MUWRP CONTRIBUTION TO UGANDA'S eHEALTH AGENDA

And how it aligns to the National Health Digital Strategic Plan

Executive Summary

MUWRP has made a significant contribution to Uganda's digital health transformation through sustained investments in software development, interoperability, infrastructure, workforce capacity, data quality, governance and operational support. Its most distinctive contribution has been the adaptation and institutionalization of ClinicMasterMOH as a comprehensive electronic medical record and hospital information system, supported by point-of-care deployment, integration with national platforms and progressive transfer of ownership and technical capacity to the Ministry of Health.

MUWRP applies an end-to-end digitalization model that combines software development, equipment, networking, connectivity, power solutions, user training, mentorship, interoperability and ongoing technical support. This approach has strengthened point-of-care EMR use, reduced fragmented systems, supported paperless service delivery and improved the availability and quality of patient-level information.

The program has supported integrations between ClinicMasterMOH and national systems, including ALIS, the Central Public Health Laboratories health information exchange, ART Access, the National Data Warehouse and DHIS2. It has also invested in computers, servers, local area networks, internet connectivity, cybersecurity, resilient power and local technical-support capacity.

These achievements align with Uganda's Health Information and Digital Health Strategic Plan and demonstrate the importance of combining technology, infrastructure, people, governance and long-term support. Through participation in national technical working groups, donation of the ClinicMasterMOH source code and continued collaboration with the Ministry of Health, MUWRP has helped translate national digital health policy into functioning and sustainable systems at the point of care.

Major Achievements and Contributions

Software Development, Updating and Customization of ClinicMaster

MUWRP has supported the evolution of ClinicMaster from an HIV-focused implementation into a comprehensive, point-of-care electronic medical record and hospital information system capable of serving all facility departments.

- The program has financed and facilitated requirements gathering, development, testing, deployment and stabilization, with changes guided by MoH tools, facility workflows and national reporting requirements.
- Expansion of modules across registration, triage, consultation, laboratory, pharmacy, inventory, radiology, admissions, maternity, theatre, chronic care and reporting.
- Incorporation of national forms and workflows, including the viral-load non-suppressed register, maternity partograph, theatre anesthesia and consent forms, child register, adolescent and young people services register, and orthopaedics module.
- Clinical and usability refinements covering PrEP follow-up, antenatal calculations and tests, cervical-cancer screening status, appointment logic, laboratory report formats, maternity/search-engine fields and radiology approval workflows.
- Development and revision of national HMIS reports, including HMIS 105, 106, 108 and 33B, with remapping when DHIS2 metadata or reporting structures change.
- Development of patient communication functionality, including automated appointment SMS workflows.

This continuous improvement model is strategically important because national digital health systems must change when clinical guidelines, HMIS tools, data standards and service-delivery models change. MUWRP's contribution has therefore been both software development and the establishment of a repeatable change-management lifecycle through annual contracts.

Source Code Donation, Government Ownership and Sustainability

MUWRP facilitated the donation of the ClinicMasterMOH source code to the Ministry of Health and aligned continued development with the Division of Health Information. The objective was to strengthen Government of Uganda ownership, enable MoH technical oversight and create a pathway for long-term public-sector stewardship.

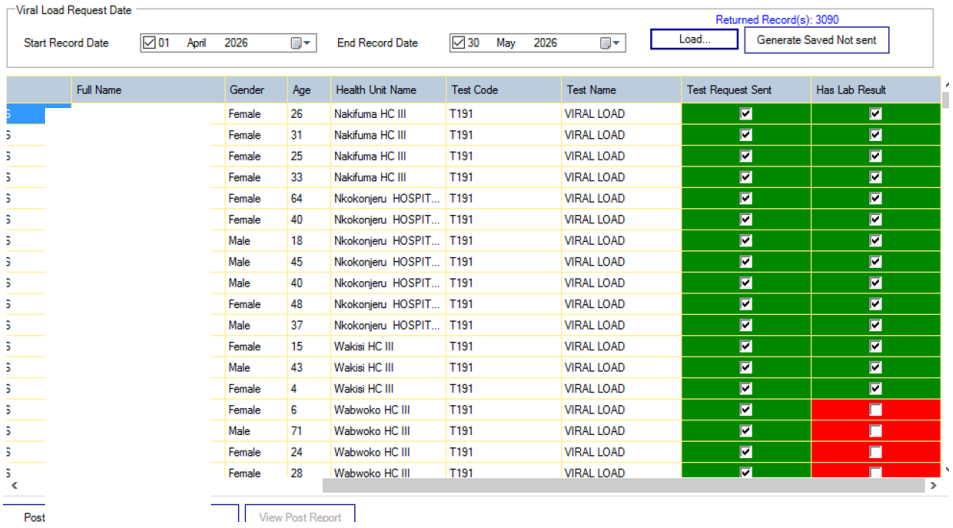
The donation has been reinforced through practical capacity transfer: MoH personnel participate in development bootcamps and testing. This makes the source-code transfer operational rather than symbolic and supports the national strategy's emphasis on government leadership, stewardship, partnership and sustainability.

Interoperability and Health Information Exchange

MUWRP has supported ClinicMasterMOH to progressively integrate with other systems in the Uganda digital health ecosystem.

Integration	Operational value
ALIS–ClinicMaster	Exchange of laboratory requests/results and strengthened laboratory workflow at integrated sites
Viral-load HIE	Enabling electronic VL requests and return of results between EMRs and CPHL.
EID and other test HIE	Extend ClinicMaster – CPHL HIE functionality to Early Infant Diagnosis and other priority tests, including sickle-cell workflows.
ART Access	Transfers eligible client, regimen, appointment, pharmacy and stock information to support community pharmacy refills for stable ART clients.
eHMIS (DHIS2)	Support aggregate reporting for HMIS 105, 106, 108 and 33B to reduce duplicate manual entry and parallel reporting.
National Data Warehouse	Data from facilities transferred to MOH
SMS/telecom mediator	Automated appointment and missed-appointment reminders

Together, these integrations have improved continuity of care, reduced transcription, shortened turnaround time, supported national visibility and allowed data captured once at the point of care to be reused for clinical, programmatic and reporting purposes.



Dashboard that monitors VL HIE in ClinicMaster

EMR Rollout, Point-of-Care Expansion and Paperless Transition

MUWRP has supported facility digitalization across six districts Buikwe, Buvuma, Kayunga, Luwero, Mukono and Nakasongola with additional technical support beyond its routine catchment, including Yumbe and Jinja Regional Referral Hospitals.

MUWRP migrated 48 health facilities from UgandaEMR to ClinicMasterMOH in accordance with Ministry of Health guidance. This transition reduced fragmentation across parallel systems, minimized data silos and supported a more coordinated regional approach to EMR implementation, support and reporting.

The program also expanded ClinicMasterMOH beyond the Chronic Care clinic by supporting point-of-care use across all service delivery points in 15 facilities including the regional referral. This has enabled health workers to capture patient information at the point of service and strengthened continuity of care across outpatient, inpatient, laboratory, pharmacy, maternity and other clinical departments.

The Case for Kayunga Regional Referral Hospital

At Kayunga Regional Referral Hospital (KRRH), reported benefits have included improved interdepartmental communication, reduced waiting time and manual errors, improved stock accountability, improved patient-record management and reporting, clinical alerts, and reduced printing costs. These outcomes demonstrate the service-delivery value of digitisation beyond reporting compliance. Success Story: Kayunga Regional Referral Hospital's EMR Point-of-Care and Paperless Journey

KRRH stands as one of MUWRP's strongest demonstrations that full-facility digitalisation is achievable when technology investment is combined with leadership, infrastructure, workforce development, interoperability and continuous implementation support. The hospital has progressed from using ClinicMaster in the ART clinic in 2017 to implementing hospital-wide point-of-care services across outpatient and inpatient departments from June 2022, followed by its transition to paperless operations in May 2024. ClinicMaster is now used across all service areas.

KRRH was recognized as the best performing EMR system Implementing Regional Referral Hospital

The KRRH experience shows that successful point-of-care implementation depends less on software installation alone and more on institutional ownership. Its success is driven by five mutually reinforcing elements: committed leadership, reliable infrastructure, trained and supported users, local technical capacity, and a responsive partnership for continuous system improvement. The hospital provides a practical reference model for other regional referral hospitals, general hospitals and high-volume health facilities transitioning from departmental EMR use to end-to-end paperless service delivery.

The case also shows that paperless transformation is a maturity journey rather than a one-time event. KRRH has achieved full digital workflows in most departments while continuing to track and address the forms, functions and integrations required in specialised units. This approach sustains progress, makes implementation gaps visible and provides a clear development agenda for future ClinicMasterMOH bootcamps and Ministry of Health prioritisation.

Hardware, Networking and Connectivity

Software adoption has been supported by substantial capital and operational investment in the digital foundation required at health facilities.

Investment	Contribution
Computing equipment	More than 800 computers donated to support facility digitalization
Servers and storage	Enterprise servers, reporting servers, backup storage and supporting UPS equipment supplied high-volume EMR operations.
LAN infrastructure	Structured cabling, switches, routers, access points and related accessories supplied and installed

Investment	Contribution
Connectivity	Internet connectivity and data bundles supported to support HIE, reporting
Physical security	Burglar proofing, computer locks, metal cages and secure server-room arrangements supported to protect digital investments.
Standardisation	Equipment packages and deployment approaches increasingly aligned to facility level and point-of-care workload, improving maintainability and scale planning.

Justin Kaleebi from MUWRP hands over Hardware Equipment to Jamiru Mpiima from MOH-DHI at the Ministry Headquarters

Workforce Development, Bootcamps and Change Management

MUWRP has treated digital health as a workforce and institutional change program, not only a technology deployment. It has supported recruitment and placement of IT officers at selected high-volume facilities, including Kayunga Regional Referral Hospital and Luwero General Hospital, and worked with facility leadership to establish daily support and escalation arrangements. This has contributed to a decentralized public sector support model in which routine issues are resolved close to the point of service, while complex issues are escalated to district, MoH or development teams.

MUWRP has supported structured ClinicMasterMOH development bootcamps that bring together ClinicMaster developers, Ministry of Health representatives, MUWRP technical personnel. During these sessions, reported system issues are reviewed, assigned and analyzed before solutions are developed, tested, validated, merged, compiled and released as updated software versions. This collaborative process ensures that system improvements respond to both national requirements and practical service-delivery needs.

The program has also conducted in-person and virtual training for district biostatisticians, medical records officers and assistants, health information assistants, clinicians, nurses, pharmacy staff and laboratory personnel. These trainings are reinforced through post-training mentorship, including onsite technical support and one-to-one pairing with experienced PEPFAR-supported data personnel to strengthen confidence, correct system use and sustained adoption.

To strengthen local ownership, MUWRP has built the capacity of district IT teams and facility IT officers to provide first- and second-line technical support. This has reduced reliance on central project teams and improved the speed at which routine user, hardware, network and system issues are resolved at district and facility level.

MUWRP has further supported change-management engagement with District Health Officers, hospital directors, medical superintendents, heads of department and end users. These engagements address resistance to digital workflows, clarify accountability for system use and support redesign of service-delivery processes. The bootcamp model is particularly important for sustainability because it is helping to establish an in-country community of practice that understands both the ClinicMasterMOH codebase and the clinical and operational environment in which the system is used.

Mukono General Hospital VMMC team undergoing a refresher EMR training

Buikwe district Biostat and facility Medical Records teams after undergoing a refresher EMR training

Data Quality, Deduplication, Reporting and Analytics

Strengthening Patient-Level Data Quality through Record Deduplication

MUWRP has strengthened the quality and reliability of patient-level information through a structured record deduplication initiative implemented in collaboration with the Ministry of Health Division of Health Information and DoD/WRAIR. The first phase covered 88 health facilities across Buikwe, Buvuma, Kayunga and Mukono districts and focused on identifying duplicate patient records, establishing a more accurate number of active patients and improving continuity of care.

The initiative combined facility-level data-quality improvement with the use of different patient-matching methods. Health facility teams collected and verified key identifiers, including date of birth, gender, village, telephone number, address, National Identification Number, viral-load information and fingerprints. MUWRP applied a basic composite-key algorithm using date of birth, gender and village; an enhanced composite-key algorithm that additionally uses telephone numbers; and exact biometric matching based on fingerprints.

The basic composite-key method initially flagged 43% of records as possible duplicates because many patients shared common demographic characteristics. Adding telephone numbers reduced the proportion of potential matches to approximately 2%, demonstrating the value of collecting more complete patient-

identification information. Biometric matching also identified approximately 2% of records as duplicates and provided the most consistent method for confirming whether patient records belonged to the same individual. The exercise identified 652 potential duplicate records through the enhanced composite-key method and 499 through biometric matching for further review and adjudication.

Through this work, MUWRP has demonstrated the importance of combining biometrics with high-quality demographic information. The initiative has informed recommendations for a hybrid national deduplication approach in which biometric matching serves as the primary method and the enhanced composite-key algorithm provides supplementary matching where biometric information is unavailable.

MUWRP continues to support the review and resolution of flagged records, development of standard operating procedures for adjudication, routine integration of deduplication into data-quality assessments, expansion of biometric capture and training of health workers in accurate patient-data collection. The work has also generated opportunities for real-time duplicate alerts, linkage with national identification services and future application of machine-learning methods.

This contribution strengthens the integrity of electronic medical records, reduces double counting, improves the accuracy of programme indicators and provides more dependable information for clinical care, commodity planning, performance monitoring and national health-sector decision-making.

MOH and MUWRP team that participated in the Data Deduplication Exercise in Kayunga Region

Systems Administration, Cybersecurity and Business Continuity

MUWRP has supported the routine administration of ClinicMasterMOH and other health digital systems infrastructure through server management, database administration, scheduled backups, software upgrades, user-account provisioning and role-based access control. These activities have helped maintain system availability, protected data integrity and ensured that users have access appropriate to their responsibilities.

The program has also strengthened data and cyber security and operational resilience through encrypted transmission and storage of remote backups. Physical and logical safeguards have been introduced to protect digital health equipment and servers. These include secure server rooms, uninterruptible power supply protection, burglar proofing, controlled user access and account-governance procedures. Together, these measures help protect critical infrastructure, maintain confidentiality and reduce the risk of data loss or unauthorized access.

MUWRP has further promoted standardized support, incident-management and escalation procedures that can be maintained within Ministry of Health, district and health-facility structures. This approach strengthens local ownership, improves response to technical issues and supports the long-term sustainability of digital health operations.

Governance, National Coordination and Technical Working Groups

MUWRP has participated in and continues to contribute personnel to national digitalization technical working groups and coordination mechanisms. Its technical work aligns with the MoH implementation structure covering infrastructure and equipment, integration and interoperability, requirements/customization/governance, deployment and support, and change management/capacity building.

Participation in these structures has enabled MUWRP to translate implementation experience from health facilities into national requirements, while ensuring that regional investments follow MoH direction. This is an important contribution to reducing fragmentation and ensuring partner investments reinforce government led architecture.

Innovation and Continuous Improvement

MUWRP's digital health portfolio has maintained an iterative innovation cycle. Examples include fingerprint capture, automated SMS, community ART refill integration, VL exchange, mediator-based NDW integration, electronic HMIS reporting, new clinical modules and investigation of synthetic or machine-learning approaches to patient deduplication. The emphasis has been on practical innovation that can be incorporated into routine service delivery and maintained by local teams.

Alignment with the National Strategic Objectives

National strategic objective	MUWRP contribution
SO1: Secure, timely access to quality-assured data	Deduplication, validation, user controls, backups, encrypted remote copies, improved source documentation and HIE result return.
SO2: Analytics and visualization	Electronic reports, DHIS2 integration, facility performance monitoring, reporting servers and support to district biostatisticians.
SO3: Institutionalize patient-level systems at point of care	ClinicMasterMOH development, department-wide POC rollout, migrations, paperless transitions and onsite user support.
SO4: Equip facilities with EMR infrastructure	Computers, servers, LANs, routers, access points, internet, UPSs, solar power and physical security.
SO5: Enabling environment, governance and capacity	Source-code donation, MoH stewardship, TWG participation, bootcamps, IT staffing, training, mentorship and standards alignment.
SO6: Collaborative research and innovation	Iterative software improvement, implementation learning, HIE pilots, mediator architecture, deduplication research and cross-institutional development teams.

Quantified Achievement Dashboard

Result	Achievement
>800	Computers donated cumulatively
>8	Enterprise servers denoted to MOH and facilities
134	facilities supported with EMRs in CCCs
97%	Coverage of supported ART sites
48	Facilities migrated from UgandaEMR to ClinicMaster
134	Facilities with viral load HIE in four districts
134	Sites covered by patient deduplication exercise
15	Health facilities supported to implement EMR POC
24	Labs including all hubs supported with Solar solutions
26	LAN installations in the stated reporting period
12%	Facilities with full solar coverage across facilities including 15 facilities relying only on solar without connection to the national grid
116 (81%)	CCCs in facilities supported with Solar installation
32	META facilities data synchronized to the MoH NDW staging environment

Key Lessons

Lesson	Implication
Digitalization is a service-redesign process	Paperless transition succeeds when leadership, workflows, staffing, equipment, power and support change together.
Interoperability requires continuous maintenance	Changes in either connected system, terminology or reporting metadata can break interfaces; integration needs monitoring, testing and funded maintenance.
Local capacity is a sustainability asset	Bootcamps, district IT capacity and facility IT officers shorten downtime and retain institutional knowledge.
Infrastructure determines adoption	Unreliable power, weak LANs, insufficient endpoints and poor internet directly undermine user confidence and system use.
Source code alone does not create ownership	Ownership requires governance, documentation, skills, release management, budgets and authority to prioritise changes.
Metrics require period and denominator discipline	EMR site counts, coverage and paperless status change over time; all reports should show date, scope and denominator.

Conclusion

MUWRP has made a sustained and system-wide contribution to Uganda's national digital health agenda. Its support has connected policy to implementation by developing and institutionalizing ClinicMasterMOH, transferring ownership to government, integrating it with national systems, equipping facilities, building the digital workforce, improving data quality and supporting operations after rollout. The resulting model demonstrates that successful eHealth transformation depends on coordinated investment in governance, software, infrastructure, interoperability, people, data and maintenance.

The next strategic opportunity is to consolidate these achievements into a fully government-led, standards-based and measurable national product and support model—one that protects past investments, accelerates scale, and ensures every digital transaction contributes to better clinical care, stronger accountability and more timely national intelligence.

Appendix A: Server Donation Letter to MOH for KRRH server

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PS' Office: +256 - 417 - 712221
Toll free: 0800100066
E-mail: ps@health.go.ug
Website: www.health.go.ug

IN ANY CORRESPONDENCE ON
THIS SUBJECT PLEASE QUOTE NO.

THE REPUBLIC OF UGANDA

ADM.174/01

Office Of The Permanent Secretary
Ministry of Health
P.O. Box 7272
Plot 6, Lourdel Road - Wandegeya
Kampala, Uganda

25th March, 2024

The Executive Director
Makerere University Walter Reed Project
KAMPALA, UGANDA

RE: DONATION OF A SERVER TO KAYUNGA REGIONAL REFERRAL HOSPITAL.

Reference is made to your letter dated 13th February 2024 on the above subject matter; informing me of your intention to donate a server to Kayunga Regional Referral Hospital.

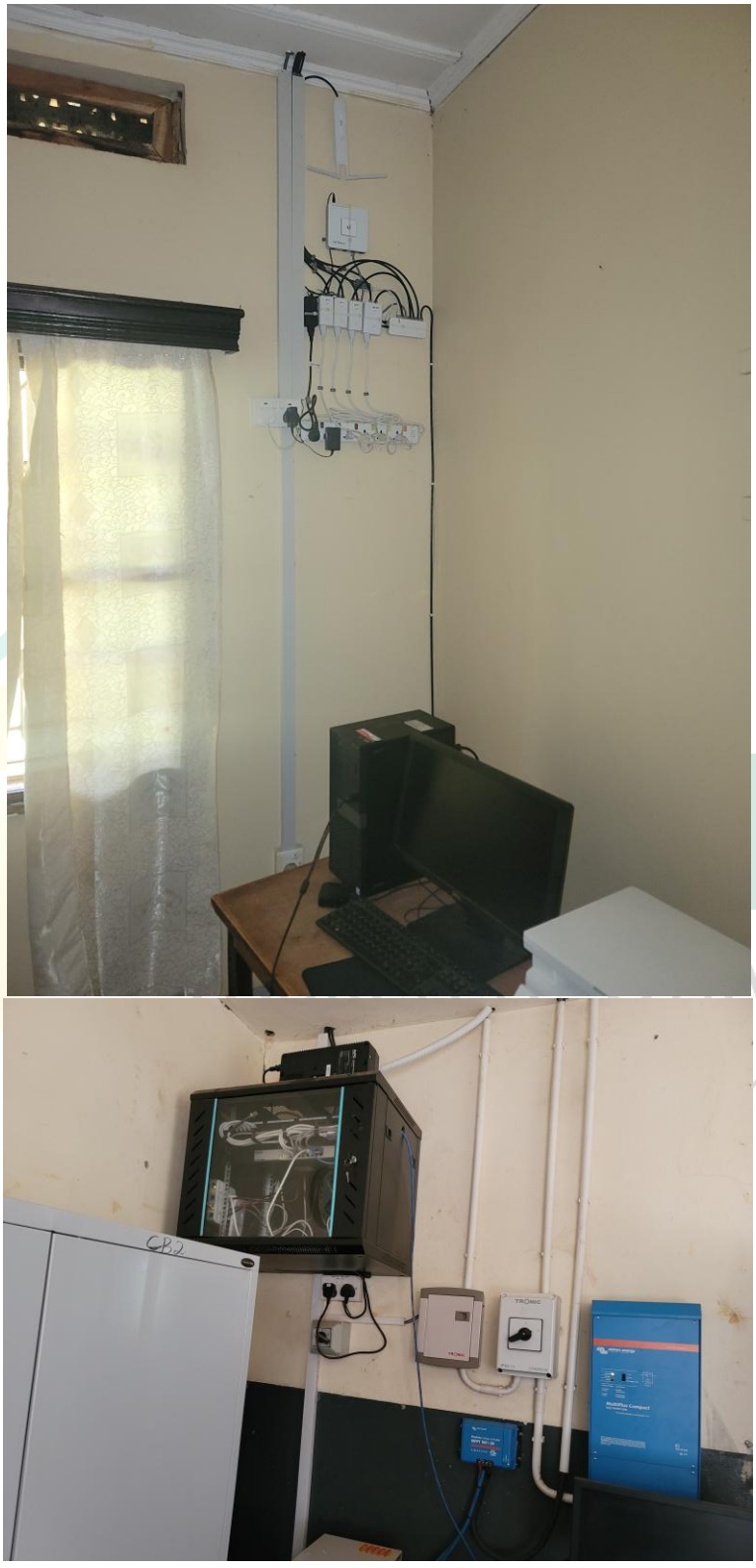
I take note that this donation will help in the attainment of some of the objectives that are laid out in our MoU, such as scaling up the use of electronic medical records (EMR) in our health facilities.

This is, therefore, to inform you that the Ministry of Health accepts the donation of the server with the following specifications: ***HPE DL 380***, Model: ***Gen 10,4210R,3.4 TM Memory 32GB,*** and Serial No: ***CZ2380425***; as it will greatly support the EMR system functionality and medical data storage at the hospital.

I thank you for your continued support to the Health Sector.

Dr. Diana Atwine
PERMANENT SECRETARY
Cc: Director, Kayunga Regional Referral Hospital
Cc: Asst. Commissioner, Division of Health Information, Ministry of Health

Appendix B: Photo Gallery



Part of the Network infrastructure setup at Buikwe HC III in Buikwe district

Solar Infrastructure at Lwapanga HC III in Nakasongola HC III

Buvuma district Biostat and facility Medical Records teams after undergoing a refresher EMR training