



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

Mackwellings Maganizo Phiri ¹, Eleanor Elizabeth MacPherson,^{1,2} Mindy Panulo,³ Kondwani Chidziwisano,^{4,5} Khumbo Kalua,⁶ Chawanangwa Mahebere Chirambo,⁶ Gift Kawalazira,⁷ Zaziwe Gundah,⁷ Penjani Chunda,⁷ Tracy Morse ^{8,9}

To cite: Phiri MM, MacPherson EE, Panulo M, *et al.* Preparedness for and impact of COVID-19 on primary health care delivery in urban and rural Malawi: a mixed methods study. *BMJ Open* 2022;**12**:e051125. doi:10.1136/bmjopen-2021-051125

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2021-051125>).

Received 20 March 2021
Accepted 29 May 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Mackwellings Maganizo Phiri; mackwellingsphiri@gmail.com

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 healthcare facilities, strategically placed throughout districts to offer primary and maternal healthcare. 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 healthcare in Blantyre District, Malawi.

Participants We conducted regular visits to 31 healthcare 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 sanitiser, water, masks and 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.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Using a mixed method approach allowed us to capture data in real time from across the district and gain 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 healthcare facility allowing for triangulation of findings captured through the qualitative interviews.
- ⇒ Collecting data from healthcare 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-income and middle-income contexts, where health systems are often fragile and care-seeking pathways for patients are more challenging, the ramifications of the pandemic are being felt in complex ways.³

The global response to the pandemic has seen development and rollout 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 Africa 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 healthcare 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 sanitiser.^{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 healthcare workers and patients.^{9–10} Psychosocial well-being of healthcare 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 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 6049 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 tuberculosis (TB) case notification.²¹

Primary healthcare 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, expanded programme of

immunisation (EPI), 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 are 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 and (2) to understand frontline 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 (DHO) is mandated to provide management and oversight of primary healthcare facilities.²⁵ This study was situated in Blantyre District in the Southern region, which is serviced by 31 government and faith based primary healthcare facilities (n=14 urban; n=17 rural) (see online supplemental file 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 to 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 healthcare 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 DHO 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 (eg, hand washing facilities (HWFs), soap and thermometers) and observed behaviour of frontline workers (inclusive of healthcare workers and auxiliary staff) and clients (eg, mask wearing and physical distancing) (see online supplemental file 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 healthcare clinics.

Data collection

Quantitative methods

Quantitative assessments were only conducted during the first phase of the study (July–November 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 preprogrammed questionnaire on KoboCollect (<https://www.kobotoolbox.org>) (see online supplemental file 3). The questions included data on patient management, physical distancing, WASH provision and practices, the presence and use of 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; these data were collected from January 2019 to September 2020 to allow for comparison of patient numbers pre-COVID-19.

Following analysis of each round of data collection, 'score cards' were generated for each health facility. The score cards summarised how the healthcare facilities were implementing COVID-19 preventative measures, including training of frontline staff and WASH materials. This included the location and presence of HWFs (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 DHO team through monthly feedback loops to provide guidance on which healthcare 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 healthcare 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 healthcare 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. Semistructured qualitative interviews were conducted over the telephone and guided by a discussion guide (see online supplemental file 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 that 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 healthcare facility. In September 2020, due to time and resource constraints, we repeated interviews with two participants per healthcare facility; this sample included both a health worker and an auxiliary worker. Between October and 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 that was triangulated with quantitative data and structured observations.

Data analysis

Quantitative discrete data related to COVID-19 preparedness within the facility was downloaded from KoboCollect (<https://www.kobotoolbox.org>) as a .csv file, cleaned and analysed using Microsoft Excel V.16 (Microsoft

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	<ul style="list-style-type: none"> ▶ Hospital attendant (IDI04). ▶ Medical assistant (clinic in charge) (IDI01). ▶ Security guard (IDI02). ▶ Ground labourer (IDI03). 	<ul style="list-style-type: none"> ▶ Medical assistant (clinic in charge) (IDI01). ▶ Ground labourer (IDI03). 	<ul style="list-style-type: none"> ▶ Medical assistant (clinic in charge) (IDI01). 	<ul style="list-style-type: none"> ▶ Medical assistant (clinic in charge) (IDI01). ▶ Nurse (IDI28). ▶ Clinician (IDI29). 	<ul style="list-style-type: none"> ▶ Medical Assistant (Clinic in charge) (IDI01)
002mpm	Rural	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI08). ▶ Pharmacy assistant (IDI06). ▶ Ground labourer (IDI14). ▶ Health surveillance assistant (IDI15). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI08). ▶ Ground labourer (IDI14). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI08). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI08). ▶ Nurse (IDI30). ▶ Health surveillance assistant (IDI15). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI08).
003mdk	Rural	<ul style="list-style-type: none"> ▶ Security guard (IDI10). ▶ Clinical officer (clinic in charge) (IDI23). 	<ul style="list-style-type: none"> ▶ Security guard (IDI10). ▶ Clinical officer (clinic in charge) (IDI23). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI23). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI23). ▶ Nurse (IDI31). ▶ Health surveillance assistant (IDI32). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI23).
004nmk	Rural	<ul style="list-style-type: none"> ▶ Medical assistant (clinic in charge) (IDI26). ▶ Hospital attendant (IDI25). 	<ul style="list-style-type: none"> ▶ Medical assistant (clinic in charge) (IDI26). ▶ Hospital attendant (IDI25). 	<ul style="list-style-type: none"> ▶ Medical assistant (clinical in charge) (IDI26). 	<ul style="list-style-type: none"> ▶ Medical assistant (clinical in charge) (IDI26). ▶ Nurse (IDI27). ▶ Health surveillance assistant (IDI33). 	<ul style="list-style-type: none"> ▶ Nurse (IDI27).
005nrd	Urban	<ul style="list-style-type: none"> ▶ Hospital attendant (IDI18). ▶ Security guard (IDI2). ▶ Nurse (clinic in charge) (IDI11). ▶ Data clerk (IDI07). 	<ul style="list-style-type: none"> ▶ Hospital attendant (IDI18). ▶ Nurse (clinic in charge) (IDI11). 	<ul style="list-style-type: none"> ▶ Nurse (clinic in charge) (IDI11). 	<ul style="list-style-type: none"> ▶ Nurse (clinic in charge) (IDI11). ▶ Health surveillance assistant (IDI34). ▶ Nurse (IDI35). 	<ul style="list-style-type: none"> ▶ Nurse (clinic in charge) (IDI11).
006gty	Urban	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI19). ▶ Ground labourer (IDI09). ▶ Nurse (IDI13). 	<ul style="list-style-type: none"> ▶ Clinical Officer (Clinic in charge) (IDI19). ▶ Ground labourer (IDI09). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI19). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI19). ▶ Nurse (IDI13). ▶ Health surveillance assistant (IDI36). 	<ul style="list-style-type: none"> ▶ Nurse (IDI13).
007slz	Urban	<ul style="list-style-type: none"> ▶ Nurse (clinic in charge) (IDI12). ▶ Hospital attendant (IDI17). ▶ Security guard (IDI16). 	<ul style="list-style-type: none"> ▶ Nurse (Clinic in charge) (IDI12) ▶ Hospital attendant (IDI17). 	<ul style="list-style-type: none"> ▶ Nurse (clinic in charge) (IDI12). 	<ul style="list-style-type: none"> ▶ Nurse (clinic in charge) (IDI12). ▶ Clinical officer (IDI37). ▶ Nurse (IDI38). 	<ul style="list-style-type: none"> ▶ Nurse (clinic in charge) (IDI12).
008bng	Urban	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI21). ▶ Clinician (IDI24). ▶ Health surveillance assistant (IDI20). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI21). ▶ Health surveillance assistant (IDI20). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI21). 	<ul style="list-style-type: none"> ▶ Clinical officer (clinic in charge) (IDI21). ▶ Clinician (IDI24). ▶ Health surveillance assistant (IDI20). 	<ul style="list-style-type: none"> ▶ Clinical Officer (Clinic in charge) (IDI21)

Corporation, Redmond, Washington, USA). Continuous data related to the department and attendance from health records were abstracted from photographs to Microsoft Excel V.16 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 analysis²⁸ (see online supplemental file 5 for coding strategy). All transcripts were transcribed and imported into NVivo V.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 DHO to gain feedback and participant checking.

Ethical approval

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 WERE 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 DHO, specifically the team leading the COVID-19 preparedness and response for primary healthcare 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-19 response policies and practices; (2) impacts of COVID-19 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 3-month monitoring period. A breakdown of urban versus rural coverage is available as supplementary material (online supplemental file 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 DHO team was quick to implement training and provide new protocols to be followed to reduce patient numbers. Over the initial 3-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, overcrowded waiting areas and small consulting rooms. The provision of PPE was limited particularly during the early part of the pandemic.

Water, sanitation and hygiene

There was an average of two moveable HWFs (eg, buckets with taps) available per facility. Despite this provision, the

Table 2 Summary of COVID-19 preparedness from 31 health facilities across Blantyre District from August to 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. of 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

Continued

Table 2 Continued

Staff training		August	September	October
	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
	Always wearing	6.5	41.9	12.9
Auxiliary staff	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
	Always wearing	0.0	19.4	3.2
Guardians	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

Continued

Table 2 Continued

Staff training		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
DHO, District Health Office; EPI, expanded programme of immunisation; HWF, hand washing facility; OPD, outpatient department.				

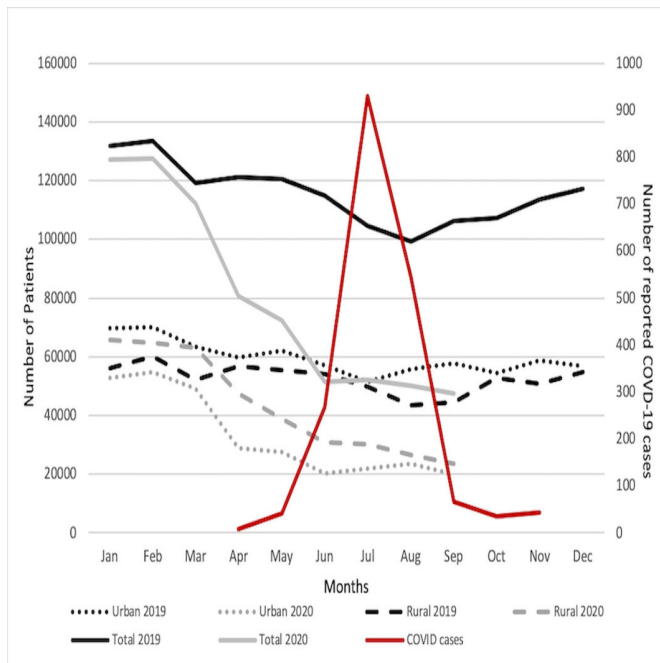


Figure 1 Outpatient service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities).

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 3 months progressed (table 2), in line with the reduced number of positive COVID-19 cases (figure 1). It was difficult for the healthcare 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 3-month period in each facility. The highest concentration of consistent provision (ie, available all 3 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 3-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 HWFs 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 healthcare 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 preconsultation checks were conducted to isolate potential cases from others in the waiting areas. Sixty-one per cent of the healthcare 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.

Personal protective equipment

The provision of PPE to healthcare 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. However, seven facilities were still disposing 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 on 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 maintenance 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 further:

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, September 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 healthcare 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 who 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, health 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

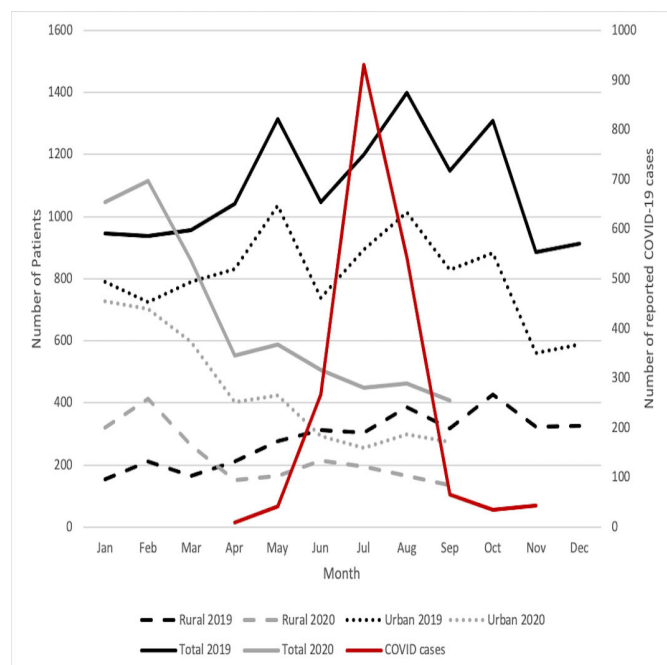


Figure 2 Tuberculosis service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities).

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 3-month dosage but were getting prescriptions for 6 months. As one DHO 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.

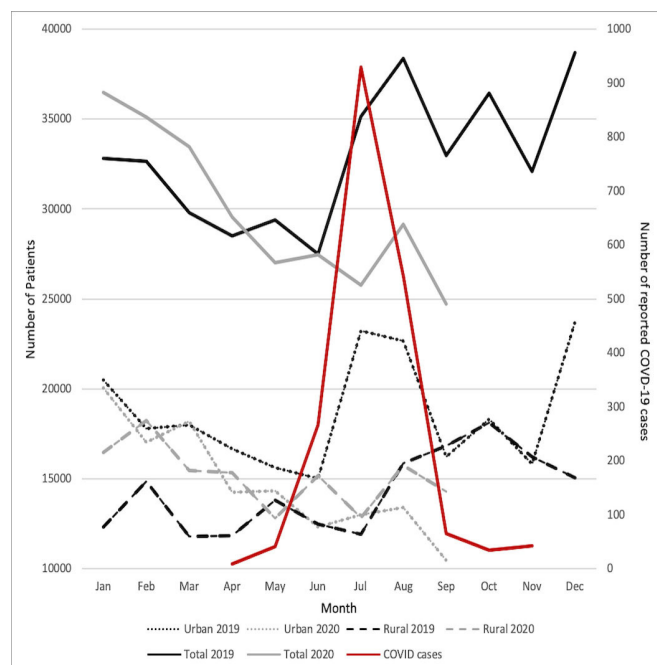


Figure 3 Child health (including immunisation) service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities).

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, an 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 FP 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 FP 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.

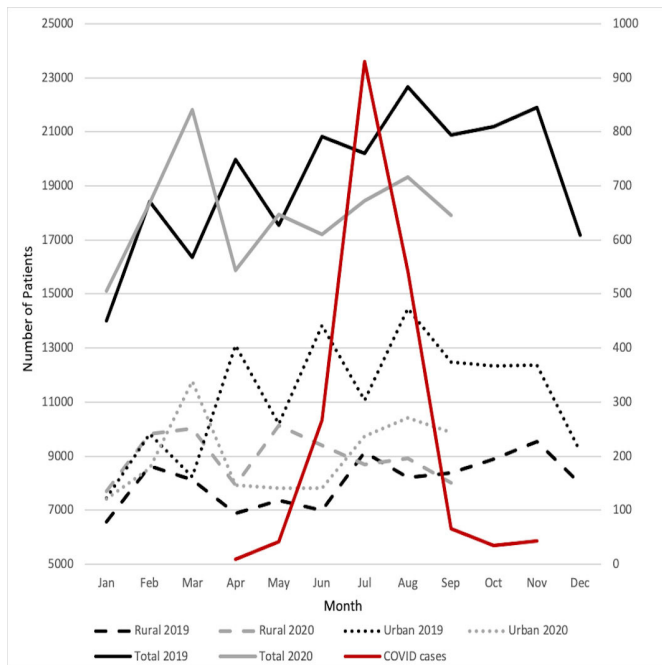


Figure 4 Family planning service attendance 2019 versus 2020 with the number of positive confirmed cases of COVID-19 in Blantyre District (n=27 health facilities).

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 labourer, IDI14, September 2020)

As part of managing the risk of exposure, health workers reduced their days and the amount of time spent at the healthcare 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 healthcare 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 twofold. 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)

Second, 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 healthcare workers being diagnosed. The requirement for these health workers to self-isolate placed pressure and stress on staff in healthcare 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 frontline worker shared his experience of being ostracised 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. However, 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 healthcare 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 hospitalisations (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, although 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 healthcare 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. Healthcare workers reported a gendered difference, with more men presenting for vaccination.

Although pragmatic guidance was published for low-income and middle-income countries,²⁹ case management of suspected COVID-19 cases at healthcare facilities was challenging, with limited staff available for patient consultations. The layout of healthcare facilities made managing patients, and reducing overcrowding 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 DHO to respond and handle all suspected cases, which overburdened this team.

In some healthcare 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-income, middle-income and low-income contexts speak to devastating impact COVID-19 had on healthcare 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 healthcare workers. By including a wider cadre of staff including guards and patient attendants, we demonstrated that the psychosocial impact was not limited to frontline healthcare 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 overemphasised, particularly with regard to COVID-19 and wider Infection Prevention and Control (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 HWFs, access to water and the need for constant maintenance.³⁹⁻⁴¹ Nevertheless, our results indicate that despite the provision of the necessary HWFs 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 healthcare 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 sanitiser) was limited by patients, healthcare workers and auxiliary staff. By failing to use the HWFs available to them (ie, 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 using the healthcare facilities, 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 (eg, HWF 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 HWFs 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 healthcare 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 healthcare 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 10-month period of the pandemic, enabling the rapid deployment of materials to support preventative measures (eg, masks and 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 healthcare 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 healthcare 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 were filtered through frontline workers' perspectives. Due to time and resource constraints, we only interviewed frontline workers at two time points and only interviewed in charges of healthcare (HC) facilities for the last two time points. The views of HC facilities in charge may not be the same as frontline workers' experiences. Collecting data from healthcare facility registers was challenging and required efforts to compare registers with 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

Healthcare facilities in the Blantyre District were initially unprepared to respond to the COVID-19 pandemic. However, despite significant resource limitations, the healthcare facilities were able to adapt their procedures to remain open and deliver the majority of key services. Although efforts were made to supply healthcare facilities with resources for COVID-19 prevention, there were limitations to their implementation (eg, HWF 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.

Author affiliations

¹Social Science Department, Malawi-Liverpool-Wellcome Trust Clinical Research Programme, Blantyre, Malawi

²Liverpool School of Tropical Medicine, Liverpool, UK

³Department of Environmental Health and WASHTEC Centre, Polytechnic, University of Malawi, Blantyre, Malawi

⁴Department of Environmental Health, Polytechnic, University of Malawi, Blantyre, Malawi

⁵Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, UK

⁶Blantyre Institute for Community Outreach, Blantyre, Malawi

⁷Blantyre District Health Office, Blantyre, Malawi

⁸Civil and Environmental Engineering, University of Strathclyde, Glasgow, UK

⁹WASHTEC Center, Polytechnic, University of Malawi, Blantyre, Malawi

Contributors MMP led collection and analysis of qualitative data and paper writing. MP and CMC led collection of quantitative data and provided paper review support. KC led analysis of quantitative data and helped with paper writing. KK, GK, ZG and PC led the study and provided paper review support. EEM and TM designed and led the study and supported paper writing. TM is also acting as the guarantor of this work.

Funding 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.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by Malawi National Health Science Research Committee Protocol Number: 20/06/2534. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available on reasonable request. 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.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and

responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Mackwellings Maganizo Phiri <http://orcid.org/0000-0001-5765-6340>

Tracy Morse <http://orcid.org/0000-0003-4185-9471>

REFERENCES

- Ahmed SAKS, Ajisola M, Azeem K, *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 Glob Health* 2020;5:e003042.
- Chersich MF, Gray G, Fairlie L, *et al*. COVID-19 in Africa: care and protection for frontline healthcare workers. *Global Health* 2020;16:1–6.
- Blanchet K, Alwan A, Antoine C, *et al*. Protecting essential health services in low-income and middle-income countries and humanitarian settings while responding to the COVID-19 pandemic. *BMJ Glob Health* 2020;5:e003675.
- Pai M, Olatunbosun-Alakija A. Vax the world. *Science* 2021;374:1031.
- Wadvalla B-A. How Africa has tackled covid-19. *BMJ* 2020;370:m2830.
- McGriff JA, Denny L. What COVID-19 reveals about the neglect of wash within infection prevention in low-resource healthcare facilities. *Am J Trop Med Hyg* 2020;103:1762–4.
- WHO, UNICEF. WASH in health care facilities global baseline report [online]. WHO/UNICEF joint monitoring programme for water supply, sanitation and hygiene, 2020. Available: <https://www.washdata.org/sites/default/files/documents/reports/2019-05/jmp-2019-wash-hcf-highlights-1.pdf>
- WHO. *Infection prevention and control during health care when coronavirus disease (COVID-19) is suspected or confirmed*. Report No.: WHO/2019-nCoV/IPC/2020.4. Geneva: World Health Organization, 2020.
- Burki T. Global shortage of personal protective equipment. *Lancet Infect Dis* 2020;20:785–6.
- Talisuna A, Yoti Z, Lee C, *et al*. The urgent need for a global commitment to protect healthcare workers. *BMJ Glob Health* 2020;5:e004077.
- 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. *Int J Environ Res Public Health* 2020;17:8149.
- Khanal P, Devkota N, Dahal M, *et al*. Mental health impacts among health workers during COVID-19 in a low resource setting: a cross-sectional survey from Nepal. *Global Health* 2020;16:1–12.
- Roberton T, Carter ED, Chou VB, *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. *Lancet Glob Health* 2020;8:e901–8.
- WHO. COVID-19 hits life-saving health services in Africa [online]. WHO | Regional Office for Africa. Available: <https://www.afro.who.int/news/covid-19-hits-life-saving-health-services-africa> [Accessed 6 Jan 2021].
- Mzumara GW, Chawani M, Sakala M, *et al*. The health policy response to COVID-19 in Malawi. *BMJ Glob Health* 2021;6:e006035.
- 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. Available: <https://blogs.lse.ac.uk/africaatlse/2020/11/13/how-have-malawis-courts-law-affected-epidemic-response/> [Accessed 21 Jan 2020].
- Kuunika. *Mathematical modeling of COVID-19 in Malawi*. Lilongwe: Kuunkia, 2020.
- Nordling L. The pandemic appears to have spared Africa so far. Scientists are struggling to explain why. *Science* 2020.

- 19 Malawi: WHO coronavirus disease (COVID-19) dashboard [online]. Available: <https://covid19.who.int> [Accessed 9 Feb 2021].
- 20 Mandolo J, Msefula J, Henrion MYR, *et al.* SARS-CoV-2 exposure in Malawian blood donors: an analysis of seroprevalence and variant dynamics between January 2020 and July 2021. *BMC Med* 2021;19:1–10.
- 21 Soko RN, Burke RM, Feasey HRA, *et al.* Effects of coronavirus disease pandemic on tuberculosis notifications, Malawi. *Emerg Infect Dis* 2021;27:1831–9.
- 22 Khuluza F, Haefele-Abah C. The availability, prices and affordability of essential medicines in Malawi: a cross-sectional study. *PLoS One* 2019;14:e0212125.
- 23 Zeng W, Sun D, Mphwanthe H, *et al.* The impact and cost-effectiveness of user fee exemption by contracting out essential health package services in Malawi. *BMJ Glob Health* 2019;4:e001286.
- 24 Makwero MT. Delivery of primary health care in Malawi. *Afr J Prim Health Care Fam Med* 2018;10:e1–3.
- 25 Ministry of Health Malawi. Health care system [online]. Available: <https://www.health.gov.mw/index.php/2016-01-06-19-58-23/national-aids> [Accessed 3 Nov 2020].
- 26 Government of Malawi. *National COVID-19 preparedness and response plan*. Lilongwe, Malawi: Government of Malawi, 2020.
- 27 Pope C, Mays N. Reaching the parts other methods cannot reach: an introduction to qualitative methods in health and health services research. *BMJ* 1995;311:42–5.
- 28 Green J, Thorogood N. *Qualitative methods for health research*. SAGE, 2018.
- 29 Cobb N, Papali A, Pisani L, *et al.* Pragmatic recommendations for infection prevention and control practices for healthcare facilities in low- and middle-income countries during the COVID-19 pandemic. *Am J Trop Med Hyg* 2021;104:tpmd201009.
- 30 Semo B-W, Frissa SM. The mental health impact of the COVID-19 pandemic: implications for Sub-Saharan Africa. *Psychol Res Behav Manag* 2020;13:713–20.
- 31 Conti C, Fontanesi L, Lanzara R, *et al.* Fragile heroes. The psychological impact of the COVID-19 pandemic on health-care workers in Italy. *PLoS One* 2020;15:e0242538.
- 32 UNICEF. Malawi COVID-19 situation report [online]. Lilongwe, Malawi: UNICEF Malawi, 2020. Available: <https://www.unicef.org/media/84831/file/Malawi-COVID-19-SitRep-21-October-2020.pdf> [Accessed 25 Mar 2022].
- 33 Thekkur P, Tweya H, Phiri S, *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. *Trop Med Infect Dis* 2021;6:81.
- 34 Reuters. Reuters COVID-19 tracker. Available: <https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/malawi/>
- 35 World Bank. Unlocking Malawi's economic growth by bridging the widening gender gaps in the labour workforce [online]. Available: <https://www.worldbank.org/en/country/malawi/publication/unlocking-malawi-s-economic-growth-by-bridging-the-widening-gender-gaps-in-the-labour-workforce> [Accessed 14 Mar 2022].
- 36 World Health Organization. Advice for the public on COVID-19 [online]. Available: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public> [Accessed 15 Jan 2021].
- 37 Rabie T, Curtis V. Handwashing and risk of respiratory infections: a quantitative systematic review. *Trop Med Int Health* 2006;11:258–67.
- 38 Prüss-Ustün A, Bartram J, Clasen T, *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. *Trop Med Int Health* 2014;19:894–905.
- 39 Wichaidit W, Biswas S, Begum F, *et al.* Effectiveness of a large-scale handwashing promotion intervention on handwashing behaviour in Dhaka, Bangladesh. *Trop Med Int Health* 2019;24:972–86.
- 40 Luby SP, Halder AK, Huda T, *et al.* 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:e1001052.
- 41 Morse T, Tilley E, Chidziwisano K, *et al.* Health outcomes of an integrated behaviour-centred water, sanitation, hygiene and food safety intervention—a randomised before and after trial. *Int J Environ Res Public Health* 2020;17:2648.
- 42 Luby SP, Halder AK, Tronchet C, *et al.* Household characteristics associated with handwashing with soap in rural Bangladesh. *Am J Trop Med Hyg* 2009;81:882–7.
- 43 Chidziwisano K, Tilley E, Malolo R, *et al.* Risk factors associated with feeding children under 2 years in rural Malawi—a formative study. *Int J Environ Res Public Health* 2019;16:2146.
- 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. *Soc Sci Med* 2015;124:103–14.
- 46 Seimetz E, Boyayo A-M, Mosler H-J. The influence of contextual and psychosocial factors on handwashing. *Am J Trop Med Hyg* 2016;94:1407–17.
- 47 Hashi A, Kumie A, Gasana J. Hand washing with soap and WASH educational intervention reduces under-five childhood diarrhoea incidence in Jijiga District, Eastern Ethiopia: a community-based cluster randomized controlled trial. *Prev Med Rep* 2017;6:361–8.
- 48 Brown J, Cairncross S, Ensink JHJ. Water, sanitation, hygiene and enteric infections in children. *Arch Dis Child* 2013;98:629–34.
- 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. *J Interdis Stud* 2020;3.