

Safer primary healthcare facilities are needed to protect healthcare workers and maintain essential services: lessons learned from a multicountry COVID-19 emergency response initiative

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ABSTRACT

Healthcare workers (HCWs) are at increased risk of infection from SARS-CoV-2 and other disease pathogens, which take a disproportionate toll on HCWs, with substantial cost to health systems. Improved infection prevention and control (IPC) programmes can protect HCWs, especially in resource-limited settings where the health workforce is scarcest, and ensure patient safety and continuity of essential health services. In response to the COVID-19 pandemic, we collaborated with ministries of health and development partners to implement an emergency initiative for HCWs at the primary health facility level in 22 African countries. Between April 2020 and January 2021, the initiative trained 42 058 front-line HCWs from 8444 health facilities, supported longitudinal supervision and monitoring visits guided by a standardised monitoring tool, and provided resources including personal protective equipment (PPE). We documented significant short-term improvements in IPC performance, but gaps remain. Suspected HCW infections peaked at 41.5% among HCWs screened at monitored facilities in July 2020 during the first wave of the pandemic in Africa. Disease-specific emergency responses are not the optimal approach. Comprehensive, sustainable IPC programmes are needed. IPC needs to be incorporated into all HCW training programmes and combined with supportive supervision and mentorship. Strengthened data systems on IPC are needed to guide improvements at the health facility level and to inform policy development at the national level, along with investments in infrastructure and sustainable supplies of PPE. Multimodal strategies to improve IPC are critical to make health facilities safer and to protect HCWs and the communities they serve.

INTRODUCTION

Healthcare workers (HCWs) are essential to maintaining individual and population health. Despite their critical importance, the

Summary box

- Infection prevention and control (IPC) measures are essential to protect healthcare workers (HCWs), patients and communities from SARS-CoV-2 and other outbreaks.
- Despite this critical need, IPC measures are suboptimal around the world, especially in resource-limited settings with austere health systems, where barriers to effective IPC include limited workforce of trained IPC professionals, paucity of availability of personal protective equipment (PPE), and limited clinical infrastructure at the primary health facility level for required environmental controls and water and sanitation for safe health service delivery.
- In response to COVID-19, we designed an emergency intervention to address these constraints in 22 African countries by supporting rapid in-service training, systematic data collection and stopgap provision of PPE and other supplies. These interventions may have contributed to improved IPC capacity at primary healthcare facilities.
- Despite this short-term success, emergency response efforts are not an optimal way to strengthen IPC systems. Urgent attention is needed to ensure the development of national IPC policies, guidelines, training curricula, supportive supervision, and monitoring and evaluation systems. Domestic and global investments are needed to enhance health facility infrastructure and to ensure availability of adequate PPE and supplies to protect HCWs and the communities they serve.

WHO estimates a shortfall of 18 million HCWs by 2030, mostly in low-income and middle-income countries (LMICs),¹ making it imperative to recruit, train, support and retain additional HCWs. Effective implementation of infection prevention and control (IPC)

programmes in healthcare settings is a global priority—not only to protect the health and well-being of HCWs and the people they serve² but also as a supporting mechanism for global health priorities to achieve universal health coverage.³

Weak IPC programmes and ineffective implementation pose a global challenge affecting all aspects of health system performance and contribute to hundreds of millions of healthcare-associated infections annually.⁴ Weak IPC programmes have also contributed to the disproportionate toll of recent epidemics on HCWs in both LMICs and high-income countries. HCWs were 21–32 times more likely than the general population to become infected with Ebola during the 2014–2015 West Africa Ebola epidemic,⁵ and 1%, 7% and 8% of the health workforce died from Ebola in Guinea, Sierra Leone and Liberia, respectively.⁶ During the 2003 SARS epidemic, HCWs comprised 21% of confirmed cases globally.⁷ HCWs are similarly at increased risk of SARS-CoV-2 infection.^{8–11} Early in the pandemic, the highest numbers of HCW infections were reported from Europe and the USA.¹² HCWs represent <3% of the global population but accounted for 14% of cases reported to the WHO as of September 2020.¹⁰ HCWs accounted for 3.4% of infections in 46 WHO African region countries as of 11 April 2021.¹³ Data on the true burden of infection are needed.¹⁴

Protecting HCWs must be prioritised to minimise the direct impact on an already fragile health workforce as well as indirect impacts on essential health service delivery. The Ebola epidemic impacted all aspects of the health system due to HCW deaths, health facility closures, diversion of resources and staff, and decreased use of services,¹⁵ including those for maternal and child health, HIV and malaria.¹⁶

The COVID-19 pandemic has similarly affected health systems. Nearly all countries (90%) surveyed by the WHO reported disruptions in essential health services, with more disruptions in LMICs.¹⁷ There were significant disruptions in care for non-communicable diseases¹⁷ and long-standing illnesses or health issues.¹⁸ Over 50% of countries limited outpatient services.¹⁷ Cancellation of elective care and deployment of clinical staff to pandemic response contributed to decreased availability of services.¹⁷ Reduced demand for services also contributed to disruptions; 76% of countries reported a decrease in patients presenting for care,¹⁷ and 45% of patients requiring services across 18 African countries delayed, skipped or were unable to obtain health services.¹⁸ Fear of COVID-19 infection was the most common reason for missing health visits.¹⁸ Similarly, fear of Ebola infection contributed to decreased use of services.¹⁹

A robust IPC programme is critical to help mitigate the impact of COVID-19 and other infectious pathogens on health systems,^{20–23} but gaps in IPC capacity and ineffective implementation pose challenges. First, IPC training is often limited in LMICs.^{24 25} A WHO survey of 88 countries to assess implementation of the WHO core

components of an IPC programme found that only 54% had in-service IPC training.²⁶ Over half (18 of 32) of national nursing associations reported IPC training had not been provided within 6 months of the pandemic's start.²⁷ Supportive supervision and mentorship for health facilities are also part of an effective IPC programme² and contribute to improved quality of care and strengthened health systems.²⁸ Yet access to IPC professionals is limited in most LMICs.²⁹ Second, programme monitoring and systematic use of data are needed to identify persistent gaps and to implement evidence-based policies; however, only 66% (58 of 88) of WHO-surveyed countries monitored IPC-related indicators, with a lower proportion among LMICs.²⁶ Third, limited resources and infrastructure in LMICs pose even greater challenges,^{29–32} and only 26% (23 of 88) of WHO-surveyed countries had a dedicated and protected IPC budget.²⁶

APPROACH TO DELIVERING AN IPC INITIATIVE

During April 2020–January 2021, Resolve to Save Lives (RTSL), an initiative of Vital Strategies, which aims to prevent millions of deaths from cardiovascular disease and epidemics, partnered with ministries of health and implementing partners in 22 African countries to deliver a comprehensive programme of in-service training, monitoring at primary healthcare facilities and procurement of personal protective equipment (PPE) and other resources to improve IPC practices. Our implementing partners included non-governmental organisations, networks and academic institutions based in Africa or with significant experience working in Africa. Two implementing partners, Last Mile Health (LMH) and Infection Control Africa Network (ICAN), provided longitudinal mentorship and supportive supervision to health facilities.

The programme prioritised competencies in six key domains: (1) recognition and reporting of suspected COVID-19 cases; (2) safe universal screening and triage; (3) facility-based IPC; (4) water, sanitation, and hygiene (WASH); (5) communication with patients; and (6) maintenance of essential services. Implementing partners used this framework to design and/or adapt training modules to individual country contexts, in partnership with ministries of health. Countries had varying levels of COVID-19-related restrictions on travel and in-person gatherings, so each country selected an appropriate combination of in-person and virtual training. Drawing from existing global guidance, a best practices toolkit,³³ which was later adapted and published by the Africa Centres for Disease Control and Prevention,³⁴ was developed in both English and French based on the IPC hierarchy—source controls, administrative controls, environmental controls and PPE³⁵—for use by implementing partners at primary healthcare settings.

To monitor IPC implementation at the health facility level, we developed a simple checklist (online supplemental materials) to assess IPC practices such as triage, COVID-19 surveillance and PPE availability. Implementing partners adapted the checklist in consultation with ministries of

health/primary healthcare agencies to monitor performance and provide structured feedback to selected health facilities. Data on HCW behaviours were collected by LMH and ICAN as part of monitoring visits. The frequency of data collection was modified in coordination with ministries of health. Duration of data collection varied as programme scale-up occurred at different times in each country. Implementing partners submitted data to RTSL for review using a standard data quality tool; discrepancies and questions were discussed with implementing partners. We present data on the number of HCW trained in all 22 countries and data from a subset of nine countries (41%) with available facility-level data and appropriate ethical and ministry approvals to publish. Facility-level data from 13 countries (59%) were excluded from the analyses because data did not meet quality criteria; limited or no data were collected; and/or ministry of health approvals were not obtained. Data were dichotomised for analysis and we conducted a z-test of proportions to evaluate changes in IPC capacity after checking for assumptions of the appropriateness of the statistical test.

TRAINING, MENTORSHIP, AND SUPPORTIVE SUPERVISION FOR HCW BEHAVIOUR CHANGE

As COVID-19 continued to spread globally, few training packages for primary healthcare settings in resource-limited environments existed; WHO guidance primarily targeted hospitals. Recognising the critical role of primary HCWs in providing care to communities and the importance of protecting them against COVID-19 infection, our implementing partners rapidly scaled this comprehensive initiative. Between April 2020 and January 2021, implementing partners trained 42 058 HCWs from 8444 health facilities, including 7574 primary health facilities, across the 22 countries (table 1).

Health facilities in Liberia received longitudinal mentorship and supportive supervision from LMH. ICAN provided this support to selected health facilities in Cameroon, DRC, Ethiopia, Kenya, Liberia and Nigeria. Regular visits provided an opportunity to reinforce best practices, implement solutions for identified challenges and promote behaviour change. Data from 20 facilities in Lagos, Nigeria, found that at baseline, only 37% and 32% of HCWs correctly performed hand hygiene and appropriately used masks inside the health facilities,

Table 1 Programme implementation in 22 African countries

Country	Implementing partner	Healthcare workers trained (n)	Health facilities trained (n) (primary health facilities, n)
Angola	ICAP at Columbia University	470	30 (27)
Burundi	ICAP at Columbia University	398	316 (293)
Cameroon	ALIMA	465	153 (139)
Cote d'Ivoire	ICAP at Columbia University	391	98 (95)
DRC	ALIMA	1421	115 (99)
Eswatini	ICAP at Columbia University	1145	37 (19)
Ethiopia	Ethiopian Medical Association	4293	139 (111)
Ghana	Jhpiego	1005	178 (141)
Kenya	ICAP at Columbia University	1219	10 (0)
Lesotho	ICAP at Columbia University	423	23 (19)
Liberia	Last Mile Health	1538	87 (87)
Malawi	ICAP at Columbia University	625	81 (74)
Mali	Muso	2810	1916 (1708)
Mozambique	ICAP at Columbia University	1062	59 (24)
Nigeria	AFENET and National Primary Healthcare Development Agency (NPHCDA)	5968	2979 (2979)
Rwanda	ICAP at Columbia University	418	148 (138)
Sierra Leone	ICAP at Columbia University	332	7 (0)
South Sudan	ICAP at Columbia University	804	24 (6)
Tanzania	ICAP at Columbia University	158	52 (24)
Uganda	Infectious Diseases Institute	13 455	976 (729)
Zambia	ICAP at Columbia University	479	128 (111)
Zimbabwe	Biomedical Research and Training Institute	3179	888 (751)
Total		42 058	8444 (7574)

Table 2 Baseline and endline values for screening and triage measures of primary healthcare facilities in eight countries (significant differences are noted in bold font)*

Indicator, country (n, number of health facilities)	Baseline value, % (95% CI)	Endline value, % (95% CI)	Difference, % (95% CI)
Outdoor triage and screening area with adequate space between persons			
Angola (n=28)	50.0 (31.5 to 68.5)	100.0 (100.0 to 100.0)	50.0 (31.5 to 68.5)
Eswatini (n=32)	87.5 (76.0 to 99.0)	93.8 (85.3 to 102.1)	6.3 (-7.9 to 20.4)
Lesotho (n=21)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Liberia† (n=74)	49.6 (37.2 to 60.03)	95.9 (91.4 to 100.4)	47.2 (35.1 to 59.5)
Malawi (n=42)	78.6 (66.2 to 91.0)	100.0 (100.0 to 100.0)	21.4 (9.0 to 33.8)
Nigeria (n=1281)	58.6 (55.9 to 61.3)	54.9 (52.2 to 57.6)	-3.8 (-0.001 to 7.6)
South Sudan (n=18)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Uganda‡ (n=521)	50.3 (46.0 to 54.6)	86.9 (84.1 to 89.8)	36.7 (31.5 to 41.8)
All facilities (n=2017)	57.7 (55.5 to 59.8)	67.5 (65.4 to 69.5)	9.8 (6.8 to 12.8)
Dedicated triage and screening personnel trained and in place			
Angola (n=30)	73.3 (57.5 to 89.2)	93.3 (84.4 to 102.2)	20.0 (1.8 to 38.2)
Eswatini (n=31)	93.5 (84.9 to 102.2)	100.0 (100.0 to 100.0)	6.5 (-2.2 to 15.1)
Lesotho (n=21)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Liberia (n=74)	21.6 (12.2 to 31.0)	86.5 (78.7 to 94.3)	64.9 (52.7 to 77.1)
Malawi (n=42)	64.3 (49.8 to 78.8)	90.5 (81.6 to 99.4)	26.2 (9.2 to 43.2)
Nigeria (n=1281)	60.3 (57.7 to 63.0)	55.3 (52.6 to 58.0)	-5.0 (-8.8 to -1.2)
South Sudan (n=19)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Uganda‡ (n=521)	34.5 (30.5 to 38.6)	84.1 (80.9 to 87.2)	49.5 (44.4 to 54.7)
All facilities (n=2019)	53.8 (51.7 to 56.0)	66.5 (64.5 to 68.6)	12.7 (9.7 to 15.7)
Tools available for triage and screening (paper-based or digital)			
Angola (n=30)	52.6 (29.0 to 96.0)	87.5 (64.6 to 110.4)	25.0 (-15.6 to 65.6)
Eswatini (n=32)	68.8 (52.7 to 84.8)	96.9 (90.8 to 102.9)	28.1 (11.0 to 90.8)
Lesotho (n=21)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Liberia§ (n=74)	9.5 (2.8 to 16.1)	63.5 (52.5 to 74.5)	54.1 (41.2 to 66.9)
Malawi (n=40)	67.5 (53.0 to 82.0)	90.0 (80.7 to 92.3)	22.5 (5.3 to 39.7)
South Sudan (n=19)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
All facilities (n=216)	52.1 (45.0 to 59.1)	82.3 (77.7 to 88.3)	30.9 (22.1 to 39.7)
Most recent case definition available and easily accessible to screening and triage staff			
Angola (n=30)	50.0 (32.1 to 67.9)	90.0 (79.3 to 100.7)	40.0 (19.1 to 60.9)
Eswatini (n=32)	59.4 (42.4 to 76.4)	96.9 (90.8 to 102.9)	37.5 (19.4 to 55.6)
Lesotho (n=21)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Liberia (n=74)	23.0 (13.4 to 32.6)	97.3 (93.6 to 101.0)	74.3 (64.1 to 84.6)
Malawi (n=42)	95.2 (88.8 to 101.7)	92.9 (85.1 to 100.6)	-2.4 (-12.5 to 7.8)
Nigeria (n=1281)	61.7 (59.1 to 64.4)	63.9 (61.4 to 66.5)	2.2 (-1.5 to 5.9)
South Sudan (n=19)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Uganda (n=521)	43.4 (39.1 to 47.6)	82.3 (79.1 to 85.6)	39.0 (33.6 to 44.3)
All facilities (n=2020)	56.8 (54.7 to 59.0)	72.0 (70.0 to 73.9)	15.1 (12.2 to 18.0)
Functional infrared no-touch thermometer available at the screening and triage area			
Angola (n=28)	75.0 (59.0 to 91.0)	78.6 (63.4 to 93.8)	3.6 (-18.5 to 25.7)
Eswatini (n=31)	58.1 (40.7 to 75.4)	74.2 (58.8 to 89.6)	16.1 (-7.1 to 39.3)
Lesotho (n=21)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Liberia (n=74)	67.6 (56.9 to 78.2)	97.3 (93.6 to 101.0)	29.7 (18.4 to 41.0)

Continued

Table 2 Continued

Indicator, country (n, number of health facilities)	Baseline value, % (95% CI)	Endline value, % (95% CI)	Difference, % (95% CI)
Malawi (n=42)	33.3 (19.1 to 47.6)	69.0 (55.1 to 83.0)	35.7 (15.7 to 55.7)
Nigeria (n=1281)	19.7 (17.5 to 21.8)	18.1 (16.1 to 20.2)	-1.5% (-4.5% to 1.5%)
South Sudan (n=19)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Uganda (n=521)	59.1 (54.9 to 63.3)	67.9 (63.9 to 72.0)	8.8 (3.0 to 14.6)
All facilities (n=2017)	34.9 (32.8 to 36.9)	37.9 (35.8 to 40.0)	3.0 (0.001 to 6.0)

*Not every country reported on each indicator, and even within countries, not every health facility reported on each indicator.

†The indicator used in Liberia and Uganda did not specify whether the screening and triage area was outdoors.

‡The indicator used was 'Is there a dedicated trained screener on duty?'

§The indicator used was availability of 1 month's supply of screening tools at the healthcare facility for screening all staff, patients and visitors.

respectively. By project end, behaviour improved with 68% and 74% of HCWs following hand hygiene procedures and mask use, respectively. Data from Cameroon also showed improvement—hand hygiene compliance increased from 51% at baseline to 93% at endline, and mask use increased by 42 percentage points. In Liberia, staff at 31 of 87 health facilities (36%) used appropriate PPE to conduct screening and triage at baseline compared with 72 of 76 health facilities (95%) at endline.

HEALTH FACILITY DATA USE FOR PERFORMANCE MONITORING

Implementing partners longitudinally collected facility-level data to provide structured feedback to health facilities, monitor programme progress and identify persistent gaps. Appropriate screening and triage of all persons entering health facilities were emphasised as an environmental and administrative measure that could help to maintain essential services in primary health facilities. The proportion of health facilities with COVID-19 screening and triage areas significantly increased from 58% at baseline to 68% ($p<0.001$) (table 2).

We saw similar levels of improvement for other screening and triage indicators, including availability of dedicated screening and triage personnel (+13%), availability of screening and triage tools (+31%), most recent case definitions (+15%) and functional infrared thermometers (+3%). While paired facility data were not available from Cameroon, a higher proportion of facilities reported having outdoor screening and triage areas, trained screening and triage personnel, and functional infrared thermometers at endline.

Despite these improvements, the majority (62%) of facilities included in the analysis reported not having functional infrared thermometers at endline, mostly driven by the large proportion of health facilities in the sample that were in Nigeria where bottlenecks in distribution contributed to the lack of availability. Additionally, in Nigeria, some measures of screening and triage decreased during project implementation as personnel and resources were repurposed during intervals between pandemic waves to focus on essential service delivery.

Some countries, including Lesotho and South Sudan, scored very high even at baseline and did not show significant improvements; these facilities were supported by implementing partners prior to programme inception and might not be representative of all facilities in those countries. In Liberia, LMH donors redirected pre-COVID project funds to emergency response, particularly to secure PPE for health facilities.

Availability of hand hygiene materials, appropriate PPE and cleaning materials varied by country and highlight the importance of sustained investments in these items (table 3).

By project end, 85% of health facilities (+4%) had functional handwashing stations at all points of care, and 79% of facilities (+6%) had alcohol-based hand rub available. However, medical and surgical mask availability decreased significantly from baseline to endline, and at neither point were masks available at the majority of health facilities. Similarly, eye protection was available in only 17% of facilities by programme end, although there was no significant change from baseline to endline; a similar pattern was observed for availability of cleaning supplies. In Cameroon, the proportion of facilities with functional handwashing stations and masks increased at endline. The programme provided for PPE procurement, but not in sufficient quantities to sustainably stock health facilities for the duration of the pandemic. Although commodities were scarce, we saw significant improvements (+16%) in appropriate cleaning and disinfection of frequently touched surfaces in health facilities, reinforcing the value of training and supportive supervision.

SURVEILLANCE FOR COVID-19

A total 2 265 104 patients were screened for COVID-19 symptoms on entrance to monitored health facilities in Angola, Cameroon, Eswatini, Lesotho, Malawi, Nigeria and South Sudan. These data were not available from facilities in Liberia, but these facilities did report the number of patients reported to local surveillance personnel and the number of patients referred to the next level of care. In these eight countries, among monitored health

Table 3 Baseline and endline values for infection prevention and control measures of primary healthcare facilities in eight countries (significant differences are noted in bold font)*

Indicator, country (n, number of health facilities)	Baseline value, % (95% CI)	Endline value, % (95% CI)	Difference, % (95% CI)
Functional handwashing stations or ABHR available and usable at each point of care			
Angola (n=28)	96.3 (89.2 to 103.4)	100.0 (100.0 to 100.0)	3.7 (-3.4 to 10.8)
Eswatini (n=30)	96.7 (90.2 to 103.1)	100.0 (100.0 to 100.0)	3.3 (-3.1 to 9.8)
Lesotho (n=21)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Liberia† (n=74)	77.0 (67.4 to 86.6)	95.9 (91.5 to 100.4)	18.9 (8.3 to 29.5)
Malawi (n=41)	87.8 (77.8 to 97.8)	100.0 (100.0 to 100.0)	12.2 (2.2 to 22.2)
Nigeria‡ (n=1281)	74.8 (72.4 to 77.2)	76.9 (74.7 to 79.2)	2.2 (-1.1 to 5.4)
South Sudan (n=19)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Uganda (n=521)	91.0 (88.5 to 93.4)	98.5 (97.4 to 99.5)	7.4 (4.8 to 10.2)
All facilities (n=2015)	80.4 (78.7 to 82.2)	84.6 (83.0 to 86.2)	4.2 (1.8 to 6.5)
ABHR available at time of site visit§			
Angola (n=30)	76.7 (61.5 to 91.8)	66.7 (49.8 to 83.5)	-10.0 (-32.7 to 12.7)
Eswatini (n=32)	81.3 (67.7 to 94.8)	84.4 (71.8 to 97.0)	3.1 (-15.3 to 21.6)
Lesotho (n=21)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Liberia (n=74)	20.3 (11.1 to 29.4)	78.4 (69.0 to 87.8)	58.1 (45.0 to 71.2)
Malawi (n=42)	46.3 (31.1 to 61.6)	61.0 (46.0 to 75.9)	14.6 (-6.7 to 36.0)
Nigeria (n=1281)	75.8 (73.4 to 78.1)	79.5 (77.3 to 81.7)	3.7 (5.2 to 6.9)
All facilities (n=1480)	72.7 (70.4 to 75.0)	79.1 (77.0 to 81.1)	6.4 (3.4 to 9.4)
Medical/surgical masks available at time of site visit§			
Angola (n=30)	80.0 (65.7 to 94.3)	90.0 (79.3 to 100.7)	10.0 (-7.8 to 27.9)
Eswatini (n=32)	39.4 (42.4 to 76.4)	96.9 (90.8 to 102.9)	37.5 (19.4 to 55.6)
Lesotho (n=21)	100.0 (100.0 to 100.0)	90.5 (77.9 to 103.0)	-9.5 (-22.1 to 3.0)
Liberia (n=74)	81.1 (72.2 to 90.0)	89.2 (82.1 to 96.3)	8.1 (-3.3 to 19.5)
Malawi (n=41)	65.9 (51.3 to 80.4)	100.0 (100.0 to 100.0)	34.1 (19.6 to 48.7)
Nigeria (n=1281)	43.3 (40.6 to 46.0)	33.3 (30.7 to 35.8)	-10.1 (-13.8 to -6.4)
All facilities (n=1479)	48.0 (45.5 to 50.6)	41.0 (38.6 to 43.5)	-7.0 (-10.5 to -3.4)
Eye protection (face shields or goggles) available at time of site visit§			
Angola (n=30)	0.0 (0.0 to 0.0)	37.5 (4.0 to 71.0)	37.5 (4.0 to 71.0)
Eswatini (n=32)	75.0 (60.0 to 90.0)	100.0 (100.0 to 100.0)	25.0 (10.0 to 40.0)
Lesotho (n=21)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Liberia (n=74)	83.8 (75.4 to 92.2)	89.2 (82.1 to 96.3)	5.4 (-5.5 to 16.4)
Malawi (n=36)	38.9 (23.0 to 54.8)	66.7 (51.3 to 82.1)	27.8 (5.6 to 49.9)
Nigeria (n=1281)	11.4 (9.7 to 13.3)	8.0 (6.5 to 9.5)	-3.4 (-5.7 to -1.1)
All facilities excluding Nigeria (n=193)	18.4 (16.4 to 20.4)	16.9 (15.0 to 18.8)	-1.5 (-4.3 to 1.2)
Required cleaning supplies available at time of site visit¶			
Angola (n=30)	73.3 (57.5 to 89.2)	83.3 (70.0 to 96.7)	10.0 (-10.7 to 30.7)
Eswatini (n=31)	93.3 (84.4 to 102.2)	96.7 (90.2 to 103.1)	3.3 (-7.6 to 14.3)
Lesotho (n=21)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Malawi (n=42)	78.6 (66.2 to 91.0)	81.0 (69.1 to 92.8)	2.4 (-14.8 to 19.6)
Nigeria (n=1281)	11.4 (10.0 to 13.1)	7.5 (6.1 to 8.9)	-3.9 (-6.2 to -1.7)
South Sudan (n=19)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Uganda (n=521)	91.0 (88.5 to 93.4)	96.2 (94.5 to 97.8)	5.2 (2.2 to 8.1)

Continued

Table 3 Continued

Indicator, country (n, number of health facilities)	Baseline value, % (95% CI)	Endline value, % (95% CI)	Difference, % (95% CI)
All facilities (n=1945)	38.2 (36.1 to 40.4)	36.7 (34.5 to 38.8)	-1.6 (-4.6 to 1.5)
Frequently touched surfaces of consultation/examination areas are cleaned and disinfected at least two times per day			
Angola (n=30)	70.0 (53.6 to 86.4)	93.3 (84.4 to 102.3)	23.3 (4.7 to 42.0)
Eswatini (n=30)	70.0 (53.6 to 86.4)	100.0 (100.0 to 100.0)	30.0 (13.6 to 46.4)
Lesotho (n=21)	100.0 (100.0 to 100.0)	100.0 (100.0 to 100.0)	0
Liberia (n=74)	31.1 (20.5 to 41.6)	95.9 (91.5 to 100.4)	64.9 (53.4 to 76.3)
Malawi (n=42)	71.4 (57.8 to 85.1)	92.9 (85.1 to 100.6)	21.4 (5.7 to 37.2)
Nigeria (n=1281)	61.8 (59.2 to 64.5)	68.1 (65.6 to 70.6)	6.3 (2.6 to 9.9)
Uganda (n=521)	55.1 (50.8 to 59.4)	86.0 (83.0 to 89.0)	30.9 (25.7 to 36.1)
All facilities (n=1999)	59.8 (57.6 to 61.9)	75.4 (73.5 to 77.2)	15.6 (12.7 to 18.4)

*Not every country reported on each indicator, and even within countries, not every health facility reported on each indicator.

†The indicator was availability of hand hygiene stations at all points of care.

‡The indicator was availability of functional handwashing stations.

§Values recoded to binary based on different forms of country reporting; availability at the time of visit of >0 items coded as 1.

¶Buckets, mops, cleaning cloths and disinfectant solution (eg, bleach) all available.

ABHR, alcohol-based hand rub.

facilities, 15 143 patients were reported to local surveillance personnel, and 3482 patients were referred to the next level of care.

We collected data on the number of incident suspected HCW infections at the facility level, as well as the number of unique HCWs reporting to work at the facility and used these data to develop a proxy indicator of suspected HCW infections during the reporting period (table 4).

Seven countries contributed data on suspected HCW infections, and Liberia reported confirmed infections. There were 1468 suspected COVID-19 infections among HCW in monitored facilities, including 55 confirmed infections in Liberia. There were some delays in reporting data, but based on reporting dates, the proportion of HCWs with suspected infections was lowest in May, peaked in July and decreased by September. The peak

in suspected COVID-19 infections was coincident with the peak of the first wave of COVID-19 in the African continent. HCWs among monitored health facilities may have been suspected of infection more than once during the project period, and early in the pandemic, the suspected case definition was broader. Although our data on suspected COVID-19 cases may be an overestimate, they indicate that during the height of the pandemic, a substantial proportion of HCWs at primary health facilities were at risk of infection.

LESSONS LEARNED AND RECOMMENDATIONS

The COVID-19 pandemic has taken a significant toll on health systems, but effective IPC programmes may help mitigate these impacts. During the Ebola epidemic, supportive

Table 4 Suspected COVID-19 infections among HCWs and average number of health workers reporting to work by date of report — 8 countries, May–November 2020*

Month	Suspected COVID-19 infections among monitored facilities (monthly total n)	HCWs reporting to work among monitored facilities (monthly average total n)	Monthly average percentage of total number of HCWs with suspected COVID-19 infections among monitored facilities
May	50	4262	1.2
June	365	1537	23.7
July	684	1650	41.5
August	268	2055	13.0
September	79	3186	2.5
October	0	303	0
November	22	1182	1.9

*Data on HCW infections were not collected as part of the programme in Uganda; Liberia reported confirmed HCW infections. HCW, healthcare worker.

supervision and monitoring likely contributed to improved IPC practices at healthcare facilities,²¹ and improved IPC practices likely contributed to a reduction in the proportion of HCW infections from 12% in July 2014 to 1% in February 2015.⁵ Training and education on IPC was shown to decrease the risk of SARS-CoV-1 and MERS-CoV infection among HCWs,²² and asymptomatic HCWs trained on protection against SARS-CoV-2 early in the pandemic were less likely to test positive.²³ In our initiative, the combination of training, monitoring and provision of resources may have contributed to short-term improvements in IPC performance at the health facility level.

A major component of our initiative was training HCWs on IPC with a focus on COVID-19. However, development and maintenance of a trained health workforce should be supported through inclusion of IPC in training curricula at all levels, rather than within individual disease-specific programmes. Integration of IPC training in curricula for medical, nursing and other health professional students and established career pathways for IPC professionals can strengthen IPC capacity at national and subnational levels.³⁶

Monitoring of IPC practices at the health facility level is also critical to assess performance, identify gaps and provide structured feedback to health facilities to facilitate improvements.² Aggregate health facility data should be used to guide evidence-based decision making at the national level. Implementing partners used checklist data to guide improvements at the facility level, including provision of PPE. However, a limitation of our checklist was the lack of measures of HCW behaviours, including appropriate use of PPE and hand hygiene adherence. To address those limitations, RTSL partnered with Africa CDC, the WHO Regional Office for Africa and ICAN to develop a continent-wide monitoring tool incorporating these critical behaviours that are amenable to training and mentorship.

The COVID-19 pandemic has further highlighted critical gaps in infrastructure and resource availability globally, in particular PPE.^{32 37 38} We saw short-term improvements in IPC performance, including availability of outdoor screening and triage areas with adequate physical distancing, but gaps remain, including PPE availability. Procurement and local production of PPE needs to increase, with donor and domestic investment in equitable distribution reaching the primary healthcare level and the 'last mile', including community health workers. These commodity gaps likely contributed to the high level of HCW infections observed during the peak of the first wave of the pandemic in Africa, although the source of infections (facility or community) is not discernible from our available data.

Improving IPC practices during outbreaks is important to response efforts, but our findings demonstrate that acute response efforts are not sufficient. IPC programmes should be prioritised as part of overall health system preparedness. National IPC policies should include primary health facilities as critical vehicles for essential service delivery and disease surveillance. There is a need for ongoing investment to prevent, detect and respond to public health risks, including

outbreaks, particularly in LMICs.³⁹ Joint external evaluation (JEE) data indicate limited IPC capacity across the WHO African region,⁴⁰ likely due to financial constraints, lack of infrastructure and administrative support, and poor implementation and regulation of IPC programmes.⁴¹ Addition of a dedicated JEE technical area on safer health facilities would provide more comprehensive assessments of IPC capacity and WASH implementation and guide longer term, sustainable investments to ensure safe, high-quality health service delivery.⁴²

Our data on suspected infections may be an overestimate but suggest that HCWs are at increased risk of infection. However, there is no global systematic record of HCW infections and deaths.²⁷ The WHO Regional Office for Africa Integrated Disease Surveillance and Response (IDSR)⁴³ strategy could be leveraged to monitor health facility-level surveillance for SARS-CoV-2 and other infectious diseases among HCWs. Adopting a new variable for occupational exposure to existing IDSR case-based investigation forms could facilitate routine data collection and reporting. Data would allow for prompt outbreak responses and inform national programmes, policies and resource mobilisation efforts.

There are some limitations to our data. First, the health-care facilities included in our initiative have received support from implementing partners; thus, IPC capacities measured at baseline and follow-up are positively biased and not indicative of national programme performance. Second, these facilities represent a small proportion of all health facilities in each country, and data may not be generalisable. Third, in some countries, not every facility was able to report on each indicator, limiting our ability to accurately assess overall IPC capacity. Despite these limitations, these data highlight the need for comprehensive, multimodal strategies to strengthen IPC programmes.

CONCLUSION

The COVID-19 pandemic has demonstrated the fragility of health systems globally, and the direct and indirect impact on health systems has been profound. Our response efforts, including training, monitoring and provision of resources, likely contributed to short-term improvements in IPC capacity and HCW behaviours. However, efforts to improve IPC programmes need to continue beyond acute response efforts. Comprehensive, funded IPC policies need to be adopted and implemented to protect HCWs and the patients they serve and ultimately to contribute to safe health services delivery.

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