Strengthening Strategic Information Activities in the Kingdom of Lesotho
Key Findings Report

PEPFAR
U.S. President's Emergency Plan for AIDS Relief

icap Global Health

Cover: DHIS2 user at a facility using a standard dashboard from a tablet provided by the SI project

Acronyms

ANC	Antenatal Care
CDC	Centers for Disease Control and Prevention
CR	Client Registry
DATIM	Data for Accountability Transparency and Impact
DCD	Disease Control Department
DHMT	District Health Management Teams
HIS	Health Information Systems
HISP	Health Information System Program
HMIS	Health Management Information System
HR	Human Resources
HSS	HIV Sentinel Surveillance
IL	Interoperability Layer
IP	Implementing Partners
IT	Information Technology
LIS	Lab Information System
MER	Monitoring, Evaluation, and Reporting
MOH	Ministry of Health
OpenEMPI	Open Enterprise Master Patient Index
OpenHIM	Open Health Information Mediator
OpenMRS	Open Medical Record System
PEPFAR	President's Emergency Plan for AIDS Relief
PMTCT	Prevention of Mother-to-Child Transmission of HIV
SI	Strategic Information
SOP	Standard Operating Procedures
TA	Technical Assistance
TB	Tuberculosis
TWG	Technical Working Group
WG	Working Group

Introduction

From June 2014-September 2020, ICAP at Columbia University collaborated with the Lesotho Ministry of Health (MOH) and the United States Centers for Disease Control and Prevention (CDC) to strengthen strategic information (SI) activities in the Kingdom of Lesotho with funding from the President's Emergency Plan for AIDS Relief (PEPFAR). At project initiation, ICAP supported the MOH and Lesotho SI stakeholders to conduct a national health management information system (HMIS) landscape and needs assessment. Key findings were weak HMIS coordination; outdated HMIS policy; a mainly paper-based HMIS; and limited MOH staff capacity at all levels for data analysis, dissemination, and data use.

Based on the HMIS assessment findings and recommendations, the Lesotho SI Project supported interventions to transform Lesotho's SI systems. The outcomes of project interventions include: stronger structures for SI planning and coordination; digital transformation and integration of HMIS established on DHIS2, a Bahmni-based client level electronic medical record (eRegister), and an Open Health Information Exchange (OpenHIE)-based integrated HMIS architecture. The Lesotho SI project also strengthened the MOH's capacity at all levels in data management, dissemination, and use.

ICAP in Lesotho SI Team Members
Standing (L-R): 'Makhotso Lilele, Tlelima Kebise, Thabo Nthako, Teboho Koma, Tello Shao, Lika Masoebe; Sitting (L-R): Mahao Molise, Tiisetso Leqela, Khahliso Pheko

Project Overview and Achievements

Enhance ability of national institutions to plan and coordinate HMIS and surveillance activities

Strengthened Technical Working Groups

To enhance MOH leadership and its ability to effectively plan and coordinate SI activities at the national level, ICAP supported the MOH to revitalize and strengthen the SI Technical Working Group (TWG) and sub-committees by providing logistical and technical support to numerous meetings. The SI TWG is an instrumental forum to mobilize stakeholders and streamline planning and co-ordinated implementation to strengthen SI systems. The SI TWG also provided a platform for the MOH and SI partners to discuss key SI policies and operational documents. SI TWG stakeholders (CHAL, Global Fund, UN agencies, CDC, USAID, implementing partners (IP), civil society organizations, and Partners in Health) were successfully mobilized and contributed human resources (HR) and equipment for DHIS2 and eRegister implementation.

ICAP also played a leading role in the **HMIS Working Group (WG) by** making significant contributions to the revision of HMIS tools and integrating the changes into the DHIS2. As the only SI partner, ICAP additionally provided logistical and technical assistance (TA) to numerous **Surveillance & Research WG** meetings and related taskforces. ICAP provided TA to MOH to conduct antenatal care (ANC) sentinel surveillance (HSS) throughout the project (2014-2018). ICAP ANC HSS TA to the MOH encompassed developing protocol and tools, executing an HSS survey, cleaning and analyzing data, preparing reports, and disseminating results. Through the HSS task team, ICAP provided key TA for the MOH to successfully transition from the traditional ANC HSS, based on anonymous non-linked primary data, to HSS, based on routine ANC data collected across 17 sentinel surveillance sites. Finally, through its district level presence, ICAP provided TA and logistic support to establish several **district-level TWGs** mandated to drive data quality improvement and data use for decision-making across Lesotho's ten districts.

Seconded Personnel for HMIS and Surveillance Capacity Building

The MOH confronted a chronic shortage of key HR which hindered its efforts to strengthen SI at all levels of the health system. ICAP provided seconded staff (Figure 1) to deliver intensive TA and capacity building, including training and mentoring in HMIS and surveillance, to existing MOH staff throughout the project.

Facilitate implementation and revision of a National HMIS Strategic Plans

Prior to the start of this project, Lesotho's Health Planning and Statistics Department developed and implemented a comprehensive HMIS Strategic Plan (2013-2017). During the first half of the project, ICAP's TA to the MOH focused on addressing priorities noted in the plan: revising outdated regulatory documents, establishing an integrated data warehouse, improving data management and use, and addressing insufficient HR and feedback from District Health Management Teams (DHMTs). In the second half of the project, ICAP provided TA to the MOH to review the status of HMIS Strategic Plan (2013-2017) priorities and used the results to inform development of a Strategic Plan for the subsequent five years (2018-2023). In 2018, ICAP provided TA to review Lesotho's 2003 HMIS policy and developed a new policy in accordance with current and future national context and international technological advances.

Figure 1

ICAP-Seconded Staff to MOH and Districts, 2020

Position	Placement	Number	Key responsibilities
HMIS officer	DCD	1	· Oversee the quality and use of HIV related, TB and TB/HIV · Support Management and implementation of DHIS2 and the use of its output
HMIS officer	HPSD	1	· Support Management and implementation of DHIS2 and the use of its output
HIS officer	DHMTs	23	· Provide intensive district and facility level mentorship to DHIS2 and eRegister users and TA to troubleshoot and maintain software and hardware
Data Clerk	DHMTs	6	· Capture monthly and quarterly reports into DHIS2
Drivers	DHMTs	15	· Provide safe and reliable transport to and from facilities for district HIS officers and other ICAP staff travelling to provide eRegister amd DHIS2 TA

Throughout the project, ICAP supported MOH in implementing multi-faceted SI interventions to address poor performance of HMIS data flow, management, and use at all levels as identified in the 2014 assessment. Interventions included development and nationwide rollout of DHIS2 at facility, district, and national levels; improvement of data quality in the DHIS2 system; and development and implementation of individual level eRegister to further enhance the national HMIS.

Nationwide roll-out of an open-source, web-based HMIS and data warehouse (DHIS2)
ICAP supported the MOH to adopt, develop, and rollout a fully functional and integrated DHIS2-based HMIS at all levels of the health system to replace multiple and conflicting systems. Working alongside MOH IT and DHIS2 trainers, ICAP began the DHIS2 customization process with HIV and tuberculosis (TB) program reports. Prior to DHIS2 implementation, ICAP provided TA to import historical data from a legacy system and developed comprehensive standard operating procedures (SOPs) and user guidelines detailing DHIS2 data entry to ensure accuracy. On February 18, 2015, the system was fully endorsed by MOH leadership and officially launched as the national health data warehouse and reporting system.

Six months later, by October 2015, ten out of eleven health programs had established reporting systems integrated into the DHIS2 platform with standardized data entry at the district level. ICAP also provided TA to MOH to import over 40 million data values across eight of the ten health programs (all but Expanded Program of Immunization and supply chain) from 2008-2015 to maintain legacy records and facilitate data trend analysis. To support DHIS2 implementation at the district level, ICAP worked with the MOH to procure and distribute 55 tablet computers configured to support DHIS2 data entry and use. In October 2017, ICAP and MOH established DHIS2-lab information system (LIS) interoperability to visualize data in LIS on a DHIS2 dashboard. The ICAP SI team supported the central MOH HMIS team in developing the DHIS2 access guidelines for IPs. To ensure smooth implementation of DHIS2, the ICAP SI team continued to provide TA to the MOH HMIS, Disease Control Departments (DCD), information technology teams, and DHMT on data management and use, and customization of DHIS2 to meet emerging information needs.

Facility-level rollout of DHIS2
Prior to facility-level DHIS2 rollout, ICAP conducted a rapid assessment at all MOH levels. At the central and district level, the assessment examined MOH's capacity to create, manage, and support many DHIS2 users as it expanded to the facility level. At the facility level, the assessment of 177 health facilities targeted

for DHIS2 rollout examined devices, internet connectivity, and the number of HMIS personnel requiring DHIS2 end-user training. ICAP developed and executed a detailed implementation plan according to priorities identified through this assessment.

First, ICAP procured, installed, configured, and optimized a high-capacity server at the central data center to host DHIS2. To support DHMTs across ten districts with HR, ICAP hired, trained, and deployed eight technical staff and engaged partners to leverage their personnel seconded at district and facility levels. ICAP procured annual data plans to address connectivity needs. Working closely with MOH, in 2017, ICAP organized and facilitated district-based training sessions across ten districts and trained 333 facility-level HMIS personnel on DHIS2. In the last three years of the project, ICAP continued to support the DHMTs by providing checklist-guided, role-tailored monthly intensive mentorship to strengthen and consolidate facility-level implementation of DHIS2. Furthermore, ICAP supported the MOH to ensure DHIS2 maintains an updated list of operational health facilities with accurate and complete geographic coordinates, allowing MOH to run geospatial data analysis.

Improve quality of data stored in the DHIS2 system
During nationwide, multi-level rollout of DHIS2, ICAP was aware that data quality in Lesotho had to improve to ensure the sustainability and longevity of the system. In response, ICAP supported MOH to expand DHIS2 access to three key user categories: senior district public health nurses, IP, and health facility HMIS personnel. Additionally, ICAP continued systematic reviews of monthly reports in DHIS2; identified key program areas and logically related data sets with recurrent data errors; and incorporated validation rules to improve data accuracy at the point of entry. On a quarterly basis, ICAP reviewed and compared DHIS2 data to corresponding PEPFAR Monitoring, Evaluation, and Reporting (MER) indicators in Data for Accountability Transparency and Impact (DATIM), the PEPFAR reporting system, and across PEPFAR-supported facilities on selected indicators to check for discrepancies in data. Since 2019, ICAP began comparing DHIS2 data with eRegister data to check for discrepancies across facilities with advanced implementation (where >95% of patients are documented in the eRegister).

Developing and implementing client-level electronic medical record (EMR) systems to enhance the national HMIS
Working closely with CDC Lesotho, ICAP supported the MOH to develop a client-level EMR on the Bahmni platform. By implementing the EMR, or commonly known in country as the "eRegister," MOH aimed to achieve three critical objectives: 1) to collect and use high quality client level data for improved care outcomes; 2) to uniquely identify and track patients through the 95-95-95
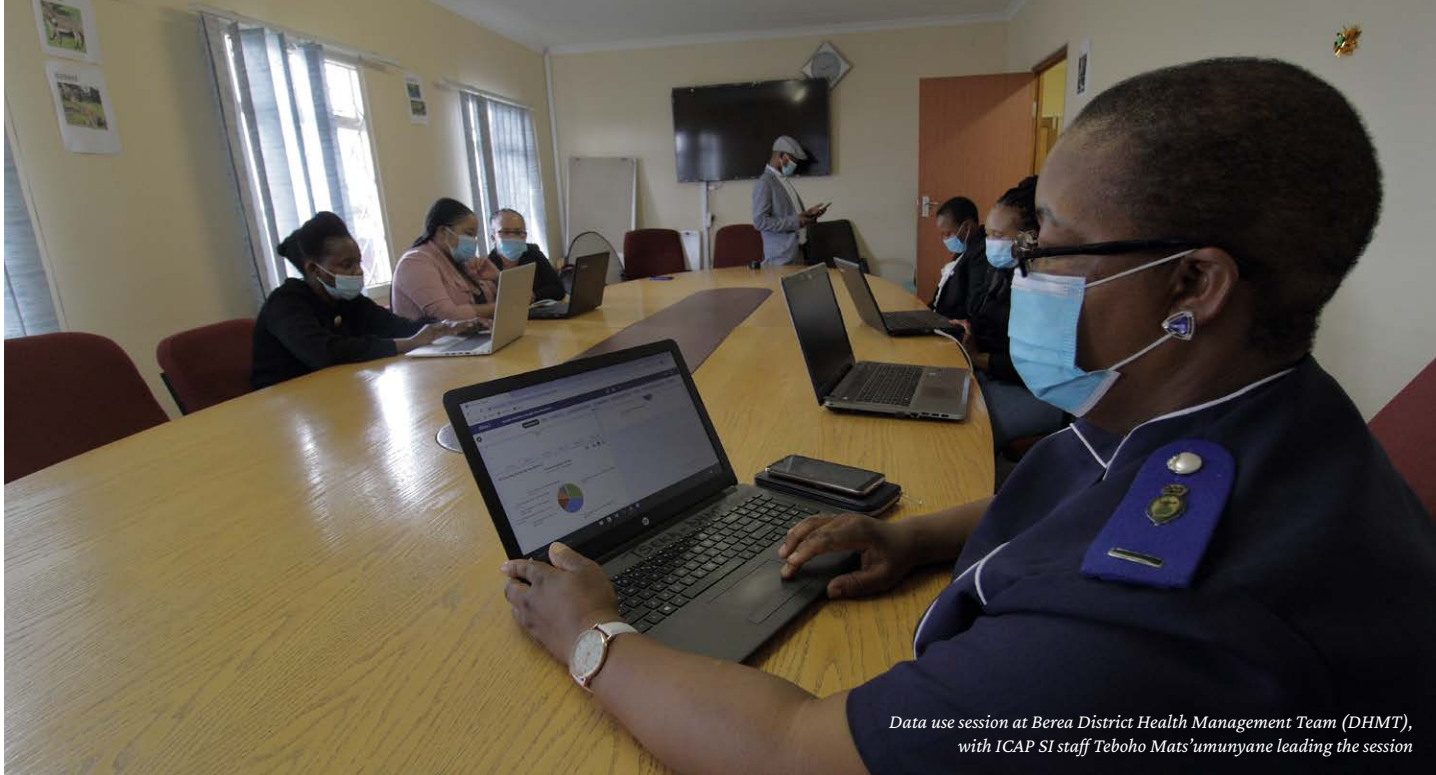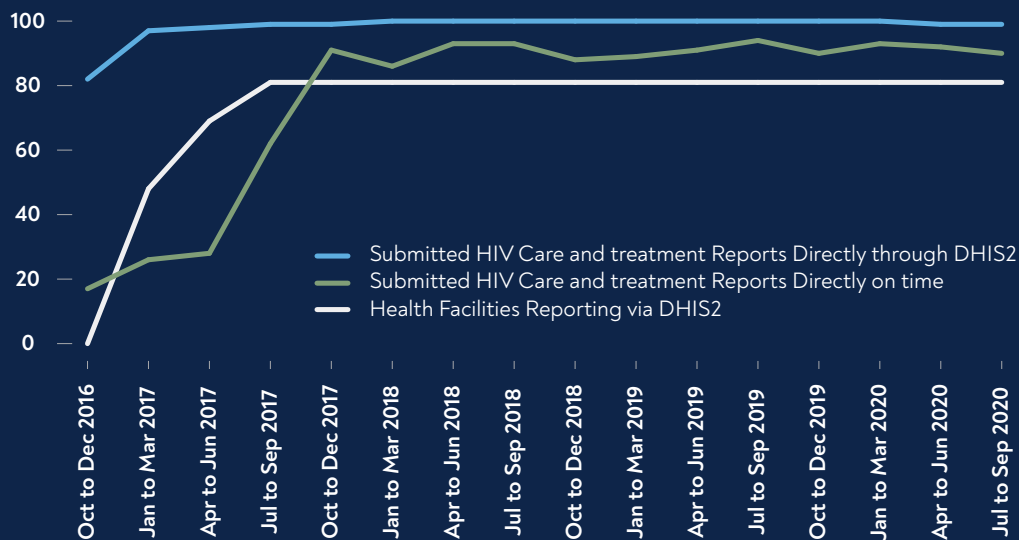
Box 1
Facility-level rollout of national DHIS2 improved data quality and ownership at all levels of health system in Lesotho

Following a successful central and district level rollout of the DHIS2 in 2015-2016, which included all 12 health programs, by 2017 ICAP supported the expansion of the DHIS2 to 177 public health facilities. ICAP conducted a critical review and cleaning, which included running analysis to identify outliers and inconsistencies; providing feedback to end users; and monitor cleaning. For common and recurring data quality issues, validation rules were developed to significantly enhance data quality at the point of entry. As a result, report completeness and timeliness significantly improved from October 2016-January 2018 and continued throughout the life of the project. The data confirms the contributory role DHIS2 expansion has played in Lesotho's quest for HIV epidemic control (Figure 2).

Figure 2
With an increase in facility reporting (white line), completeness of reporting (blue line) increased from 78% in October 2016 to 100% in January 2018 and timeliness of reporting (green line) from 49% in October 2016 to 81% in January 2018

Submitted HIV Care and treatment Reports Directly through DHIS2
Submitted HIV Care and treatment Reports Directly on time
Health Facilities Reporting via DHIS2

HIV care cascade within and across facilities for care continuity; and 3) to automate facility-level routine and key operational reports to support data use and evidence-based programming.

After supporting core team members to attend advanced Bahmni development training in South Africa, ICAP supported MOH to gather technical and programmatic materials for a phased development and rollout. ICAP supported the installation and development of the HIV care and treatment module and pilot implementation of eRegister at six sites. Following successful piloting, ICAP supported MOH to conduct a nationwide phased rollout in 178 health facilities.

Concurrent to the nationwide rollout of eRegister, ICAP undertook significant efforts to enhance the eRegister by strengthening existing modules and incorporating new ones in response to users' and MOH's growing information needs. These new modules aimed at expanding eRegister to encompass services in HIV testing, prevention of mother-to-child transmission (PMTCT), tuberculosis (TB), and cervical screening, among others.

Adjustments to existing modules aimed to address five critical operational areas: strengthening data quality through building logic checks and validation rules; enhancing the end-user experience by simplifying user interface and providing more real-time decision support tools for clinical decision-making; accommodating M&E tool revisions to align with up-to-date guidelines; and developing eRegister operational reports to automate generation of PEP-FAR MER indicators to streamline quarterly program reporting.

ICAP also supported MOH to develop detailed transition criteria and SOPs to guide a phased transition of eRegister sites from double data capture (paper and electronic) to point-of-care electronic data capture and phase out paper-based reporting. ICAP supported the MOH to identify eligible sites, conduct rigorous data verification, and evaluate 50 sites, of which 43 scored at or above the criteria to transition as of September 2020.

ICAP also supported the MOH with the configuration, development, integration, and piloting of Lesotho's web-based centralized HIE. The goal of the HIE is to enhance the eRegister's capacity to uniquely identify and track individuals through the 95-95-95 HIV care cascade across facilities, de-duplicate multiple records, identify silent transfers, and facilitate sharing of information among providers across sites for continuity of care. The HIE was built on three platforms, including Open Medical Record System (OpenMRS)-based shared health record (OpenSHR), Open Enterprise Master Patient Index (OpenEMPI)-based client registry (CR) and Open Health Information Mediator (OpenHIM)-based interoperability layer (IL).

Following six months of pilot at five eRegister sites, ICAP conducted rigorous onsite testing of the HIE's capability. Testing confirmed that HIE effectively identified and merged true duplicates. The pilot also confirmed that HIE was efficient to uniquely identify and track movement of clients across multiple sites seeking the same service (Figure 3 provides a sample use case scenario report for individuals who received repeat HIV tests at multiple sites). It also gave the ICAP team further insight on areas to refine the HIE's data quality at source (eRegister) and address prevailing challenges such as frequent network failure, which hampered smooth information sharing.

In the last quarter of FY20, ICAP explored an innovative strategy to pursue its national HIE expansion plan during the COVID-19 pandemic. ICAP, assisted by WhatsApp and the TeamViewer app, conducted remote readiness assessments and provided a day-long virtual training across 38 sites. Following the training, legacy data on patient demographic information from eRegister was imported into the HIE to establish unique IDs within the CR, enabling sites to send sentinel information to OpenSHR. By end of FY20, a total of 38 (5 pilot and 33 new) eRegister sites (10 in Botha Bothe, 15 in Leribe, and 13 in Maseru) accessed HIE and shared data. By November 2020, HIE expansion reached 173 out of 178 eRegister sites.

Figure 3

SHR Use Case Scenario Results, HIV Multi-tester Across Five Pilot Sites, March 2020

Highlights of HIE Pilot Output:

Shared Health Records (SHR) Use Case Scenario Report, e.g. HIV Testing Services (HTS):

· Unique individuals tested for HIV documented in eRegister/SHR: **9,555**
· Unique individuals who tested HIV-negative: **9,156**
· Unique individuals who tested HIV-positive: **399 (4.2% yield)**
· Unique individuals with HIV test result at multiple sites: **627 (19 HIV-positive and 608 HIV-negative)**

19

608

■ Unique individuals with HIV- test result at multiple sites

■ Unique individuals with HIV+ test result at multiple sites

Total Number of Multiple Testers
(n=627, 6.6% of 9,555 testers)
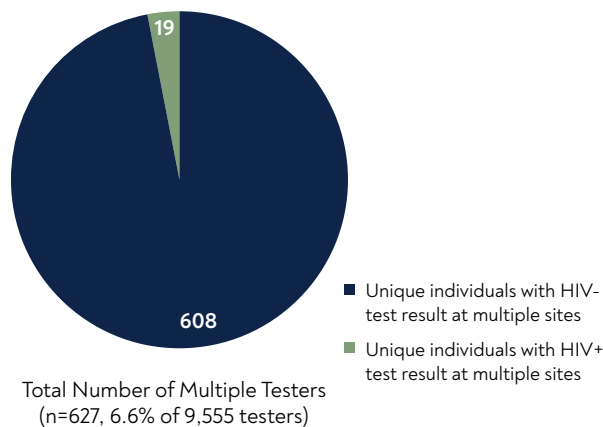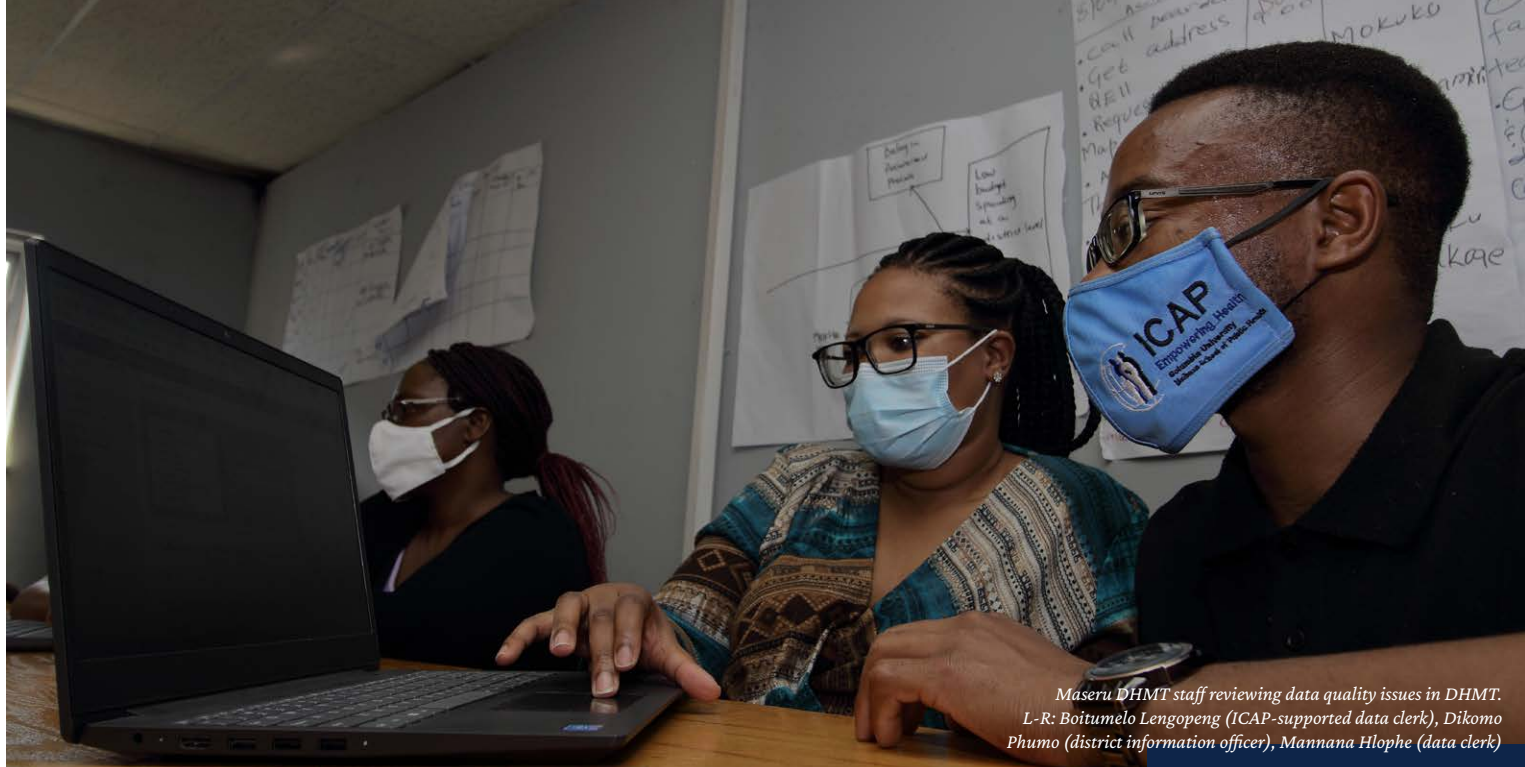
*Maseru DHMT staff reviewing data quality issues in DHMT.
L-R: Boitumelo Lengopeng (ICAP-supported data clerk), Dikomo Phumo (district information officer), Mannana Hlophe (data clerk)*

Strengthen human resources and support country ownership of sustainable hmis and surveillance activities

Prior to the start of the project, there were major gaps in HR capacity for HMIS, surveys, and surveillance. Gaps in HR restricted MOH's data management practices, including building robust HMIS for data collection, analysis, dissemination, and use. MOH capacity to plan, design, and implement surveys and surveillance activities; analyze, disseminate, and use findings in support of planning and strategic decision making at all levels was also limited. ICAP worked to build MOH capacity to improve demand for and quality of health through trainings, mentorship, and skills transfer tailored to key MOH staff members at the facility, district, and central levels.

Development of an HMIS capacity building plan
As part of the baseline project assessment conducted in 2014, ICAP collaborated with MOH to assess the extent of vacancies in HMIS-related positions at the national and district levels. Based on the findings, ICAP supported MOH by seconding trained HMIS personnel at central and district levels and conducting training of its existing staff with HMIS roles on how to develop, implement, and use HMIS as per the national HMIS strategic plans (2013-2017 and 2018-2023). ICAP also provided intensive survey and surveillance capacity building through hands-on trainings and skill transfer tailored to the biannual ANC HSS and annual ART cohort surveys.

Building MOH capacity to develop, customize, manage, implement and maintain HMIS systems (DHIS2 and eRegister)
Since Lesotho's adoption of DHIS2, ICAP engaged Health Information System Program (HISP) South Africa and trained MOH's information technology (IT) team on advanced DHIS2 development. This training was conducted as part of Lesotho's DHIS2

first national data warehouse incorporating data from HIV and TB-related programs. The ICAP team continued to provide task-oriented training to MOH's IT team throughout the integration of the remaining nine programs into DHIS and continued improvements during the project's duration.

ICAP similarly supported the training of two MOH IT members on advanced OpenMRS development (November 20-December 5, 2017). Throughout the eRegister development, ICAP built the capacity of the MOH IT team in responding to users' needs and M&E tool revisions; administering the two systems (DHIS2 and eRegister); and configuring, usaging, and managing remote support tools (osTicket virtual help desk and TeamViewer app) to manage end-user TA requests.

Central-level HMIS team capacity building
From 2015-2020, ICAP engaged the central HMIS team to lead end-user trainings and successfully trained 715 MOH staff on DHIS2, including 51 at the central level, 110 at the district level, and 508 at the facility level. All DHIS2 training sessions and follow up were tailored to match participants' roles and responsibilities in the system. Additionally, ICAP engaged 114 MOH staff and stakeholders as eRegister expert trainers and supported MOH-led training of over 2,496 facility-level staff.

Central level program managers and M&E staff capacity building
At the central level, initial DHIS2 trainings targeted program managers and M&E staff from departments whose health information would be reported via DHIS2. These trainings were followed by continued mentorship of the trained users, addressing

skill gaps and improving their ability to create, interpret, use, and share personalized dashboards. ICAP also supported central MOH IT and HMIS teams to organize three DHIS2 conferences These conferences created an instrumental fora for users to share experiences with DHIS2 and its impact on service improvement and strategic decision-making, as well as a platform to communicate recommendations for system improvements.

District level HMIS capacity building
In the early days of DHIS2 rollout, the focus was to train data staff at the DHMTs to effectively use DHIS2 for data entry, to verify data quality, and to create demand for quality data at the district level. The district health managers and senior public health nurses were also trained on increasing demand for quality data and effective data visualization to improve data use for program improvement. Additionally, 45 district level data staff were trained as trainers to cascade down DHIS2 trainings to facilities. Over the course of the project, ICAP continued to provide role-refresher trainings and mentorship.

Facility level capacity building
In preparation for the nationwide facility level rollout of DHIS2, ICAP organized multiple district-based trainings simultaneously and trained 508 key facility level users, 175 facility managers and nurses in-charge facility users, and 333 data personnel (data clerks and record assistants) on how to use DHIS2 to enter and verify data for completeness and accuracy. ICAP also procured 162 tablets, provisioned with annual data plans to ensure uninterrupted internet connection at facilities, and distributed them to all but Berea district facilities, which had received tablet donations from WHO. ICAP additionally organized annual DHIS2 refresher trainings and monthly checklist-guided, role-tailored mentorship visits for facility level DHIS2 end users.

Building MOH capacity to plan, design and implement surveys and related surveillance activities
As a member of the Research and Surveillance TWG, ICAP provided TA to strengthen MOH's research and surveillance team's ability to conduct key national HIV surveillance activities. ICAP supported these activities, including the biannual ANC HSS and annual ART cohort surveys. ICAP provided training to 140 MOH staff on various survey and surveillance activities (Table 7) and continually supported MOH's surveillance team during the survey process.

In the final two years of the project, ICAP sustained its extensive technical support to conduct surveillance-based activities beyond ANC HSS and HIV, to include the PMTCT cascade and TB preventive treatment coverage survey. The ICAP team supported the MOH in reviewing over 20 research protocols, and revising and updating operating procedures and tools.

Contributing to Knowledge Base of DHIS2 and eRegister Implementation
ICAP routinely updated the online DHIS2 resources, accessible by all MOH departments, DHMTs, and IPs, with new implementation documents; updated mentorship checklists, training materials for various users, and tablet use guides; and updated DHIS2 risk registers, DHIS2 user access guidelines for partners, among other documents.

During the adoption, development, and implementation of eRegister, ICAP meticulously compiled and archived technical and operational documents. The project has kept track of eRegister concept dictionary, codes, configuration files, automated deployment scripts, and other technical documents, which are stored on GitHub. While operational documents, such as the phased expansion plan, site readiness assessment report, end user training material, pilot reports, backup and recovery strategy, cloud computing and transition standard operating procedures, and other operational documents are stored on the DHIS2 repository.

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