USAID Medicines, Technologies, and Pharmaceutical Services (MTaPS) Program

Improved Access.
Improved Services.
Better Health Outcomes.

A mother and her daughter show their COVID-19 cards after getting vaccinated in Côte d'Ivoire.
Photo credit: Timothé Chevaux

COVID-19 SUMMARY REPORT

About USAID MTaPS

The US Agency for International Development (USAID) Medicines, Technologies, and Pharmaceutical Services (MTaPS) Program (2018–2025) enables low- and middle-income countries to strengthen their pharmaceutical systems, which are essential to establishing higher-performing health systems and achieving better health outcomes. The program is implemented by a consortium of global and local partners, led by Management Sciences for Health (MSH), a global health nonprofit.

Learn more at https://www.mtapsprogram.org/

INTRODUCTION

The USAID MTaPS program enables low- and middle-income countries to strengthen their pharmaceutical systems, which are critical for ensuring access to and appropriate use of safe, effective, quality-assured, affordable medicines, vaccines, health technologies and products, and related pharmaceutical services to improve health. MTaPS' objectives are to (1) strengthen pharmaceutical-sector governance; (2) increase institutional and human resource capacity for pharmaceutical management and services, including regulation of medical products; (3) increase availability and use of pharmaceutical information for decision making and advance the global learning agenda; (4) optimize pharmaceutical-sector financing, including resource allocation and use; and (5) improve pharmaceutical services, including product availability and patient-centered care, to achieve desired health outcomes. MTaPS employs a pharmaceutical systems strengthening (PSS) approach to identify and implement strategies and actions that achieve coordinated and sustainable improvements of a pharmaceutical system to make it more responsive and resilient for achieving better health outcomes.

MTaPS' COVID-19 portfolio actions in 17 countries are aligned with the US COVID-19 Global Response and Recovery Framework and related USAID Implementation Plan specifically focusing on two objectives of this plan: (1) accelerate widespread and equitable access to and delivery of safe and effective COVID-19 vaccinations, and (2) reduce morbidity and mortality from COVID-19, mitigate transmission, and strengthen health systems, including to prevent, detect, and respond to pandemic threats.[1,2] MTaPS actions also align with the World Health Organization (WHO) COVID-19 Strategic Preparedness and Response Plan, including objectives (2) Reduce exposure and (4) Protect the vulnerable through vaccination.[3] Learn more at https://www.mtapsprogram.org/covid-19/.

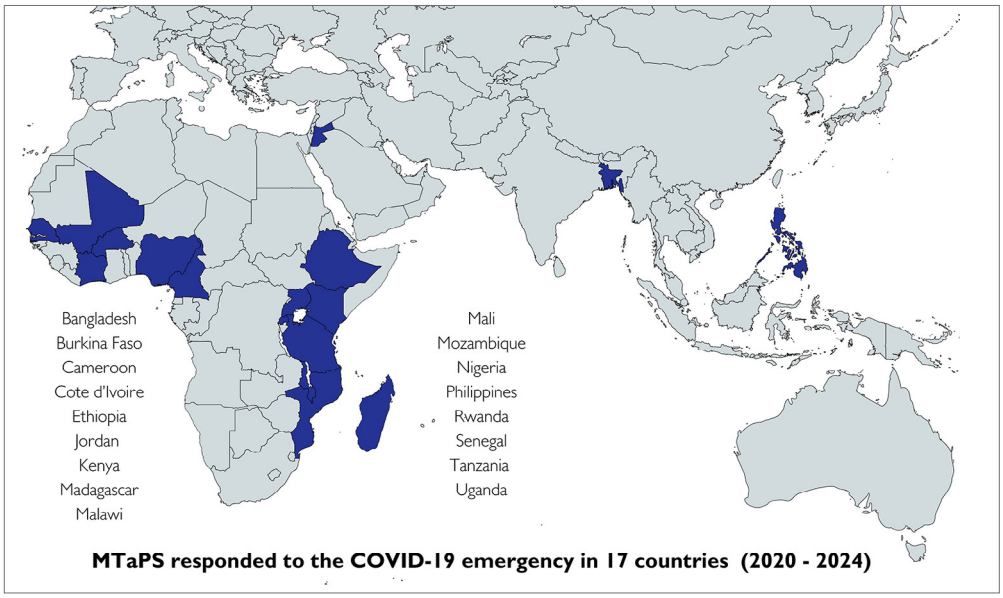
USAID
FROM THE AMERICAN PEOPLE

CHALLENGES

- Revitalized One Health platform was required for effective multisectoral coordination.
- IPC programs and guidelines required strengthening at the national and health facility levels.
- Surveillance program needed for health care-associated infections at the national and subnational levels.
- Biomedical waste was not always managed properly.
- Compliance with regulations and guidelines on antibiotic use was inadequate.
- IPC capacity to handle health emergencies such as Ebola virus disease and COVID-19 required improvement.

PARTNERS

- Cooperative for Assistance and Relief Everywhere (CARE)
- Food and Agriculture Organization (FAO)
- National Committee for Antibiotic Treatment
- Permanent Secretary High National Health Security Council
- Senegal MOH
- Senegalese Agency for Pharmaceutical Regulations
- UNICEF
- US Centers for Disease Control and Prevention (CDC)
- USAID-Breakthrough ACTION
- USAID Infectious Disease Detection and Surveillance (IDDS)
- USAID Africa One Health University Network (AFROHUN)
- WHO



MTaPS responded to the COVID-19 emergency in 17 countries (2020 - 2024)

CHALLENGE

At the onset of the pandemic, MTaPS-supported countries faced an escalating crisis as lockdowns disrupted health services and logistics. Rapid infection prevention and control (IPC) capacity strengthening was critical to slow the spread of the virus, protect health care workers (HCWs) and the public, and maintain critical health services. Establishing a reliable supply chain for personal protective equipment (PPE) and other IPC products was both urgent and challenging, with rising global demand and resulting shortages. As COVID-19 vaccines became available, the rollout presented yet another challenge due to the unprecedented scale, required speed, and unclear cost of vaccinating so many people in such a short time. Addressing these challenges would require improved planning, capacity, and collaboration.

STRATEGIC APPROACH

MTaPS' strategy for increasing countries' capacity to respond to the COVID-19 pandemic centered on reinforcing existing health systems, leveraging established infrastructure and expertise, and actively encouraging collaborative cross-country knowledge exchange. MTaPS supported national government coordination and regulatory bodies to develop and implement relevant policies and regulations. MTaPS also promoted interagency collaborative mechanisms to secure broad technical consensus to ensure participatory mechanisms for the development of all methods, tools, and materials. MTaPS' approach incorporated required and refresher training provisions and supported the development of record systems to support accountability; development of e-Learning materials and supporting integration into learning management platforms; monitoring and evaluation of system performance; and identification, documentation, and promotion of best practices. MTaPS also contributed to global efforts to cost COVID-19 vaccination.

The MTaPS approach to increasing countries' capacity to effectively respond to the COVID-19 pandemic is rooted in USAID's strategy for PSS and international evidence-based guidelines, such as WHO "Guidance on Developing a National Deployment and Vaccination Plan for COVID-19 Vaccines," WHO guidance on operational microplanning, the CDC's IPC recommendations for HCWs during the COVID-19 pandemic, WHO's manual for COVID-19 safety surveillance, and WHO's IPC principles and procedures for COVID-19 vaccination.[4–9]

KEY ACHIEVEMENTS

Support for coordination and collaboration on the COVID-19 response

Countries: Bangladesh, Cameroon, Cote d'Ivoire, Ethiopia, Kenya, Senegal, Tanzania

Building on its extensive experience in strengthening multisectoral coordination networks to address antimicrobial resistance (AMR), MTaPS fostered collaboration among key players needed for a successful pandemic response.

- In **Kenya**, MTaPS, as a member of rapid response teams, led the coordination of national, county, and facility efforts to improve IPC with the Ministry of Health (MOH) and partners such as the national COVID-19 task force and its subcommittees for case management, IPC, and capacity building.
- In **Côte d'Ivoire**, the MTaPS-supported national AMR technical working group and multisectoral IPC task force rapidly reoriented to focus on the coronavirus threat and evolved into the national IPC COVID-19 task force.
- In **Ethiopia**, the National Preparedness and Response Plan and 24 guidelines and standard operating procedures (SOPs) for COVID-19 were developed to improve country preparedness and response at the national and health facility levels through MTaPS' collaboration with the MOH and the Ethiopia Public Health Institute.

49,278
Number of **workers trained** on COVID-19-related IPC and/or WASH

29 Number of **COVID-19 e-Learning modules** developed in English and French (some accessible on LeaderNet.org)

6,254
Number of **health facilities supported** for IPC and/or WASH for COVID-19

Rapid health workforce and institutional IPC capacity development

Countries: Bangladesh, Burkina Faso, Cameroon, Côte d'Ivoire, Ethiopia, Kenya, Mali, Mozambique, the Philippines, Senegal, Tanzania, Uganda

MTaPS leveraged its earlier IPC work and training expertise to help country partners improve HCW capacity and develop sustainable training and capacity programs.

- CDC and WHO COVID-19 IPC protocols were rapidly adapted for country contexts, and "just-in-time" COVID-19-focused IPC training and mentorship programs were developed and implemented based on existing structures and materials developed during prior MTaPS Global Health Security Agenda AMR work.
- Teams of master trainers prepared to rapidly cascade COVID-19 IPC training in **Ethiopia**, **Kenya**, and **Uganda**. In **Cameroon**, **Côte d'Ivoire**, **Mali**, and **Senegal**, standardized tools including WHO scorecards for performance monitoring and supportive supervision were introduced to support health care facility compliance with IPC protocols.
- These efforts were significantly advanced through the establishment of local capacity to manage e-Learning platforms with interactive e-Learning modules on COVID-19 IPC and related topics. Francophone modules were developed for **Burkina Faso**, **Cameroon**, **Mali**, and **Senegal**.
- COVID-19-related topics such as IPC, health care waste management (HCWM), and supply chain management for vaccines were integrated into government e-Learning platforms in **Mali** and the **Philippines**.
- In **Ethiopia**, a local solution was introduced by the MOH/Plan, Monitoring, and Evaluation Directorate (PMED) to improve access to alcohol-based hand rubs (ABHRs) by developing and implementing the SOPs on local production of ABHRs at over 140 health facilities.

> *"MTaPS program provided support to our Kodiaga Prison based in Kisumu County, including COVID-19 IPC training for our HCWs and assisting us to establish our prison IPC committee. Through this committee we were able to formulate our prison waste management plan again with your technical assistance and also conducted our first hand hygiene audit. I want to thank MTaPS and hope this collaboration continues."*
>
> *Inspector Kepha Onditi,*
> *Public Health Officer, Kodiaga Prison, Kenya*

Emergency supply chains for COVID-19 IPC products

Countries: Bangladesh, Jordan, Kenya, the Philippines

MTaPS' assistance in strengthening emergency supply chains for COVID-19 IPC commodities was instrumental to the pandemic response, helping prevent stockouts of IPC products such as PPE and maintaining transparency in distribution.

- In **Jordan**, an emergency procurement and supply management (PSM) strategy was developed by the Procurement Supply Directorate, and an emergency supply chain reporting system was designed and rolled out to inform direct procurement of key PPE commodities, such as N95 respirators and gloves.
- In the **Philippines**, the emergency supply management tracking system and a dashboard to track COVID-19 and laboratory commodities were built by the Department of Health (DOH). The dashboard tracks supply and demand and automatically calculates replenishment volumes. The system was endorsed by the DOH and rolled out nationwide.
- In **Bangladesh**, a COVID-19 supply quantification tool was developed, and the COVID-19 electronic Logistics Management Information System (eLMIS) was developed and rolled out by the Directorate General of Health Services (DGHS), enabling real-time monitoring of emergency commodity stocks across health facilities and pharmacies and informing coordinated efforts to prevent the stockouts. The COVID-19 eLMIS was integrated with the DGHS management information system, with 430 HCWs from 126 facilities trained in managing stock data through the online portal.

Strengthening Jordan's Response to COVID-19 and Increasing the Preparedness of the Health Care System to Manage and Treat COVID-19 Patients

USAID supported Jordan's MOH in enhancing COVID-19 response through training workshops on IPC in hospitals nationwide. These workshops improved hospital preparedness and IPC practices, reducing virus transmission among HCWs, patients, and visitors. With a focus on PPE usage aligned with international guidelines, the training significantly enhanced participants' competencies. Assessments demonstrated a remarkable 114% average improvement rate post-training. Over 1,300 HCWs, including 56% females across 36 hospitals, benefited from the program. Ms. Samira Badr, nursing manager at Abdel-Hadi Hospital, emphasized the invaluable impact of the training, stating "We are very grateful to USAID MTaPS for organizing this training workshop. It gave the staff the knowledge, skills, and most importantly, confidence to treat COVID-19 patients, especially when new cases came to the ER."

COVID-19 vaccination coordination and microplanning

Countries: Bangladesh, Burkina Faso, Cameroon, Cote d'Ivoire, Kenya, Senegal

MTaPS introduced microplanning at the national and subnational levels for equitable delivery of COVID-19 vaccines and vaccination services. To facilitate microplanning, MTaPS strengthened partner coordination, provided training, and supported data management.

- In **Senegal**, 13 COVID-19 vaccination microplans were developed and implemented for regional and district levels targeting priority populations, and the model was adopted nationwide by the MOH's Expanded Vaccination Program.
- In **Burkina Faso**, subnational microplans were developed by the Directorate for Vaccine Prevention, and 368 stakeholders were trained on their implementation and monitoring.
- In **Kenya**, the National COVID-19 Vaccine Deployment Plan was developed, and over 1600 HCWs were trained on the safe administration of multiple vaccines in nine counties.

COVID-19 Immunization Costing in Malawi

Initial evidence suggested that rolling out a new vaccine amidst a global pandemic was much costlier than previous vaccination efforts. To better understand this issue, MTaPS assessed the existing costing studies, and in Malawi a costing study was conducted across 20 health facilities. MTaPS adapted a COVID-19 vaccine costing model and developed a scenario builder to look at the various cost estimates of delivering COVID-19 vaccines under different assumptions, contributing to evidence-based decision-making for investments in vaccine delivery during the pandemic. MTaPS also conducted three global online surveys of health experts, highlighting unexpected trends in hiring and reliance on newer and costlier delivery and demand generation methods. The results from these surveys were used to fill significant gaps in human resources (HR), supplies, boosters, cold chain, and reaching subpopulations. The findings of the costing study contribute to a growing body of evidence on the real cost of COVID-19 vaccination delivery using a bottom-up costing approach. These efforts will support future decisions on investments and strategies for vaccine delivery.

Regulatory and pharmacovigilance systems for safe vaccine introduction

Countries: Bangladesh, Jordan, Kenya, Mozambique, Rwanda, Tanzania

MTaPS supported regulatory and pharmacovigilance (PV) systems to introduce COVID-19 vaccines as a critical step in monitoring patient safety, maintaining public trust, and achieving desired vaccination rates.

- In **Rwanda**, the national Integrated Regulatory Information Management System was deployed by the Rwanda Food and Drugs Authority (Rwanda FDA) to expedite vaccine and medicines marketing authorization and ensure product safety monitoring. The guidelines for surveillance of adverse events following immunization (AEFI) were adapted to include AEFI reporting for COVID-19 vaccines.
- In **Bangladesh**, the Safety Surveillance Cell, an early warning system for monitoring vaccine-related events, was established for COVID-19 vaccines at the Directorate General of Drug Administration and National AEFI Advisory Committee. Overall, 4,508 AEFI reports were received and reviewed via the web-based COVID-19 AEFI reporting and surveillance system.
- In **Kenya**, the national electronic PV system was put in place, with live dashboards, digitized adverse drug reaction (ADR) and AEFI reporting, and an investigation form accessible from hand-held devices. In addition, 870 HCWs were trained on COVID-19 vaccine safety and assisted in reviewing 3,446 AEFI reports.
- In **Tanzania**, a training package on COVID-19 vaccine safety and electronic reporting via VigiFlow (the WHO global Individual Case Safety Report reporting tool) and PV supervision tools was developed with the Tanzania Medicines and Medical Devices Authority, and training was delivered to over 300 HCWs and supervisors.
- In **Jordan**, safety data on over 400,000 COVID-19 vaccine recipients were analyzed to inform the MOH campaign to enhance public confidence in COVID-19 vaccines.

In **Bangladesh,**
4,508
AEFI reports were received and reviewed via the **web-based COVID-19 AEFI reporting and surveillance system**

In **Kenya,** **870**
HCWs were trained on COVID-19 vaccine safety and assisted in reviewing
3,446
AEFI reports.

In Jordan, safety data on over
400,000
COVID-19 **vaccine recipients were analyzed** to enhance public confidence in COVID-19 vaccines.

Vaccine logistics support

Countries: Bangladesh, Cameroon, Cote d'Ivoire, Nigeria, the Philippines

MTaPS assisted with the rapid deployment of COVID-19 vaccines, which directly impacted the speed and scope of vaccine rollouts, ensuring timely access to vaccination and helping the governments to achieve vaccination coverage goals.

Supply chain management of health commodities is essential for ensuring uninterrupted services at the health facilities. Due to the uncertainties associated with COVID-19 related emergencies, along with the commodities supply, health facilities must be trained on supply chain management to ensure optimum distribution and use of the commodities to achieve maximum impact from our fight against COVID-19. I am happy that DOH, in partnership with USAID, has launched a timely and appropriate training for our health facilities providing COVID-19 services."

Ms. Carolina Taino,
Undersecretary of the DOH, the Philippines, on the launch of the e-training module on HCWM

11,697
Number of **people trained** on **COVID-19 vaccine-related topics**

In the six supported states of **Oyo, Akwa-Ibom, Cross River, Rivers, Kaduna, and Federal Capital Territory in Nigeria,**

122,170 **doses of COVID-19 vaccine** were administered at

82 **community pharmacies** and **private hospitals,** which prompted **national consideration on expanding the model to routine immunization.**

- In **Bangladesh**, MTaPS assisted the government with the development and deployment of a COVID-19 vaccine LMIS (vLMIS) to manage COVID-19 vaccine inventory and distribution. Uninterrupted access to vaccines ensured an impressive 88.5% COVID-19 vaccine coverage (as of July 2024). The vLMIS will be expanded by the DGHS for managing all vaccines of the national immunization program.
- In the **Philippines**, MTaPS led the integration of COVID-19 vaccine supply management into National eLMIS, which was set up to provide real-time data on vaccine stock levels, usage, and needs, informing timely decisions to prevent shortages or overstock. MTaPS also assisted the DOH in developing terms of reference for engaging third-party logistics (3PL) providers for COVID-19 vaccine distribution. The model will be expanded for all medicines used in national health programs.
- In **Cameroon**, the Expanded Program for Immunization (EPI) was provided with the logistics support to conduct vaccination campaigns in hard-to-reach areas in the Center, Littoral, and West regions. Overall, over 680,000 people received the recommended COVID-19 vaccine doses, which were delivered with MTaPS support.

Access to safe vaccination services

Countries: Cameroon, Côte d'Ivoire, Kenya, Mozambique, Nigeria

Safe vaccination services are critical to protecting the population and ensuring public confidence and trust. MTaPS supported safe vaccination at the national and site level by helping countries develop IPC standards for vaccination sites, introducing compliance monitoring tools for safe vaccine administration during the pandemic, and strengthening relevant human and institutional capacity.

- In **Mozambique**, training materials were developed, and cascade trainings were conducted for 130 HCWs on COVID-19 vaccination-related IPC and waste management. The MTaPS-introduced compliance monitoring and continuous quality improvement approaches contribute to the sustainability of the intervention.
- In **Côte d'Ivoire**, over 2,000 vaccinators were trained by the Directorate for Coordination of the Expanded Immunization Program (DCPEV) on topics related to vaccine administration, IPC, and vaccination waste management.
- In **Kenya**, 826 providers were trained on IPC, occupational safety, and waste management through cascade training using a peer-to-peer approach for transfer of knowledge across the health care system.
- In **Cameroon**, SOP manual on vaccine-related waste management developed jointly with the WHO EPI to ensure the safe disposal of medical waste to protect the public and the environment.

Private-sector engagement

Countries: Cameroon, Côte d'Ivoire, Nigeria

Engaging the private sector in COVID-19 vaccination is a novel approach for most countries. Where MTaPS collaborated with the private sector, the approach proved very efficient for accelerating vaccine rollout and ensuring broad outreach, especially to vulnerable and hard-to-reach populations.

- In **Nigeria**, private clinics and community pharmacies in the states of Oyo, Akwa-Ibom, Cross River, Rivers, Kaduna, and Federal Capital Territory were engaged by the national government in vaccination. MTaPS collaborated with relevant stakeholders to develop and implement the policy and engagement strategy, adopt minimum requirements for private community pharmacies to participate in the program, and implement vaccination training manual and materials. MTaPS trained 948 private providers on all aspects of COVID-19 immunization.

As a result, in the six supported states, 122,170 doses of COVID-19 vaccine were administered at 82 community pharmacies and 64 private hospitals, which prompted national consideration on expanding the model to routine immunization.

- In **Côte d'Ivoire**, vaccination services were introduced in private clinics and pharmacies by the DCPEV. A charter agreement was prepared and signed by key stakeholders, including the MOH and National Union of Private Pharmacies, which established a legal basis for the private-sector engagement. The launch campaign included training and coaching of 12 pharmacies from five MTaPS-supported districts slated to initiate vaccination services.
- In **Cameroon**, hands-on supportive supervision was conducted for 38 private health facilities that were trained on COVID-19 vaccination. Of these, 36 had integrated COVID-19 vaccination in their routine services, which increased vaccine accessibility, especially for underserved communities in remote areas.

Localization of vaccine manufacturing

Countries: Kenya, Rwanda

Initial delays with COVID-19 vaccine availability demonstrated the importance of localization of vaccine manufacturing capacity to ensure rapid and equitable access to life-saving vaccines. MTaPS supported governments to enhance the regulatory system capacity to manage and oversee the production of vaccines and guarantee their safety and efficacy.

- In **Kenya**, a government-led assessment and mapping was conducted of existing skills and competencies for selected pharmaceutical regulatory functions identified during the WHO Global Benchmarking Tool (GBT) assessment. This covered leadership, marketing authorization, clinical trials, PV and post-marketing surveillance, licensing, and laboratory, which helped establish national capabilities for the oversight of future vaccine production.
- In **Rwanda**, regulatory capacities of the Rwanda FDA progressed toward the achievement of the WHO GBT maturity level 3. This allowed the Rwanda FDA to successfully conduct good clinical practice inspections of 10 clinical trial sites—including two sites that administered COVID-19 vaccines to pregnant women—and to manage a partnership with BioNTech to set up the first modular manufacturing unit for manufacturing mRNA medicines. This was a critical step in establishing a resilient vaccine ecosystem in Africa and future pandemic preparedness.

Improving Efficiency of Integrated Diagnostic Services in Madagascar

Diagnostic services for infectious diseases have been suboptimal for years in developing countries due to the verticalization of services by disease programs. The weakness of siloed diagnostic services became even more obvious when the pandemic struck and hampered access to diagnostic tools for COVID-19 response. In Madagascar, an action plan was developed with the Ministry of Public Health for networking peripheral laboratories in Fort-Dauphin, Toliary, and Fianarantsoa with the central medical laboratory of Madagascar (LA2M, Laboratoire d'Analyses Médicales Malagasy) to streamline the diagnostic process for COVID-19, TB, and HIV. A rapid situational analysis and mapping of diagnostic facilities and equipment, laboratory information systems and data flows, and HR capacities informed the new network design capacities. The bottlenecks and inefficiencies of the laboratory product supply were addressed by establishing optimized standardized processes for the quantification and procurement of laboratory supplies for the newly adopted diagnostic network. To ensure sustainability, MTaPS developed training materials for laboratory supply management, COVID-19 rapid diagnostic testing techniques (including use of the GeneXpert platform), and the use of harmonized electronic registers and data entry into DHIS2.

Staff member at LA2M. April 2024. Photo credit: Timothé Chevaux

FEATURED RESOURCES

- MTAPS Global Learning Series. Building Resilient Health Systems: What Has COVID-19 Taught Us About Infection Prevention and Emergency Supply Chains? (2021)
- COVID-19 SCM Bangladesh.
- The Philippines DOH Academy e-Learning platform COVID-19 Courses (2020). (IPC, HCWM, and supply chain management courses developed with MTaPS support)
- Bangladesh Ministry of Health and Family Welfare, Quality Improvement Secretariat. COVID-19 video gallery.
- Rwanda FDA. Guidelines for Adverse Events Following Immunization (AEFI) Surveillance (2021)
- Fantahum T, Tadeg H, Joshi M, et al. "Strengthening Infection Prevention and Control to Enhance Preparedness and Response for COVID-19 Emergencies in Ethiopia." Poster presented at the American Public Health Association Annual Meeting, November 6-9, 2022, Boston, MA.
- Kenya's Pharmacovigilance Electronic Reporting System (PvERS).

MTAPS Global Learning Series. Building Resilient Health Systems: What Has COVID-19 Taught Us About Infection Prevention and Emergency Supply Chains? (2021)

FUTURE CONSIDERATIONS

- Analyze and invest in mainstreaming the successful approaches to "last mile" delivery under emergency conditions that were implemented during the COVID-19 pandemic, such as real-time stock reporting and quantification, enhanced eLMIS with transparent public dashboards, contracting of private 3PL providers, and broader private-sector engagement.
- Support strategies for improved IPC behaviors aligned with the updated IPC guidelines and SOPs produced during the pandemic, including previously overlooked areas (for example, IPC for specific health services such as vaccination, HCWM, patient and sample transportation, and mortuaries). This can be done through country-specific analysis of blockers and enablers, continuous education, and continuous quality improvement.
- Strengthen pharmaceutical regulatory bodies according to WHO GBT standards, including the implementation of relevant electronic platforms, to increase their capacity for rapid product authorization, surveillance, and ongoing safety and quality control.
- Promote comprehensive PV systems and electronic platforms with the capacity for adaptable active safety surveillance of medicines and vaccines (AEFI), user-friendly reporting interfaces for HCWs and the public, ADR reports review, and feedback and follow-up.
- Localize the manufacturing of vaccines and essential IPC products (e.g., PPE, hand rubs, disinfectants, waste management products) to ensure uninterrupted supply in case of pandemic closedowns and global supply chain disruptions; this will also be economically beneficial for countries.
- Strengthen the national capacity for maintaining and continuously updating e-Learning platforms with readily available targeted "just-in-time" IPC content, as well as solutions for continuous professional development.
- Sustain and replicate the types of public-private partnerships that significantly enhanced the COVID-19 vaccination outreach and related health initiatives and improved equitable access to services, especially for hard-to-reach and vulnerable populations.
- Support national efforts to establish integrated diagnostic and surveillance laboratory networks with integrated information systems and pooled quantification and procurement of laboratory equipment and supplies.

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PEER-REVIEWED PUBLICATIONS

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- Mathur I, Church R, Ruisch A, et al. Insights to COVID-19 Vaccine Delivery: Results from a Survey of 27 Countries. Vaccine. 2023;41(43), 6406–6410. Available from: https://doi.org/10.1016/j.vaccine.2023.08.087

RECOMMENDED CITATION

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