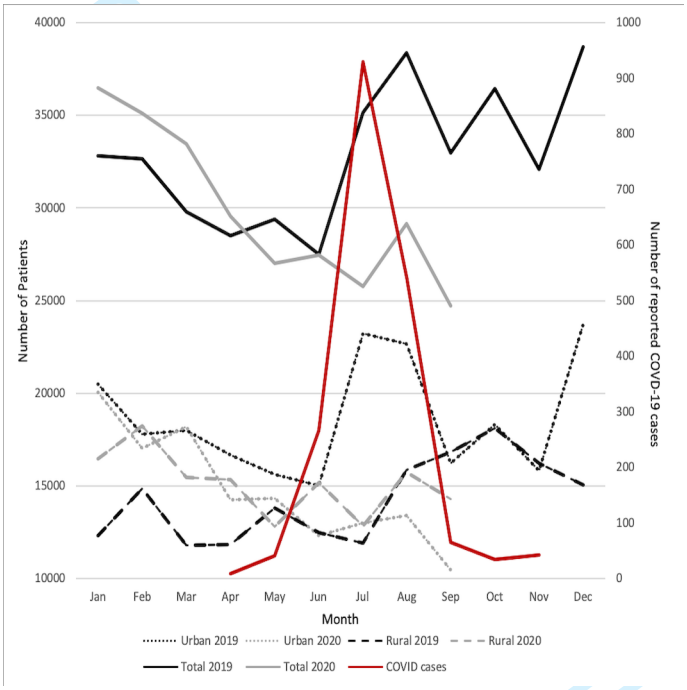
Staff training		August	September	October
All frontline workers	Percentage trained in COVID-19	51.6%	69.6%	80.4%
Hand washing		August	September	October
HWF at entrance	Percentage of facilities	32.3%	32.3%	32.3%
HWF at OPD	Percentage of facilities	71.0%	58.1%	54.8%
HWF HIV	Percentage of facilities	25.81%	22.58%	19.35%
HWF at EPI	Percentage of facilities	19.35%	6.45%	3.23%
HWF at Maternity / antenatal	Percentage of facilities	32.26%	32.26%	29.03%
HWF at toilets	Percentage of facilities	3.23%	0.00%	0.00%
HWF in consultation room	Percentage of facilities	32.26%	25.81%	9.68%
No. HWF per facility	Average number per facility	2.4	2.1	1.7
HWF with soap and water	Percentage with	32.0	29.5	14.9
HWF with water only	Percentage with	61.8	51.8	66.5
Hand sanitiser	Number with access (from 31)	3.0	2.0	0.0
Temperature checks		August	September	October
Thermometer available	Number with access (from 31)	9.0	8.0	4.0
Checks at entrance	Number of the 31 health facilities	0.0	1.0	0.0
Checks at waiting area	Number of the 31 health facilities	0.0	0.0	1.0
Checks in consultation room	Number of the 31 health facilities	8.0	7.0	0.0
Masks		August	September	October
Surgical masks available	Percentage of facilities with available	83.87%	100.00%	90.32%
N95 masks available	Percentage of facilities with available	38.71%	38.71%	35.48%
Mask wearing				
Health workers (non nursing)	Always wearing	25.8%	51.6%	19.4%
	Sometimes wearing	48.4%	45.2%	64.5%
	Not wearing	25.8%	3.2%	16.1%
Nurses	Always wearing	29.0%	51.6%	22.6%
	Sometimes wearing	38.7%	29.0%	54.8%
	Not wearing	32.3%	19.4%	22.6%
Auxiliary staff	Always wearing	6.5%	41.9%	12.9%
	Sometimes wearing	48.4%	35.5%	67.7%
	Not wearing	45.2%	22.6%	19.4%
Patients	Always wearing	0.0%	16.1%	3.2%
	Sometimes wearing	25.8%	64.5%	67.7%
	Not wearing	74.2%	19.4%	29.0%

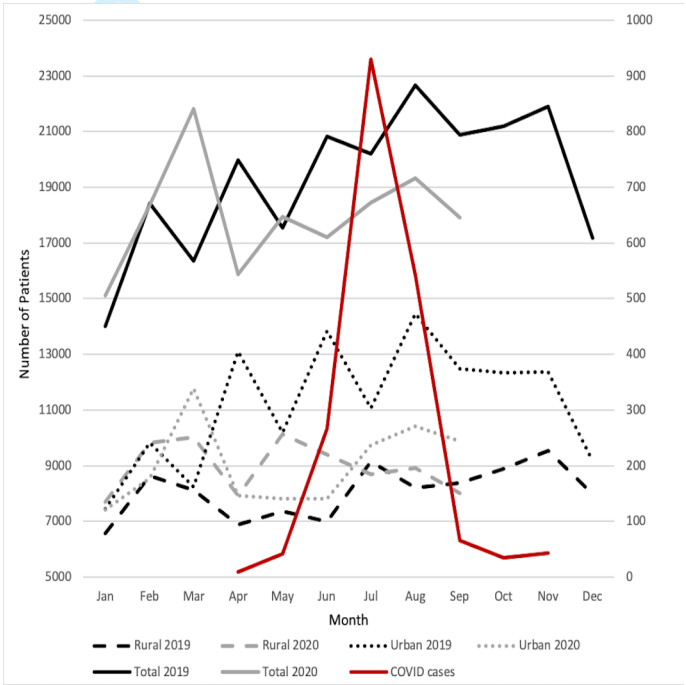
Guardians	Always wearing	0.0%	19.4%	3.2%
	Sometimes wearing	3.2%	58.1%	67.7%
	Not wearing	96.8%	22.6%	29.0%
Mask type				
Health workers (general)	Surgical	68.97%	76.9%	92.9%
	N95	27.59%	15.4%	7.1%
	Cloth	3.45%	7.7%	0.0%
Nurses	Surgical	80.8%	85.2%	96.0%
	N95	19.2%	14.8%	4.0%
	Cloth	0.0%	0.0%	0.0%
Auxiliary staff	Surgical	81.8%	85.2%	88.9%
	N95	18.2%	11.1%	3.7%
	Cloth	0.0%	3.7%	7.4%
Patients	Surgical	53.3%	41.0%	35.9%
	N95	0.0%	2.6%	7.7%
	Cloth	46.7%	56.4%	56.4%
Guardians	Surgical	50.0%	44.4%	36.8%
	N95	0.0%	2.8%	5.3%
	Cloth	50.0%	52.8%	57.9%
Waste management				
Pit	Number of the 31 health facilities	9	5	7
Incinerator	Number of the 31 health facilities	19	21	19
Open burning	Number of the 31 health facilities	3	5	5
Physical distancing		August	September	October
Physical distancing on arrival	Number of the 31 health facilities	9	14	6
	Word of mouth	54%	69.2%	100%
	Chairs spaced	38%	15.4%	0%
	Floor markings	8%	15.4%	0%
Physical distancing in waiting area	Number of the 31 health facilities	13	18	13
	Word of mouth	41%	45.0%	52.9%
	Chairs spaced	41%	30.0%	41.2%
	Floor markings	18%	25.0%	5.9%
Physical distancing in consultation area	Number of the 31 health facilities	16	17	14
	Word of mouth	50%	33.3%	0.0%
	Chairs spaced	50%	66.7%	91.7%
	Floor markings	0%	0.0%	8.3%
Physical distancing in wards	Number of the 31 health facilities	6	2	1
	Word of mouth	37.50%	0.0%	0.0%
	Chairs spaced	62.50%	100.0%	100.0%
	Floor markings	0%	0.0%	0.0%

Case management		August	September	October
Isolation room	Number of the 31 health facilities	3	4	4
Presence of suspected cases	Number of the 31 health facilities	12	15	19
Action to take when case is available	Give a mask	11.11%	17.24%	17.07%
	Isolation	37.04%	31.03%	29%
	Call covid-19 team at DHO	40.74%	44.83%	29%
	Call hotline number	3.70%	0.00%	0%
	Other	7.41%	6.90%	24%


160000
140000
120000
100000
80000
60000
40000
20000
0
Number of Patients
1000
900
800
700
600
500
400
300
200
100
0
Number of reported COVD-19 cases
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Months
Urban 2019
Urban 2020
Rural 2019
Rural 2020
Total 2019
Total 2020
COVID cases


1600
1400
1200
1000
800
600
400
200
0
Number of Patients
1000
900
800
700
600
500
400
300
200
100
0
Number of reported COVID-19 cases
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Rural 2019
Rural 2020
Urban 2019
Urban 2020
Total 2019
Total 2020
COVID cases


40000
35000
30000
25000
20000
15000
10000
Number of Patients
1000
900
800
700
600
500
400
300
200
100
0
Number of reported COVD-19 cases
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Urban 2019
Urban 2020
Rural 2019
Rural 2020
Total 2019
Total 2020
COVID cases


25000
23000
21000
19000
17000
15000
13000
11000
9000
7000
5000
1000
900
800
700
600
500
400
300
200
100
0
Number of Patients
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Rural 2019
Rural 2020
Urban 2019
Urban 2020
Total 2019
Total 2020
COVID cases

HEALTH FACILITY CHARACTERISTICS

Health facility name	Health facility Location	number of healthcare workers		Number of auxiliary staff	Population of catchment area
		Number of nurses	Number of clinicians		
Mpemba	Rural	7	2	19	20,619
Dziwe	Rural	5	3	32	18,886
Chabvala	Rural	3	2	25	13,746
Chileka SDA	Rural	3	2	26	17,240
Lundu	Rural	5	3	26	27,164
Namikoko	Rural	3	2	19	9,675
Makata	Rural	2	2	27	36,213
Kadidi	Rural	4	4	21	20,414
Gateway	Urban	15	10	43	No records available
Mbayani	Urban	6	2	49	74,102
Chirimba	Urban	6	5	45	61,093
Ndirande	Urban	31	11	80	131,353
Malabada	Rural	6	3	42	No records available
Chikowa	Rural	6	6	36	36,174
Chileka	Rural	19	7	62	30,803
Mdeka	Rural	8	3	37	33,406
Lirangwe	Rural	9	3	40	28,896
Madziabango	Rural	6	2	33	9,901
South Lunzu	Urban	21	11	25	89,963
Pensulo	Rural	4	1	29	16,245
Mitsidi	Rural	5	2	40	No records available
Zingwangwa	Urban	21	9	71	141,123
Limbe	Urban	21	11	95	77,108
Ameca	Rural	6	3	20	No records available
Light House	Urban	0	1	10	No records available
Bangwe	Urban	21	10	98	203,022
Makhetha	Urban	7	3	37	62,919
Mpingo	Rural	3	0	16	9,780
Chimembe	Rural	5	2	16	20,088
Soche Maternity	Rural	3	2	33	15,948
Chilomoni	Urban	21	8	55	76,030

Summary of COVID preparedness from 31 health facilities across Blantyre District (Urban vs Rural) from August – October 2020

		Urban			Rural		
Staff training		August	September	October	August	September	October
All frontline workers	Percentage trained in COVID-19	41.10%	67.10%	80.70%	63.10%	73.80%	84.70%
Hand washing		August	September	October	August	September	October
HWF at entrance	Percentage of facilities	33.33%	33.3%	25.0%	36.8%	37%	42.1%
HWF at OPD	Percentage of facilities	67%	33.3%	41.7%	68.4%	74%	78.9%
HWF HIV	Percentage of facilities	8%	16.67%	8.33%	31.58%	26%	31.58%
HWF at EPI	Percentage of facilities	8%	0.00%	0.00%	26.32%	11%	5.26%
HWF at Maternity / antenatal	Percentage of facilities	17%	8.33%	33.33%	73.68%	68%	47%
HWF at toilets	Percentage of facilities	0%	0.00%	0.00%	10.53%	0%	0%
HWF in consultation room	Percentage of facilities	25%	33.33%	8.33%	36.84%	26%	11%
No. HWF per facility	Average number per facility	1.58	1.25	1.27	2.54	2.22	2.11
HWF with soap and water	Percentage with	31.58%	28.57%	28.57%	46.00%	44.44%	33.33%
HWF with water only	Percentage with	68.42%	64.29%	71.43%	52.00%	55.56%	66.67%
Hand sanitiser	Number with access (from 31)	2	1	0	1	1	0
Temperature checks		August	September	October	August	September	October
Thermometer available	Number with access (from 31)	1	4	2	8	4	2
Checks at entrance	Number of the 31 health facilities	0	1	0	0	0	0
Checks at waiting area	Number of the 31 health facilities	0	0	0	0	0	1
Checks in consultation room	Number of the 31 health facilities	1	3	0	7	4	0
Masks		August	September	October	August	September	October
Surgical masks available	Percentage of facilities with available	91.67%	100.00%	83.33%	84.21%	100.00%	89.47%
N95 masks available	Percentage of facilities with available	16.67%	25.00%	66.67%	52.63%	42.11%	42.11%

Mask wearing							
Health workers (non nursing)	Always wearing	41.67%	50.00%	8.33%	15.79%	47.37%	26.32%
	Sometimes wearing	58.33%	50.00%	83.33%	42.11%	47.37%	57.89%
	Not wearing	0.00%	0.00%	8.33%	42.11%	5.26%	15.79%
Nurses	Always wearing	27.27%	50.00%	25.00%	26.32%	42.11%	26.32%
	Sometimes wearing	63.64%	16.67%	66.67%	31.58%	36.84%	47.37%
	Not wearing	9.09%	33.33%	8.33%	42.11%	21.05%	26.32%
Auxiliary staff	Always wearing	16.67%	50.00%	0.00%	5.26%	36.84%	21.05%
	Sometimes wearing	50.00%	41.67%	25.00%	47.37%	31.58%	63.16%
	Not wearing	33.33%	8.33%	75.00%	47.37%	31.58%	15.79%
Patients	Always wearing	0.00%	33.33%	0.00%	0.00%	5.26%	5.26%
	Sometimes wearing	41.67%	66.67%	91.67%	21.05%	57.89%	57.89%
	Not wearing	58.33%	0.00%	8.33%	78.95%	36.84%	36.84%
Guardians	Always wearing	0.00%	41.67%	0.00%	0.00%	5.26%	5.26%
	Sometimes wearing	8.33%	41.67%	91.67%	5.26%	57.89%	57.89%
	Not wearing	91.67%	16.67%	8.33%	94.74%	36.84%	36.84%
Mask type							
Health workers (general)	Surgical	74.43%	80.00%	84.62%	76.92%	66.67%	94.12%
	N95	28.57%	13.33%	15.38%	23.08%	22.22%	5.88%
	Cloth	0.00%	6.67%	0.00%	0.00%	11.11%	0.00%
Nurses	Surgical	76.92%	88.89%	91.67%	84.62%	78.95%	93.33%
	N95	23.08%	11.11%	8.33%	15.38%	21.05%	6.67%
	Cloth	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Auxiliary staff	Surgical	77.78%	83.33%	75.00%	84.62%	86.67%	100.00%
	N95	22.22%	8.33%	8.33%	15.38%	13.33%	0.00%
	Cloth	0.00%	8.33%	16.67%	0.00%	0.00%	0.00%
Patients	Surgical	42.86%	40.91%	35.00%	80.00%	42.86%	38.10%
	N95	0.00%	4.55%	10.00%	0.00%	0.00%	4.76%
	Cloth	57.14%	54.55%	55.00%	20.00%	57.14%	57.14%

Guardians	Surgical	50.00%	50.00%	40.00%	50.00%	42.86%	36.84%
	N95	0.00%	0.00%	5.00%	0.00%	4.76%	5.26%
	Cloth	50.00%	50.00%	55.00%	50.00%	52.38%	57.89%
Waste management		August	September	October	August	September	October
Pit	Number of the 31 health facilities	6	4	2	3	1	5
Incinerator	Number of the 31 health facilities	6	13	10	3	8	9
Open burning	Number of the 31 health facilities	0	3	0	3	2	5
Physical distancing		August	September	October	August	September	October
Physical distancing on arrival	Number of the 31 health facilities	5	6	3	4	8	3
	Word of mouth	50%	66.67%	25.00%	40.00%	75.00%	66.67%
	Chairs spaced	38%	16.67%	0.00%	60.00%	0.00%	0.00%
	Floor markings	13%	16.67%	0.00%	0.00%	25.00%	33.33%
Physical distancing in waiting area	Number of the 31 health facilities	7	9	6	6	9	7
	Word of mouth	45.46%	33.33%	42.67%	28.57%	50.00%	55.56%
	Chairs spaced	27.27%	16.67%	8.33%	74.43%	25.00%	0.00%
	Floor markings	27.27%	41.67%	33.33%	0.00%	25.00%	44.44%
Physical distancing in consultation area	Number of the 31 health facilities	9	6	5	7	11	9
	Word of mouth	54.55%	25.00%	0.00%	50.00%	26.67%	20.00%
	Chairs spaced	45.46%	50.00%	41.67%	50.00%	73.33%	70.00%
	Floor markings	0.00%	0.00%	0.00%	0.00%	0.00%	10.00%
Physical distancing in wards	Number of the 31 health facilities	1	0	0	2	2	1
	Word of mouth	100.00%	0.0%	0.0%	33.33%	0.00%	0%
	Chairs spaced	0.00%	0.0%	0.0%	66.67%	100.00%	100%
	Floor markings	0.00%	0.0%	0.0%	0.00%	0.00%	0%
Case management		August	September	October	August	September	October
Isolation room	Number of the 31 health facilities	1	2	2	2	2	2
Presence of suspected cases	Number of the 31 health facilities	8	8	8	4	7	11

Action to take when case is available	Give a mask	11.11%	0.00%	11.11%	16%	8.70%	10.53%
	Isolation	33.33%	16.67%	44%	32%	30.43%	31.58%
	Call covid-19 team at DHO	33.33%	50.00%	33%	35%	34.78%	31.58%
	Call hotline number	0.00%	16.67%	0%	10%	13.04%	5.26%
	Other	22.22%	16.67%	11%	3%	13.04%	21.05%

Appendix 7: **Health Centre Assessment Questionnaire**

District:_____Date:_____

Dispensary/Health centre Name: _____

Facility ID NO: _____

GPS Coordinates:

Observations

No	Question	Responses
1	What is the distance (in kilometres) from the "district hospital" to this health facility?	☐☐☐ Kilometres
2	Type of road reaching the health facility	☐ Dirty small road ☐ Improved large road (paved)
3	Is there cell phone coverage at the health facility	☐ Yes ☐ No
4	Visible Hand washing facility at the health facility	☐ None ☐ Yes with Soap and water ☐ Yes with no soap
5	Temperature Check	☐ Yes present and working ☐ Thermometer present but not working ☐ Thermomter present but not used ☐ Not present
6	Type of masks HCW wearing	☐ Surgical Masks ☐ N95 ☐ Home made
7	Do they have COVID -19 leaflets (any other sensitisation messages) available	Yes/No
8	How are gloves, masks waste being disposed	BIN PIT Open Space

9	Observe if there are adhering to physical distance between a. Patient to patient b. Patient to attendant/health care worker c. Health care worker to health care worker	Yes/No
10	Staff wearing face masks /face shield	Nurses Yes /NO or some ---------- Medical assistants Yes/No or some ---------- HSAs Yes/No or some---------- Cleners Yes /No or some---------- Pharmamcy Yes /NO or some ---------- Security Patients assistants Ground labourers
11	Water source at the health facility	
12	Hand washing points	
13	Latrines att the facility	
14	Isolation space	

Collect monthly Total Number of Patients attended at the facility;

No	2019	Number of patients	2020	Number of patients
1	January		January	
2	February		February	
3	March		March	
4	April		April	
5	May		May	
6	June		June	
7	July		July	
8	August		August	
9	September		September	

10	October		October	
11	November		November	
12	December		December	

SECTION A: Human Resource

Ask for Number of total health workers at the health facility according tto cadre		**Total Number**	**Number present today**
1.	Clinical Officers		
2.	Nurses/midwives		
3.	Patients Attendants/		
4.	Health surveiallance assistants		
5	Hospital Attendant/Maid/Cleaners		
6	Security officers		
7	Medical Assistants		
8	Data clerk		
9	Pharmacy Assistant		
10	Ground Labourers		
11	Counsellors		

Training

Number of total health workers at the health facility who were trained in COVID-19

Cadre	**Number Trained**	**When were they trained**	**Who trained them**	**What areas were they trained**
Clinical Officers			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)

Nurses/midwives			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management
Patients Attendants/			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Health surveiallance assistants			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Hospital Attendant/maid/Cleaners			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Security officers			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Medical Assistants			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Data clerk			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Pharmacy Assistant			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)

Ground Labourers			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)
Counsellors			Government NGO Other (*Specify*)	Case Identification & Tracing Case Management Other (*Specify*)

Does the facility has a working shift schedule for diffèrent cadres

Cadre	**Yes/No**	**How many per shift**
Clinical Officers		
Nurses/midwives		
Patients Attendants/		
Health surveiallance assistants		
maid/Cleaners		
Security officers		
Medical Assistants		
Data clerk		
Pharmacy Assistant		
Counsellors		
Ground Labourers		

SECTION B : Disease Control

Question	**Options**	**How many (Qty) This should refer to in-Stock?**

Do you have the following Supplies; Soap Hand sanitizer Buckets Masks. 1. N95 2. Surgical Masks Maternity Aprons Plastic Aprons Face Shields Gloves Gumboots	Is it available (Yes/No)	_____
Do you do health talks about COVID-19		_____
If yes how frequent	Daily Once a Week More than once a week Other (Specify)	_____
If yes how is the health talk delivered	During morning sessions During consultation As we are waiting Using Mass Media (e.g. TV)	_____
How do you do contact tracing		_____
In the last month did you have patients you could not treat because your health facility run out of supplies		_____

If yes, which supplies were out of stock Soap Sanitizer Washing facilitlities Masks. 1. N95 2. Surgical Masks Maternity Aprons Plastic Aprons Face Shields Gloves Gumboots		_____
When you run out of stock of supplies, how long does it take for stock to be re-supplied.		_____
When are you expecting the other supplies?		_____
What further questions do you ask a suspected case	_____	
Then what do you do when you find a suspect	Give a mask Isolation Call the COVID-19 team at DHO Call HOTLINE Number Other (Specify)	
What is the hotline number for COVID 19		
Do you have a contact person for COVID19 at facility level? If yes, what is their name and phone number?	Name: Number :	

Which services do you provide as a facility;	- OPD (include malaria etc) - General Counseling - Family Planning - Sti Services - Ante-Natal, Delivery And Post-Natal Care Services - Prevention Of Mother To Child Transmission Of Hiv (Pmtct) - Treatment Of Sexual Abuse (Including Pep) - Post Abortion Care (Pac) - ART Services - HTC - Cancer Screening Other:_____	
In the last three months, which services were you not able to provide	- OPD (include malaria etc) - General Counseling - Family Planning - Sti Services - Ante-Natal, Delivery And Post-Natal Care Services - Prevention Of Mother To Child Transmission Of Hiv (Pmtct) - Treatment Of Sexual Abuse (Including Pep) - Post Abortion Care (Pac) - ART Services - HTC - Cancer Screening Other:_____	

Which service are you currently providing	- Opd - General Counseling - Family Planning - Sti Services - Ante-Natal, Delivery And Post-Natal Care Services - Prevention Of Mother To Child Transmission Of Hiv (Pmtct) - Treatment Of Sexual Abuse (Including Pep) - Post Abortion Care (Pac) - Art Services - Htc - Cancer Screening Other:_____	

What are the usual source of electricty at this health facility.	☐ ESCOM ☐ Functioning generator ☐ Solar ☐ Other (please specify) ☐ No reliable source of electricity
When the usual source of electricty is not available what supplemental source do you have? ***Please select only one answer***	☐ Generator ☐ IPS (rechargeable battery) ☐ Solar ☐ No supplemental source ☐ Other (specify)
What are the main sources of water at the health facility	☐ Tap ☐ Borehole ☐ Well must be fetched from elsewhere
Do you have latrines at the facility? If Yes, How are they distributed?	☐ At least 2 latrines (at least one each for men and women) ☐ 1 latrine ☐ No latrines

Impact of COVID-19 on health centre service delivery in urban and rural Malawi

Topic guides: In-depth Interviews (front-line health workers)

Due to the iterative nature of qualitative research, the interviews that we conduct with participants will be open-ended and iterative, limiting the extent to which the content and direction of interviews can be fully anticipated. However, the topic guide provides a guide to the themes and questions that will be discussed with front-line staff at health care clinics. We will refine and update the topic guides as new themes will be discussed with each group of participants, which will be refined in response to new themes and findings that emerge.

First round

Demographics
Role at the clinic:
Age:
Birth place:
Highest qualification:
Length of time in post:
Length of time working in health care:

Theme 1: Experiences of delivering care

- Can you tell me about your day to day work? (explore how many patients they normally see at the clinic, what are the most frequent illnesses they treat, any challenges with stockouts)
- If you think back over the two months, have you seen any changes at the clinic? (probe around the number of patients coming to the clinic, incorporating new practices into their work including new screening practices, length of day, changes in the illnesses they are seeing and any differences in stockouts)
- Looking forward what do you think is likely to change in the coming months in relation to delivering care to patients?

Theme 2: Provision of support

- Have you been provided with any specific support to work during COVID? (if they say yes, probe around what this is, and whether it has had any impact on day to day work practices)

Theme 3: Risk perception and COVID-19

- What do you think are the biggest risks in your life? (probe around inside and outside of work)
- If you look back two months to now, how do you feel about coming to work? (is there anything you feel more worried about? Anything you feel less worried about?)
- What do you know about COVID-19? (probe around how it is transmitted, whether they see any specific groups at risk, what practices people can put in place to avoid becoming infected)
- Do you see yourself as at risk of COVID-19? (if they do, where to they see this risk is coming from, does it link to any specific procedures)
- If they do see themselves at risk of COVID-19 are they doing anything to protect themselves?

Second round

Theme 1: Experiences of delivering care

- If you think back during the first wave of COVID, have you seen any changes at the clinic?
    - Explore whether the number of patients coming to the clinic has increased or reduced (probe what influences people to or not come)
- If at all, what is the impact of the second wave of COVID on health service delivery?
    - Probe whether health service delivery has been reduced or not, what changes have brought in reduction in service delivery or what has caused an increase in service delivery)
    - Probe on what services have been affected in the second wave and why?
      Probe whether there have been changes in the way patients are managed, what have brought in changes in patient management

Impact of COVID-19 on health centre service delivery in urban and rural Malawi

Topic guides: In-depth Interviews (front-line health workers)

- Explore whether there have been new practices incorporated into their work (including screening practices, changes in the ways patients are managed)

Theme 2: Infrastructural support for COVID response

WASH

- What type of hand washing facilities do you have in place at the moment at the HF
  - Buckets with taps:
    - Quantity (being used and in storage)
    - Location (multiple areas)
  - Piped water to permanent sinks:
    - Quantity (functioning)
    - Location
  - None
  - Other
- Has anything changed in terms of hand washing facilities since the first wave for example: now have piped water supply, piped water not working so using buckets?
  - Have any of these changes led to specific challenges at the clinic?
  - Have any of these changes led to improvements or benefits to the clinic?

- If you are using or have movable systems such as buckets with taps were they:
  - At the HF before COVID was an issue
  - Provided during the first wave of COVID and now not available – if no why not?
  - Provided during the first wave of COVID and still being used
  - Provided during the first wave of COVID and not being used – if not why not?
  - Not provided – why (already have piped supply, not known etc)
  - Do you have some of the buckets for handwashing stored in the storage room (if yes, probe for reasons).
- Do you have any soap available for hand washing?
  - Had during first wave but not now – why?
  - Yes have it available and being used now – why is it available now?
  - Yes have it available but not being used
- Who is the soap made available to:
  - Everyone
  - Staff only – if this is the case why?
  - Where is the soap from (personal, purchase, supplied etc)
  - Is the soap available all the time (if no, probe for reasons)
- Is the soap available even when the facility is closed for the patient guardians or support staff (e.g. security guards)
- Do they think that washing hands with water only is the same as washing hands with soap – in general and specifically related to COVID
- Do you have access to hand sanitiser at all?
  - Where is it from (personal purchase, supplied, etc)
  - Is the sanitizer available all the time (if no, probe for reasons)
  - Who has access to it? (clinical staff, all frontline workers, everyone)
  - Do you think hand sanitiser is the same, more or less effective than hand washing with soap? Why?

Client management

- Are there any checks on patients as they arrive at the clinic – what are they, what happens if someone fails the checks (e.g. temperature, clinical symptoms etc)
- What happens when there is suspected case of COVID?
- Is there any system of physical distancing at the facility? (arrival, waiting area)
  - What is it and how effective do you think it is?

Impact of COVID-19 on health centre service delivery in urban and rural Malawi

Topic guides: In-depth Interviews (front-line health workers)

- What are the challenges?
- If there is no distancing why is it not done?

- Are thermometers available to check the clients?
  - What type of thermometers are they?
  - Where at the facility is the temperature check conducted?

Masks

- Does the facility have masks available for frontline workers?
  - What type - explore for multiple types and whether they are different for different cadre of staff i.e. health workers, patient attendants or security guards
  - Are people using them – explore who is using what, why using and why not using
  - Are clients/patients arriving wearing masks? What type? What happens if they are not?
  - For those using masks, are they using them properly (i.e. cover nose and mouth).

Theme 3: Risk perceptions and COVID-19

Perceived danger about COVID-19

- What are your perceptions on COVID-19? (What do they think might happen to you or your family should you be infected? Are you concerned about disease complications? Are you worried about loss of income or job because of illness due to COVID-19?
- Have you changed any aspects of your work practice due to COVID-19?
- Have you ever missed work because of illness or testing COVID positive?
- Have you considered missing work because of fear of being exposed? (If they were COVID positive, what did that mean to them?)
- If you think back during the first wave of COVID, how do you feel about coming to work?
  - Is there anything you feel more worried about than before?
  - Anything you feel less worried about than before?

- What do you think are the patients' or people in the wider community's perceptions on COVID-19?
  - Have you seen an increase in fear from patients coming to the clinic? (probing around rumours about COVID?)
  - Have patients asked any questions around COVID-19 during their time at the clinic? If so what kinds of questions are they asking?
  - Are people in the wider community asking you about COVID-19, are you hearing any rumours around fear of getting infected?
  - Have you seen changes from the first and second wave?

Perceptions of the vaccine

- Have you accessed the vaccine?
  - If yes probe around whether this has impacted on feelings about going to work or work practice?
- Have you heard any rumours around the vaccine?
  - If yes can you describe what they relate to?
  - Who are you hearing these rumours from – patients, family members?
  - Do you think the rumours have impacted on people attending the clinic?
  - Is there anything you think can be done to address the rumours (only ask this if they report hearing rumours)

Third round

For this round of interviews we will be focusing on the in-charges of the 8 facilities we have sampled. Reviewing the transcripts we will ensure we follow up on any unanswered questions and target the guide to each in-charge (or clinician)

- How has your clinical practice changed with COVID-19? [probe around commitment to practicing safety (e.g. use of PPE), interaction with patients]
  - Looking to the future are there things you will continue to do?

Impact of COVID-19 on health centre service delivery in urban and rural Malawi

Topic guides: In-depth Interviews (front-line health workers)

- How have practices and procedures in the clinic changed? (probe around strategies for preventing overcrowding of patients e.g. opening the clinic earlier, alternative methods of delivering services e.g. women administering contraceptives themselves)
    - Looking to the future do you think these are likely to continue?
- How has the clinic been implementing the health communication about COVID-19?
    - What communication strategies the clinic used? (probe around community engagement and the role of chiefs/churches in disseminating COVID-19 information)
    - If any, what challenges they encountered with communication?
- What has been the impact of the health communication?
    - How has the communication shaped people's behaviours and practices?
- What do you think will be the long-term impacts of the health communication about COVID-19?
    - Looking to the future how do you think people will react should the virus resurface?

Fourth round

Changes in clinic responses to COVID-19

- Can you tell me if there have been any new developments at the clinic in terms of responding to the COVID-19 situation? (Probe whether clinic attendance, handwashing, use of PPEs/masks, social distancing has changed. What led to the change? What's the impact of the change?)

Health workers' job satisfaction and motivation during COVID-19

- What do you think about your current working conditions? (What motivates you or discourages you to work during this time? If at all, does it affect your behaviour towards your work? If yes, in what way?
- Do you get allowances on your job? If yes or no, how does it impact on your behaviour towards your work?)

Psychosocial impacts of COVID-19 on health workers and coping mechanisms

Perceived danger about COVID-19

- What are your perceptions on COVID-19? (What do they think might happen to you or your family should you be infected? Are you concerned about disease complications? Are you worried about loss of income or job because of illness due to COVID-19?
- If at all, does feeling at risk impact your behaviour towards your work? If yes, in what way?
- Have you ever missed work because of illness or testing COVID positive, or considered missing work because of fear of being exposed? (If they were COVID positive, what did that mean to them?)
- What do you think are the patients' or people's perceptions on COVID-19? (Do they feel at risk? If yes, in what way do they think they might get infected? Or who do they think might infect them? What are the consequences of them being infected? If no, why do they feel in this way?

Social stigma and self-stigma about COVID-19

- How does the perception of being at risk of COVID-19 make you feel? (Are you concerned about infecting other people? Do you feel you might infect others if you have the virus? If at all, does this affect how you interact with other people both at and outside of work (families, patients)?
- Based on your personal experiences, how do people perceive health workers with regards to COVID-19? (What reactions do you get from the public when it comes to COVID-19? Any changes in how people interact with you or other health workers in the community or at the clinic? How does this make you feel? [Probing in this one around whether they have experienced any abuse or anger from the community more broadly]

Social support for health workers during COVID-19

- Are you receiving any support to deal with the negative impacts of COVID-19? (If yes, what kind of support, where does the support come from?)

Is there any support you would like to receive regarding dealing with the negative impacts of COVID-19?

Impact of COVID-19 on health centre service delivery in urban and rural Malawi

Topic guides: In-depth Interviews (front-line health workers)

Fifth round

Focusing on the in-charges of the 8 facilities we have sampled, following up on any unanswered questions, and targeting the guide to each in-charge.

Theme 1: Impacts of COVID-19 on healthcare practices

- How has your clinical practice changed with COVID-19? [probe around commitment to practicing safety (e.g. use of PPE), interaction with patients]
    - Looking to the future are there things you will continue to do?
- How have practices and procedures in the clinic changed? (probe around strategies for preventing overcrowding of patients e.g. opening the clinic earlier, alternative methods of delivering services e.g. women administering contraceptives themselves)
    - Looking to the future do you think these are likely to continue?

Theme 2: Public health communication and long-term impacts

- How has the clinic been implementing the health communication about COVID-19?
    - What communication strategies the clinic used? (probe around community engagement and the role of chiefs/churches in disseminating COVID-19 information)
    - If any, what challenges they encountered with communication?
- What has been the impact of the health communication?
    - How has the communication shaped people's behaviours and practices?
- What do you think will be the long-term impacts of the health communication about COVID-19?
    - Looking to the future how do you think people will react should the virus resurface?

Theme 2: Gender differences in COVID-19 vaccine uptake

- Why are we seeing more men than women uptake? (explain that previous interviews showed this)
- Has this changed during the second vaccine?
- Access and challenges?

Theme 3: Uptake of COVID-19 vaccine among healthcare providers

- What is COVID vaccine uptake like amongst health centre staff?
- Have there been any challenges?

Impact of COVID on health service provision

- What is causing an increase in the uptake of family planning services? (Explain that previous interviews showed this)
- Has something changed?
- Why is there a drop in uptake of TB services? Has something changed?

Covid19 study: Coding strategy (NVIVO extract)

Nodes

Name		Description
1. Knowledge on COVID-19		Frontline workers knowledge on COVID-19: causes or risk factors; transmission; prevention or treatment; vulnerable groups; etc.
COVID-19 preparedness and response		
• **Prevention measures**	• **Restricting movement**	Emphasis on the need for people to stay in door
	• **Social distancing**	E.g. marking the floor/seat, or letting in only a number of clients at a time, or seeing patients in an open space rather than in a confined space of a consultation room
	• **Using PPEs**	Eg masks, aprons, gloves etc, including mandatory masking in public spaces
	• **Hand washing**	Washing hands mainly with soap and water, sanitizer irregularly provided
	• **Suggestions on COVID preparedness and response**	Improving supplies through engagement with corporate stakeholders Holding community outreach covid services to facilitate wide screening and case isolation Enforcing mandatory public use of masks Motivating hospital staff
	• **COVID communication and messaging**	Strategies for communicating COVID-19 information: through chiefs or church leaders; public health talks during service provision; radio or TV; etc.
2. COVID-19 prevention barriers		
	• **Behavioral barriers**	Noncompliant behaviours: distrust (COVID as a hoax); misconceptions (linking COVID to weather); spiritualism (associating COVID with satanism); lack of adherence (mask causing breathing discomfort, resumption of public activities, decline in cases); sharing masks (lack of money to buy); etc.
	• **Conditions at work**	Issues affecting staff: lacking COVID training; not receiving compensation or risk allowance;

Name		Description
		increased workload
	• **Underlying health system challenges**	Limits in resources: drug stockouts; early shortage of working materials; lack of hospital equipment; shortage of funding; shortage of space; staffing deficiencies; etc.
3. Case management		Explanation about management of COVID suspects or confirmed cases
	• **Communication between DHO and facility**	How the facility communicated with isolation centre or main district hospital regarding COVID suspects or cases
	• **Isolation/quarantine**	Referring cases to the isolation centre, or advising patients to self isolate at home
	• **Guidelines on case management**	
	• **Number of suspect cases**	
4. COVID -19 support		Supply of work materials (masks/PPEs/sanitary facilities, hospital equipment, financial support) from government, companies, and non-governmental organisations
	• **Impact of support**	Better case management, safety of health workers, improved hospital supplies
5. Impacts of COVID-19		
• **Impacts on health seeking**		Decrease in clinic attendance (e.g., due to fear of COVID-19)
• **Impacts on service provision**	• **Suspending service**	Temporarily stopping some services e.g., TB and HIV screening services
	• **Increased waiting hours**	Increased workload coupled with a shortage of staff making patients stay longer
	• **Adapting strategies for delivering care**	E.g., clients administering contraceptives on their own; community outreach clinics; extending ART/TB prescription duration; reducing clinic time; patients visiting on appointments; working in shifts; suspending services; etc.

Name		Description
• **Impacts on staff or patients**	• **Economic impacts**	Economic impacts: cost of managing COVID-19 illness; loss of income because absence from work/business due to COVID illness; etc.
	• **Physiological impacts**	Physical health impacts: abuse from patients; fatigue from increased workloads; illness from COVID
	• **Psychological impacts**	Anxiety about catching COVID due to frequent contact with patients; stress from increased workloads; helplessness (difficulties managing the need to work for income and the risk of COVID at work); concern for family (fear of infecting family members); sacrifice versus moral obligation (feeling compelled to work despite seeing themselves at risk because they promised to serve people); stigma/discrimination (unable to interact with others because of fear of being treated differently)
	• **Psychosocial support systems for negative impacts**	Counselling, social networks (seeking moral support from families, neighbors/friends, etc.), ombudsman (for support on verbal/physical abuse from patients/community members)
6. COVID-19 vaccine provision and public reaction		
	• **Early hesitancy**	Distrust: misconceptions and spiritual beliefs causing reluctance to vaccinate Vaccine safety concerns: fear of side effects; rumors of people becoming animals once vaccinated
	• **Public becoming willing over time**	Continuous awareness campaigns (in conjunction with local leaders) helping to improve public behaviours about COVID-19 vaccine; limited evidence of negative side effects also encouraging people to vaccine
	• **Vaccine and gender**	How men and women are responding to COVID-19 vaccine; more men getting vaccinated than women
7. Demographics		
	• **Daily routines**	What the frontline worker's work involve on daily basis
	• **Years in service**	How long they have been working in this position
	• **Education**	Their level of education

Name		Description
	• **Age**	

Research Checklist

#1	**Title** Concise description of the nature and topic of the study identifying the study as qualitative or indicating the approach (e.g. ethnography, grounded theory) or data collection methods (e.g. interview, focus group) is recommended.	Page 1
#2	**Abstract** Summary of the key elements of the study using the abstract format of the intended publication; typically includes background, purpose, methods, results and conclusions.	Page 2
#3	**Introduction** **Problem formulation** Description and signifcance of the problem / phenomenon studied: review of relevant theory and empirical work; problem statement.	Pages 4, 5
#4	**Purpose or research question** Purpose of the study and specific objectives or questions.	Page 5
#5	**Methods** **Qualitative approach and research paradigm** Qualitative approach (e.g. ethnography, grounded theory, case study, phenomenolgy, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g. postpositivist, constructivist / interpretivist) is also recommended; rationale. The rationale should briefly discuss the justification for choosing that theory, approach, method or technique rather than other options available; the assumptions and limitations implicit in those choices and how those choices influence study conclusions and transferability. As appropriate the rationale for several items might be discussed together.	Pages 5-9
#6	**Researcher characteristics and reflexivity**	

	Researchers' characteristics that may influence the research, including personal attributes, qualifications / experience, relationship with participants, assumptions and / or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results and / or transferability.	
#7	Context Setting / site and salient contextual factors; rationale.	Page 5-6
#8	Sampling strategy How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g. sampling saturation); rationale.	Pages 6, 7
#9	Ethical issues pertaining to human subjects Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues.	Page 8
#10	Data collection methods Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources / methods, and modification of procedures in response to evolving study findings; rationale.	Pages 6, 7
#11	Data collection instruments and technologies Description of instruments (e.g. interview guides, questionnaires) and devices (e.g. audio recorders) used for data collection; if / how the instruments(s) changed over the course of the study.	Page 6,7
#12	Units of study Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results).	Pages 6,7

#13	**Data processing** Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymisation / deidentification of excerpts.	Page 9
#14	**Data analysis** Process by which inferences, themes, etc. were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale.	Page 9
#15	**Techniques to enhance trustworthiness** Techniques to enhance trustworthiness and credibility of data analysis (e.g. member checking, audit trail, triangulation); rationale.	Page 9
#16	**Results/findings** **Syntheses and interpretation** Main findings (e.g. interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory.	Pages 10-22
#17	**Links to empirical data** Evidence (e.g. quotes, field notes, text excerpts, photographs) to substantiate analytic findings.	Pages 10-22
#18	**Discussion** **Intergration with prior work, implications, transferability and contribution(s) to the field** Short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of	Pages 22-25

	earlier scholarship; discussion of scope of application / generalizability; identification of unique contributions(s) to scholarship in a discipline or field.	
#19	**Study strength and Limitations** Trustworthiness and limitations of findings.	Page 25
#20	**Other** **Conflicts of interest** Potential sources of influence of perceived influence on study conduct and conclusions; how these were managed.	Page 27
#21	**Funding** Sources of funding and other support; role of funders in data collection, interpretation and reporting.	Page 26
#22	**Author contributions** Role of each other in the study and their contributions	Page 26