Stars in Global Health Project Report

Strengthening integrated care and support for people living with HIV in Western Kenya through the use of an electronic medical record

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Collaborating partners:

Japanese International Co-operation Agency, Kenya Country Office
I-TECH Kenya
Ministry of Health, Kenya
National AIDS and STI Control Program, Kenya
Vestergaard Africa Limited

ABSTRACT

- Uamuzi Bora is a medical project that supports the Ministry of Health and partners in Kenya to implement an electronic medical record (EMR) to improve clinical and public health decision-making.

- The EMR is built using free, open source software and is based on the Open Medical Record System (OpenMRS) platform, increasingly being adopted in resource-constrained settings around the world.

HIV EMR

- The HIV EMR, implemented in partnership with Ministry of Health, has registered more than 17,000 patients across five sites in Western Kenya, including Kakamega Provincial Hospital, which has the largest caseload in all of Kakamega County.

- The following indicators are attributed to implementation of the HIV EMR:
    - 17,145 patients registered
    - 79.6% increase in patients eligible but not on ART, who have now started ART (880 patients)
    - 50.6% increase in patients now on ART (3,336 patients)
    - 4,493 patients previously lost to follow up have been traced (100% increase)
    - 1,312 patients previously lost to follow up have returned to care
    - 90.1% reduction in missing first CD4 count among patient records
    - 82.3% reduction in missing first WHO stage among patient records

MCH EMR

- The maternal and child health (MCH) EMR pilot, implemented in partnership with the Japanese International Cooperation Agency (JICA) and Ministry of Health, registered more than 1,000 pregnant women across five clinics in Western Kenya.

- The following indicators are attributed to implementation of the MCH EMR:
    - 1,189 women, 275 deliveries and 470 children enrolled

- Average age of pregnant women 23.6 years
- Average of 1.9 clinic visits attended per pregnant woman during pilot period
- 0.2%, 4.7% and 14.0% of women confirmed TB, Malaria and HIV positive
- 50.4% HIV positive women receiving ART during pregnancy
- 66.3% reduction in missing data

The Way Forward

- The project has demonstrated feasibility of implementation of a cloud-based EMR model and the ability to make real-time health information available at different levels of the health service to improve clinical and public health decision-making. Significant improvements in data quality and provision of clinical care are recorded through its implementation.

- The cloud-based EMR model has demonstrated how data can be shared between different services in Kenya. Uamuzi Bora will continue to explore how the EMR can strengthen linkages and pathways of care between different services, through sharing of real-time health information. The concept of a ”Universal EMR” – whereby one common patient record is accessed by different health services – will be further explored and developed.

- Uamuzi Bora will continue to program innovatively and develop the cloud-based model of data sharing at different levels of care to improve clinical and public health decision-making. Further development of the cloud-based model of data sharing will be undertaken, including use of Google or Amazon server infrastructure and the ability to make use of this model “offline”.

- Proposals have been submitted to in-country partners and donors to support Ministry of Health ownership of the EMR in 2014 and to begin scale-up of implementation to other sites. The cloud-based EMR model is ultimately more cost-effective and scalable than local clinic models of EMR implementation. Technical support and training will be provided by Uamuzi Bora to support Ministry of Health ownership and sustainability for the long-term.

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ACKNOWLEDGEMENTS

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Sincere thanks to Dr Kenrick Turner and Gunnar Ro for developing the data management model and system infrastructure for the electronic medical record (EMR). Thanks to Collins Otwane for project management of the EMR and to Lauryn Amiga, Reginah Wambui and Charity Olubero for project management, training and mentorship of clinicians and data clerks at the project sites.

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HIV EMR

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Maternal and Child Health EMR

Thanks to Dr Tomohiko Sugishita and Kaori Saito at the Japanese International Cooperation Agency (JICA) who led the MCH EMR pilot. Thanks to Dr Shanaaz Sharif, Dr Annah Wamae and their teams at Ministry Health for their vision and leadership in taking the EMR concept forwards for MCH and thanks to George Odhiambo, Elizabeth Onyango and the Kisumu West District Health Management Team for leading the pilot in their district.

Finally, sincere thanks to all clinic staff who participated so eagerly in implementing the HIV and MCH EMR and all those patients living with HIV and the pregnant women and mothers who accepted to be a part of this implementation. We hope this project can inform future work to improve the delivery of HIV and maternal and child health care in Kenya.

SECTION 1

Introduction

1.1 Background

Despite significant scaling up of HIV services and access to treatment in sub-Saharan Africa (SSA), global targets for achieving universal access to HIV prevention, treatment, care and support by 2010 were not been achieved. The 2010 Progress Report “Towards Universal Access” estimated that only 36% of people living with HIV in low- and middle-income countries, who were eligible for treatment, were receiving antiretroviral therapy (ART). (1)

Knowledge of HIV status also remains inadequate and only an estimated 38.6% of people living with HIV in SSA know their status. (1) Late diagnosis of HIV and delayed linkage to care following diagnosis is leading to late initiation of treatment and poorer prognoses for patients. Poor adherence to therapy and retention in care is also leading to failure of first-line treatments and progression and relapse of disease. (1)

HIV is a chronic disease and treatment guidelines require that patients on ART visit health care providers at least every month. (2) Early testing, linkage to care, monitoring of disease status, initiation of ART, and adherence and retention in care are all essential components of HIV care and support but limited human and financial resources, as well as increasing demand for services, can compromise the quality of care provided. Electronic medical record (EMR) systems could strengthen pathways of care for HIV and enhance delivery of HIV care through verification of data and clinical decision support. (3)

1.2 Uamuzi Bora

Uamuzi Bora is a medical project that supports the Ministry of Health and partners in Kenya to implement an EMR to improve clinical and public health decision-making. Uamuzi Bora is a Swahili phrase meaning “the right choice”.

The project uses mobile information technology and an EMR to strengthen pathways of care and facilitate exchange of information between health providers at different levels of care between home, clinic and the hospital. The project facilitates more accurate diagnosis early in the course of HIV infection, timely linkage to HIV care, clinical decision support, adherence to treatment and retention in care.

The first version of the Uamuzi Bora EMR was implemented in Kakamega Provincial General Hospital in 2009 and supported follow up and referral of 2,000 people living with HIV who tested positive following a campaign of community-based HIV testing in 2008. The system was updated in 2010 and all 8,000 HIV patients registered at the hospital were additionally enrolled in the EMR.

In 2012, Uamuzi Bora received a grant from Grand Challenges Canada to continue to develop the EMR and expand to other clinics. The HIV project is implemented in partnership with the Ministry of Health, National AIDS and STI Control Program (NASCOP) and Kenya Medical Research Institute (KEMRI) adhering to national standards and pathways of care. HIV EMR implementation is reviewed in Section 3 of this report.

In November 2012, the Director of the Ministry of Public Health and Sanitation requested that Uamuzi Bora extend the scope of the EMR to include Maternal and Child Health, to strengthen linkage of patients testing positive for HIV via this service and to support improved delivery of services and clinical care for mothers and their babies. The Director requested that Uamuzi Bora partner with the Japanese International Cooperation Agency (JICA) to pilot a MCH EMR in selected antenatal care (ANC) facilities in Western Kenya.

In February 2013, JICA and Ministry of Health led a technical working group, including partners and stakeholders, to agree on the content of the MCH EMR

modules, indicators and reporting framework for the pilot. The MCH EMR adheres to national standards and pathways of care and replicates information currently collected in the MCH handbook, which is provided to every pregnant woman who attends ANC in Kenya.

The Ministry of Health, in partnership with JICA and Uamuzi Bora, selected five health facilities in Western Kenya to implement the pilot between April and June 2013. MCH EMR implementation is reviewed in Section 4 of this report.

SECTION 2

The Electronic Medical Record

2.1 Uamuzi Bora EMR

The Uamuzi Bora electronic medical record is built on the open-source OpenMRS platform, adhering to national and international standards.

The Uamuzi Bora electronic medical record (EMR) is is built using free, open source software and builds on common platforms and previous work, notably that of Open Medical Record System (OpenMRS). (4)

OpenMRS was created as a collaboration between Partners in Health (PIH) and the Regenstrief Institute in the USA and has been approved for EMR use in Kenya. (5) The platform supports open standards for data exchange such as HL7, allowing exchange of patient records with other medical records systems, including a WHO-supported record standard. (4) OpenMRS supports a modular architecture that enables new modules to be designed without disturbing core functions. A Concept Dictionary allows users to enter new concepts, develop data collection forms and store data.

2.2 Model of Implementation

The Uamuzi Bora model removes the need for local clinic infrastructure and enhances access and data sharing at all levels of health care.

Traditional models of EMR implementation have installed local systems infrastructure, such as a server and network in each clinic (see Figure 1). Locally installed infrastructure can be costly to implement and maintain and can be a barrier to EMR implementation in some areas. (3) A local clinic model also limits the ability of the system to readily share information between different levels of the health service.

This underscores the need for innovative solutions that are appropriate for resource-limited settings. Uamuzi Bora uses a cloud-based model of EMR deployment to clinics that only requires a single server to be maintained centrally, with no infrastructure required by the individual clinic (Figure 2). A secure, encrypted virtual private network (VPN) has been established with Safaricom, a mobile phone provider in Kenya, to which the server and clinic computers can connect securely. The VPN is air gapped from the internet and only computers that have been registered by the project can access this secure private network.

Each clinic only requires a single computer to run the EMR. We have selected the Google Chromebook as the clinic computer of choice. Chromebooks function as a laptop and are capable of hosting a SIM card and connecting directly to a mobile data network. In this manner, each clinic can connect securely to the EMR server via the VPN on the mobile data network. The server is currently hosted for the Ministry of Health by Uamuzi Bora and is located in Kakamega.

This cloud-based model has been extended one step further, to allow health information to be shared in real-time between different levels of care to improve clinical and public health decision-making (Figure 3). Every 24 hours, the database of individual patients (which remains encrypted and secure and only accessible to clinics) is copied and all patient-identifiable information is removed. This anonymous version of the database is then used to provide health information to different users at different levels of health care.

Figure 1. Features of a local clinic model of EMR implementation

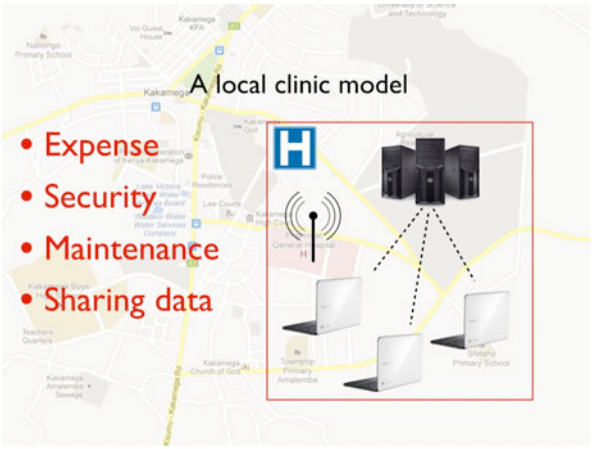


Figure 2. The Uamuzi Bora model of EMR implementation

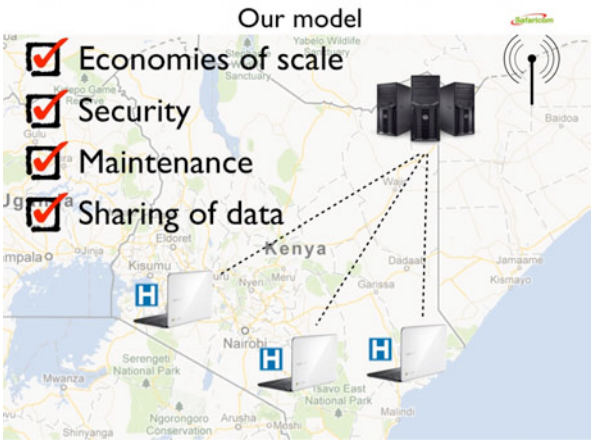
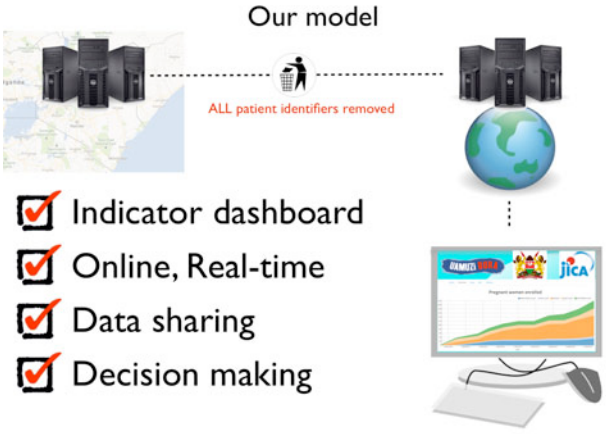


Figure 3. The Uamuzi Bora model of EMR implementation (extended)



2.3 Features of the EMR

2.3.1 Data Entry

Data is entered from the paper record to the electronic medical record either by the clinician or a data entry clerk.

During the first phase of implementation in a new clinic, the existing paper-record is entered into the EMR. Clinic data clerks are trained in data entry and additional support for data entry and supervision is provided in high volume sites.

Once the "backlog" of historical patient data is entered, prospective new patients and clinic visit data continues to be entered. Depending on the site, this data entry can proceed in two ways:

1. Data is entered during the patient consultation by the clinician
2. Data is entered after the patient consultation has finished by a data entry clerk

Uamuzi Bora advocates that clinicians should enter data directly into the EMR but accepts that this adds to the clinician workload and may not be feasible in high volume sites with a heavy workload.

2.3.2 Data Verification

Data checks are run automatically on all data collected in the EMR to ensure data is valid, accurate and complete.

Once data is entered into the EMR, the system automatically reviews all data every 24 hours and produces a data verification report to indicate if pertinent data is missing from the record. Individual patient records are also flagged to highlight which data is missing. Clinic data clerks review these reports and flags to correct missing data from the patient record.

2.3.3 Clinical Decision Support in Care

Clinical decision support is designed to ensure standardised care is provided that will improve the quality of care delivered. The EMR automatically reviews the database every 24 hours to generate a clinical verification report and flag patients who have not received care according to standardised guidelines and protocols.

Adherence to clinical guidelines is essential for ensuring a high standard of health care provision. Despite efforts and resources invested in developing and disseminating clinical guidelines, practitioners still ignore them. EMR-based clinical decision support has been shown to improve adherence to guidelines, reduce data errors, and reduce missed appointments.

The EMR automatically reviews the database every 24 hours to generate a clinical verification report and flag patients who have not received care according to standardised guidelines and protocols. Clinicians then regularly review the clinical verification report and individual patient flags to review appropriate management plans.

2.3.4 Follow Up and Retention in Care

A successful outpatient program must ensure continuity and retention in care. The EMR automatically flags and provide a list of all patients who have not attended their clinic appointment.

Continuity of care and retention in care remain particular challenges for many health services in resource-constrained settings. The EMR automatically flags and provide a list of all patients who have not attended their clinic appointment. The EMR also automatically sends out SMS text message reminders to these patients and a phone call is made from the clinic to ensure patients are followed up appropriately and retained in care.

2.3.5 Reporting

The EMR automatically generates standard reports and enhances the monitoring and evaluation functions of the clinic, as well as district and provincial public health management.

The EMR provides standard reporting to Ministry of Health and partners. Reports can be generated via the EMR itself and summary reports can be created at the following web address:
https://uamuzibora.org/reports/hiv

2.3.6 Indicator Dashboard

Uamuzi Bora provides a dashboard of indicators, updated in real-time, to provide feedback and monitoring at all levels of health management and decision-making.

Uamuzi Bora has defined several core indicators to monitor progress of the project, which are updated in real-time via online indicator dashboards. A list of these indicators and how they are calculated is provided in Appendices 2 and 3.

Views of the HIV and MCH indicator dashboards are shown in Figure 4 and Figure 5. The HIV indicator dashboard can be accessed at the following web address:
https://uamuzibora.org/data/hiv

Figure 4. The Uamuzi Bora HIV EMR indicator dashboard

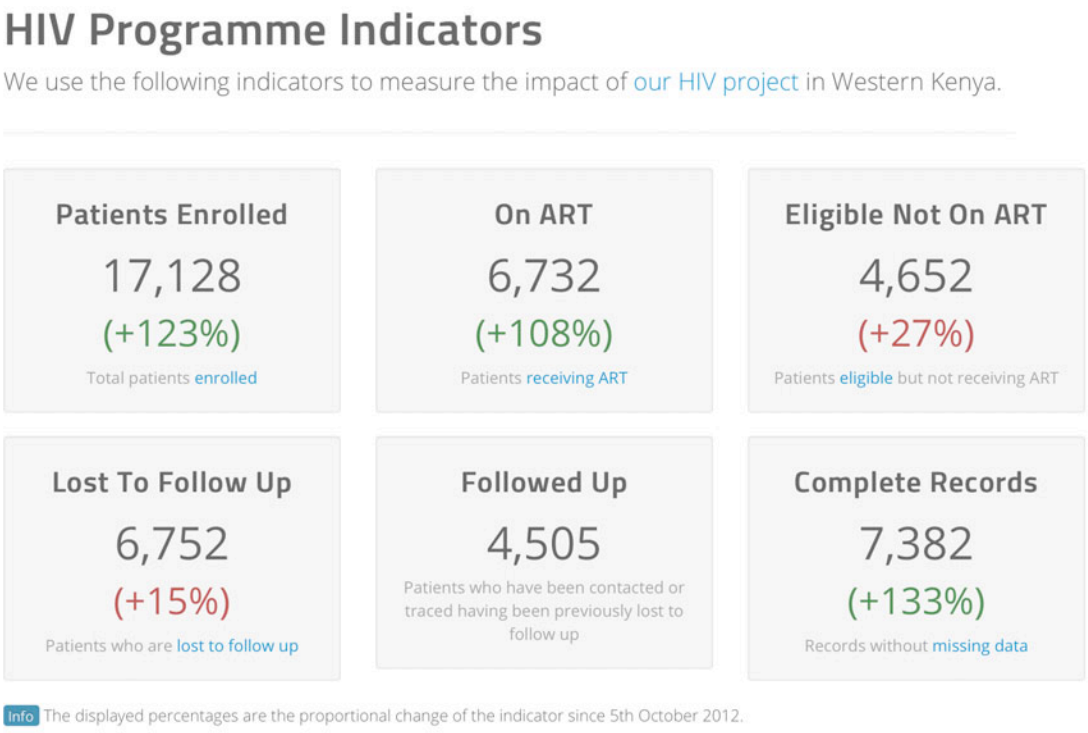
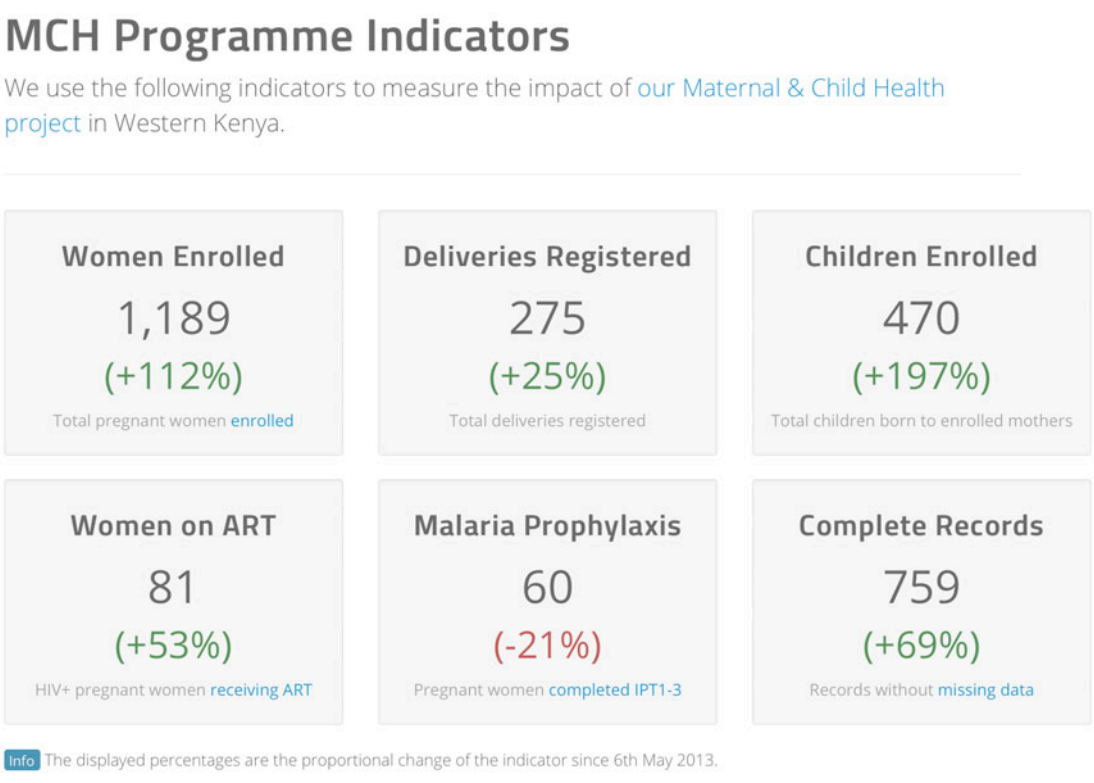


Figure 5. The Uamuzi Bora MCH EMR indicator dashboard



2.4 System Infrastructure

2.4.1 Network

Uamuzi Bora utilises a secure, encrypted virtual private network (VPN) with Safaricom, a mobile phone provider in Kenya, to which the server and clinic computers can connect securely. The VPN is air gapped from the internet and only Chromebooks and SIM cards that have been registered by the project can access the secure, private network.

2.4.2 Server

The physical server is hosted for Ministry of Health by Uamuzi Bora, and is currently located in Kakamega. It uses a WiMAX radio connection to connect to the Virtual Private Network (VPN).

The Uamuzi Bora server runs a customised version of OpenMRS 1.9x: a Java application running on top of Apache Tomcat 7, using MySQL 5.5 as a database server, and run behind Nginx as a reverse proxy server, on a server running Ubuntu 12.04 LTS Linux. Regular security updates are applied to the system from the main Ubuntu repositories.

The BIOS is password protected. The hard drives are encrypted using *dm-crypt* and a key file is used to decrypt the hard drives at boot time. The key file is stored on a separate USB memory stick that is required to be plugged into the server to boot. The USB stick is then removed after booting and stored in a locked cabinet elsewhere in the building.

The server runs a fully patched version of Debian using only packages from official Debian stable repositories. Only ports 80, 443, and 22 are open; the rest firewalled. SSH has a stringent configuration to resist brute force attacks and root login is disabled. MySQL has been secured from its default configuration, and only accepts connections from the localhost. Tomcat only serves pages over HTTPS: it redirects all port 80 traffic to port 443 and uses SSL/TLS with our own self-signed certificate.

All server processes are owned by non-privileged users and are sandboxed. OpenMRS user accounts have permissions relevant to their roles and may only access relevant data, as per principle of least privilege. A strong password policy is enforced.

2.4.2 Clinic computers

Clinic computers are Google Chromebooks, which use a 3G mobile internet connection to connect directly with the VPN. The 3G mobile internet connection does not permit access to the internet, and Wifi and Ethernet networking on the client machines is disabled.

Clinicians and data clerks use the Chromebooks to search, view, edit and create electronic patient records and access verification reports and clinical reminders within the OpenMRS web application.

2.5 Data Management

2.5.1 Data Protection

Uamuzi Bora stores patient data confidentially and in accordance with best practices, data are protected through a variety of mechanisms.

The server is physically secured in a locked office in Kakamega, and physical access is limited to select Uamuzi Bora staff. An alarm is triggered if the server case is tampered with and the BIOS requires a password to continue booting. Patient identifiable information (such as the MySQL database) is stored on an encrypted file system that is decrypted at boot time using a USB key, which is then stored in a different secure physical location to the server.

Connections between the clinic computers and the server use exclusively HTTPS over an IPsec VPN. Core Uamuzi Bora staff can also connect to the server from the internet using public-key authenticated SSH over the IPsec VPN. All connections and connection attempts to the server are logged and audited.

2.5.2 Data transfer and backup

Encrypted backups are made of patient identifiable data. These backups are encrypted using GnuPG to a private key, which is split between four lead Uamuzi Bora staff using Shamir's Secret Sharing in a (3,4)-threshold scheme. This means that no-one person can decrypt the backup - it requires two people to combine their shares of the private key to decrypt it.

Encrypted backups are transferred to long-term storage on Amazon Glacier over the VPN and held for a period of 6 months for the purpose of disaster recovery after which time they are securely deleted. All backups are protected with strong encryption. Only the project's public keys are on the server; the corresponding private keys are held out of country by the research team. Temporary files are immediately securely deleted after encryption is completed.

2.5.3 Anonymisation

In addition to backups for the purposes of disaster recovery, regular anonymised versions of the database are created automatically by the server, which contain no patient identifiable data. This anonymous database is encrypted with a different key to the main backup and is held by all core project members.

The anonymisation process is automated by a backup script and does not involve any human intervention. It occurs on the same physical machine as OpenMRS, so data are anonymised at point of source.

Patient identification numbers, names, data of birth, relations, first line of address and free-text fields are considered represent patient identifiable data and these are deleted as part of the anonymisation process, apart from date of birth which is rounded to the nearest year. Our anonymisation process thus performs the following functions:

- Deletes the UPN (the unique patient identification number).
- Deletes the patient's forename(s) and replaces it with 'Unknown'.
- Deletes the patient's surname and replaces it with 'Unknown'.
- Deletes the patient's middle names (if applicable).
- Deletes the patient's maiden name or previous surnames (if applicable).

- Deletes any prefixes or suffixes of the patient's name (if applicable).
- Deletes the first line of the patient's address
- Deletes the patient's telephone number
- Rounds the patient's date of birth to the nearest month (e.g. 14/07/1970 would be come 01/07/1970)
- Deletes all details of the patient's treatment support (names, phone numbers and addresses)

The only identifier that remains is the internal database primary key, which is a simple integer value. Individual patients cannot be identified from this identifier alone.

The anonymous database is used to create aggregated data that is transferred over a VPN to a public webserver for use in the dashboard indicators and application programming interface (API), which allows partners to access aggregated data.

2.5.4 Application Programming Interface (API)

We have created an application programming interface (API) so that data can be accessed programmatically. An API key is required to access certain data, which is provided to users on request.

The following methods available without an API key:

`/locations/hiv`	returns a list of all the locations in the HIV database
`/hiv/all`	returns all aggregated data required by the HIV dashboard
`/mch/all`	returns all aggregated data required by the MCH dashboard
`/hiv/total_patients`	returns the total number of HIV patients
`/mch/total_patients`	returns the total number of MCH patients

All methods should be appended to our API root URL:
`https://uamuzibora.org/api`

Unless otherwise specified, all data are returned in JSON format.

Access to the following methods requires an API key. You should include your API key as part of your request as a `GET` variable e.g.:

`https://uamuzibora.org/api/performance/hiv?api-key=your_api_key`

Please note that a separate API key is required for the HIV and MCH databases. An incorrect or unauthorised API key will return HTTP Error 401 (Access Forbidden).

`/performance/hiv` returns a JSON object with a list of how many forms each user has entered each day into the HIV database

`/performance/hiv/[date]` returns a JSON object with a list of how many forms each user has entered each week since \[date\](in ISO format: YYYY:MM:DD) in the HIV database. The data can be requested in CSV format by appending `type=csv` to the request.

`performance/hiv` returns a JSON object with a list of how many forms each user has entered each day in the MCH database

`/performance/hiv/[date]` returns a JSON object with a list of how many forms each user has entered each week since \[date\](in ISO format: YYYY:MM:DD) in the MCH database. The data can be requested in CSV format by appending `type=csv` to the request.

`/patients/mch` returns a JSON object with a line for each patient with data from the MCH database. The data can be requested in CSV format by appending `type=csv` to the request.

`/patients/hiv` returns a JSON object with a line for each patient with data from the HIV database. The data can be requested in CSV format by appending `type=csv` to the request.

2.6 Personnel

Only data entry clerks and clinicians have access to the local system, and are subject to the patient confidentiality clauses in their contracts. All users undergo mandatory training on the system, which includes training on data protection best practices and information governance.

2.7 Training

All CCC staff are trained on the use of the EMR including reviewing and editing of patient records and adding new test results. Data clerks are trained on data entry and administrative functions of the EMR. The data manager is able to provide support to other staff should they need it.

SECTION 3

HIV EMR

3.1 Introduction

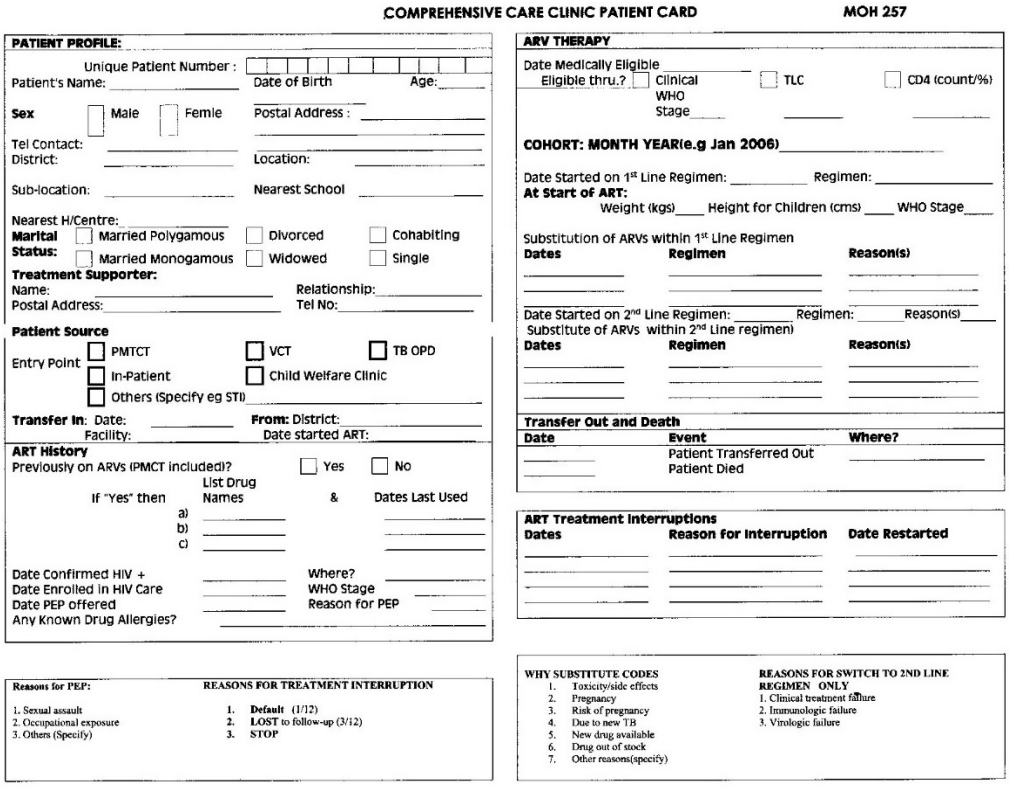
The HIV EMR makes health information available at different levels of the health service to inform clinical and public health decision-making and to strengthen pathways of care for people living with HIV.

The HIV EMR adheres to national standards and pathways of care and replicates information currently collected in the MOH257 Comprehensive Care Clinic (CCC) outpatient HIV patient record (see Figure 6). Individual patient data collected in the EMR therefore replicates information collected in the MOH257 CCC card and includes:

- patient profile (including socio-demographics)
- patient source (entry point to care)
- ARV history (including date)
- ARV therapy (including treatment regimen)
- results (including laboratory investigations, other medical conditions and opportunistic infections);

Figure 6. MOH257 Comprehensive Care Clinic outpatient HIV patient record

a) front



COMPREHENSIVE CARE CLINIC PATIENT CARD MOH 257

PATIENT PROFILE:

Unique Patient Number :

Patient's Name: _____ Date of Birth _____ Age: _____

Sex ☐ Male ☐ Femle Postal Address : _____

Tel Contact: _____

District: _____ Location: _____

Sub-location: _____ Nearest School _____

Nearest H/Centre: _____

Marital Status: ☐ Married Polygamous ☐ Divorced ☐ Cohabiting ☐ Married Monogamous ☐ Widowed ☐ Single

Treatment Supporter:

Name: _____ Relationship: _____

Postal Address: _____ Tel No: _____

Patient Source

Entry Point ☐ PMTCT ☐ VCT ☐ TB OPD ☐ In-Patient ☐ Child Welfare Clinic ☐ Others (Specify eg STI) _____

Transfer In: Date: _____ **From:** District: _____

Facility: _____ Date started ART: _____

ART History

Previously on ARVs (PMCT included)? ☐ Yes ☐ No

If "Yes" then List Drug Names & Dates Last Used

a) _____ _____

b) _____ _____

c) _____ _____

Date Confirmed HIV + _____ Where? _____

Date Enrolled in HIV Care _____ WHO Stage _____

Date PEP offered _____ Reason for PEP _____

Any Known Drug Allergies? _____

ARV THERAPY

Date Medically Eligible _____

Eligible thru.? ☐ Clinical ☐ TLC ☐ CD4 (count/%)

WHO Stage _____ _____ _____

COHORT: MONTH YEAR(e.g Jan 2006) _____

Date Started on 1st Line Regimen: _____ Regimen: _____

At Start of ART:

Weight (kgs)____ Height for Children (cms) ____ WHO Stage____

Substitution of ARVs within 1st Line Regimen

Dates	Regimen	Reason(s)

Date Started on 2nd Line Regimen: _____ Regimen: _____ Reason(s)____

Substitute of ARVs within 2nd Line regimen)

Dates	Regimen	Reason(s)

Transfer Out and Death

Date	Event	Where?
	Patient Transferred Out	
	Patient Died	

ART Treatment Interruptions

Dates	Reason for Interruption	Date Restarted

Reasons for PEP:

1. Sexual assault
2. Occupational exposure
3. Others (Specify)

REASONS FOR TREATMENT INTERRUPTION

1. **Default** (1/12)
2. **LOST** to follow-up (3/12)
3. **STOP**

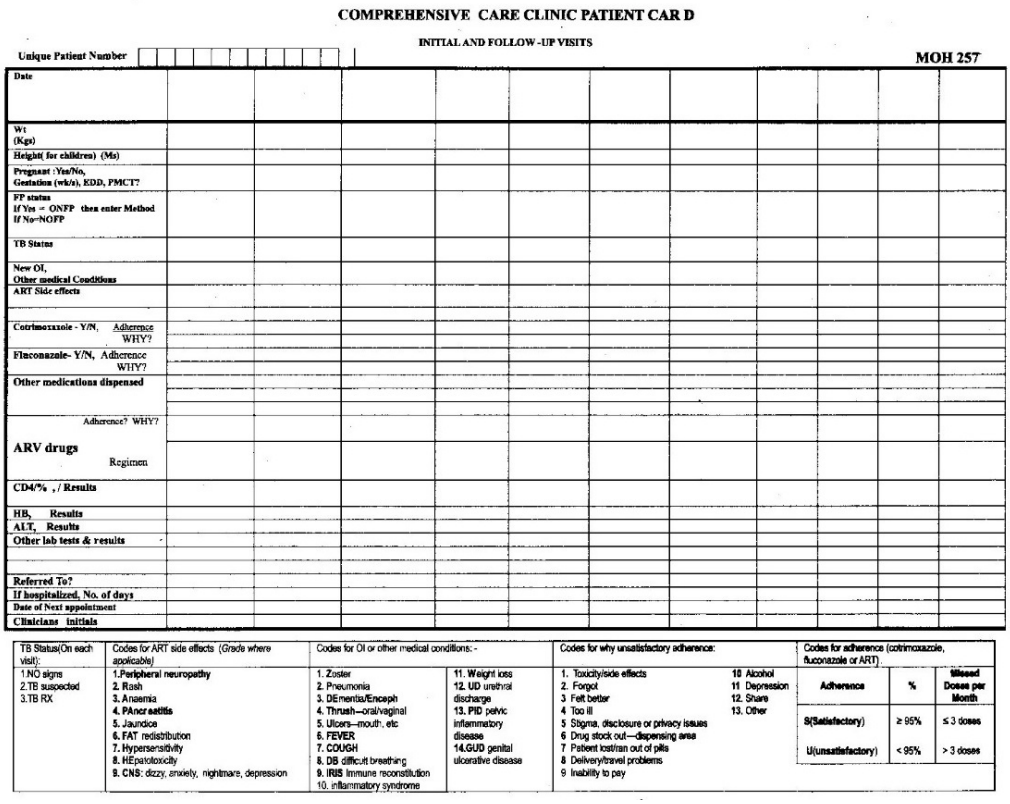
WHY SUBSTITUTE CODES

1. Toxicity/side effects
2. Pregnancy
3. Risk of pregnancy
4. Due to new TB
5. New drug available
6. Drug out of stock
7. Other reasons(specify)

REASONS FOR SWITCH TO 2ND LINE REGIMEN ONLY

1. Clinical treatment failure
2. Immunologic failure
3. Virologic failure

b) back



COMPREHENSIVE CARE CLINIC PATIENT CAR D

INITIAL AND FOLLOW -UP VISITS

Unique Patient Number _____ **MOH 257**

Date											
Wt (Kgs)											
Height(for children) (Ms)											
Pregnant :Yes/No, Gestation (wks/s), EDD, PMCT?											
FP status If Yes = ONFP then enter Method If No=NOFP											
TB Status											
New OI, Other medical Conditions											
ART Side effects											
Cotrimoxazole - Y/N, Adherence WHY?											
Fluconazole- Y/N, Adherence WHY?											
Other medications dispensed											
Adherence? WHY?											
ARV drugs Regimen											
CD4/% , / Results											
HB, Results											
ALT, Results											
Other lab tests & results											
Referred To?											
If hospitalized, No. of days											
Date of Next appointment											
Clinicians initials											

TB Status(On each visit):	Codes for ART side effects (*Grade where applicable*)	Codes for OI or other medical conditions: -		Codes for why unsatisfactory adherence:		Codes for adherence (cotrimoxazole, fluconazole or ART) :		
1.NO signs 2.TB suspected 3.TB RX	1.**Peripheral neuropathy** 2. **Rash** 3. **Anaemia** 4. **PAncreatitis** 5. Jaundice 6. **FAT** redistribution 7. Hypersensitivity 8. HEpatotoxicity 9. **CNS**: dizzy, anxiety, nightmare, depression	1. Zoster 2. Pneumonia 3. DEmentia/Enceph 4. Thrush—oral/vaginal 5. Ulcers—mouth, etc 6. **FEVER** 7. **COUGH** 8. DB difficult breathing 9. **IRIS** Immune reconstitution 10. inflammatory syndrome	11. Weight loss 12. UD urethral discharge 13. **PID** pelvic inflammatory disease 14.**GUD** genital ulcerative disease	1. Toxicity/side effects 2. Forgot 3 Felt better 4 Too ill 5 Stigma, disclosure or privacy issues 6 Drug stock out—dispensing area 7 Patient lost/ran out of pills 8 Delivery/travel problems 9 Inability to pay	10 Alcohol 11 Depression 12. Share 13. Other	**Adherence**	**%**	**Missed Doses per Month**
						S(Satisfactory)	≥ 95%	≤ 3 doses
						U(unsatisfactory)	< 95%	> 3 doses

3.2 Descriptive Analysis

3.2.1 Patients enrolled

On 1 December 2013, 17,145 patients were registered in the HIV EMR, from five clinics across Western Kenya (Kakamega Provincial Hospital, Vihiga District Hospital, Bushiri, Bukura and Emusanda Health Centres). Table 4 and Figure 7 shows a breakdown of these patients by status (active or inactive). Table 5 and Figure 8 shows the number of active patients registered by location. Figure 9 shows a timeline of registration between 5 October 2012 and 1 December 2013.

67.9% of patients registered are female (Table 7, Figure 10). 31.1% of patients are aged between 35 – 44 years (Table 6, Figure 11). 48.2% of patients were tested for HIV at voluntary counselling and testing (VCT) services (Table 8, Figure 12). 53.7% of patients had a first CD4 count less than 350 on registration (Table 9, Figure 13). 21.6% of patients were registered with first WHO Stage 3 or 4 (Table 10, Figure 14).

Figure 7. Patients registered by status

Figure 8. Active patients registered by location

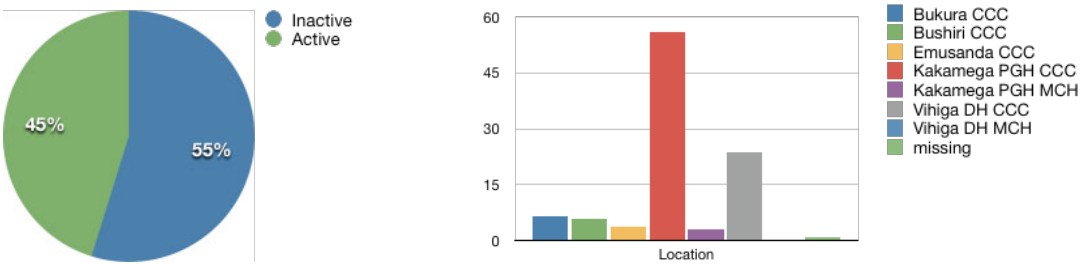


Figure 9. Timeline of registration of patients, by location

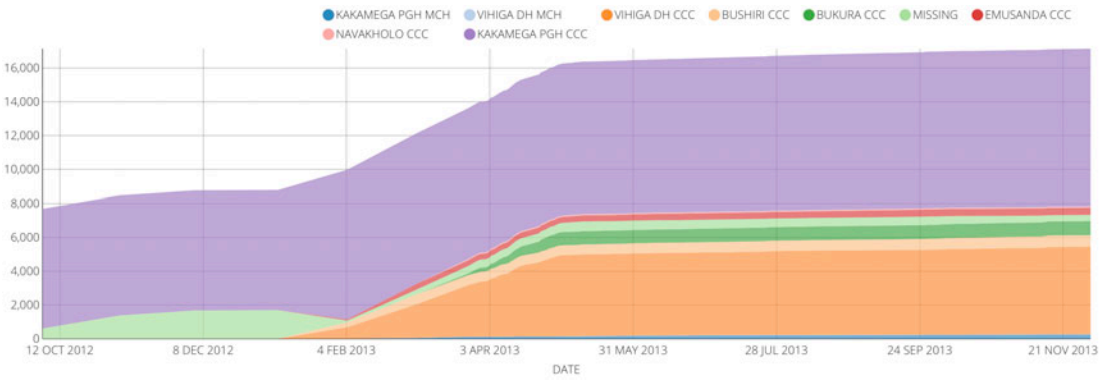


Figure 10. Gender of active patients registered

Figure 11. Age group of active patients

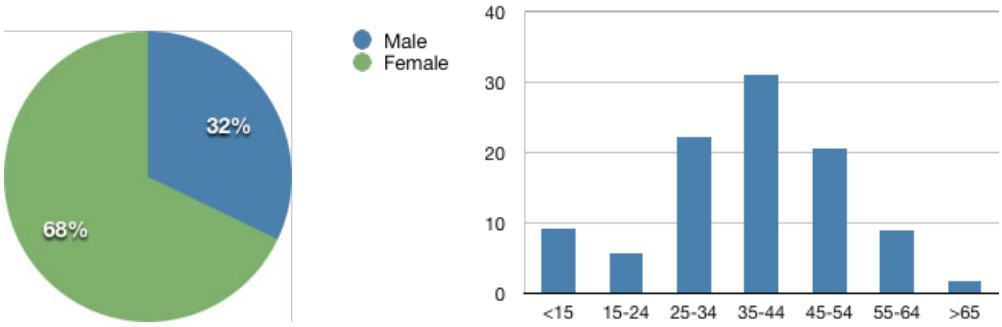


Figure 12. Source of testing of patients registered

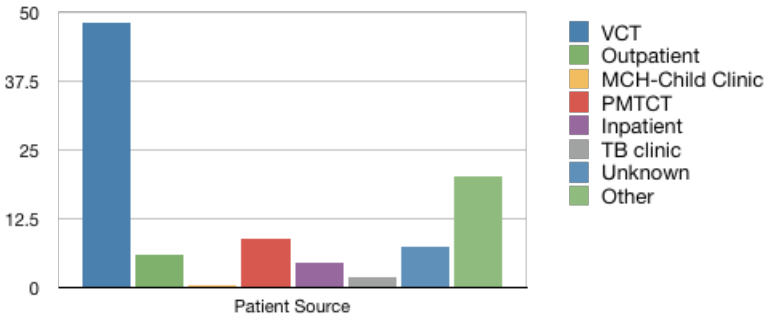
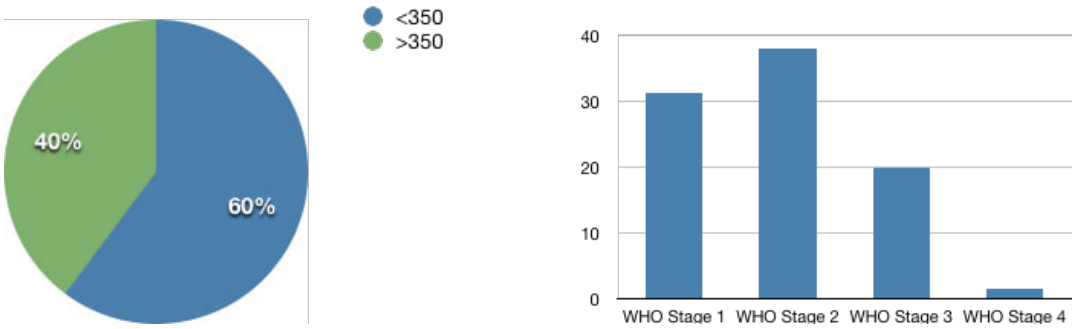


Figure 13. First CD4 count of patients registered

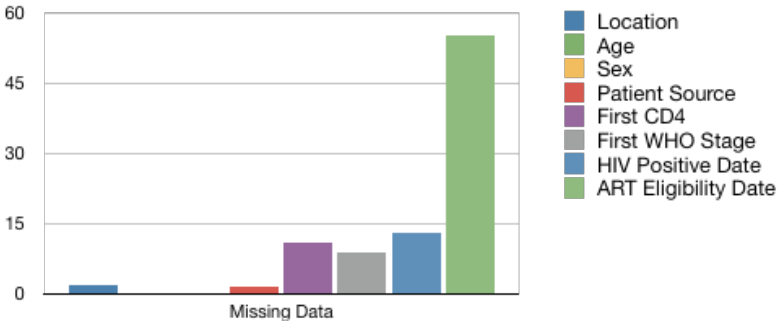
Figure 14. First WHO Stage of patients registered



3.2.2 Record Keeping

Data checks are run automatically on all data collected in the EMR to ensure data is valid, accurate and complete. Table 11 and Figure 15 show the percentage of selected missing data for active patients registered in the HIV EMR.

Figure 15. % selected missing data recorded for active registered patients



3.2.3 Clinical Decision Support

Clinical reminders are designed to ensure standardised care is provided that will ultimately improve the quality of care delivered. Figure 16 shows a timeline of patients registered on ART. 70.5% of active patients are currently on ART (Table 12 and Figure 17). 94.0% of patients eligible for ART, based on CD4 count or WHO stage are currently on ART (Table 15 and Figure 18). Table 13 and Table 14 show the number and percentage of patients eligible for ART but not on ART based on either CD4 count alone or WHO stage alone, respectively. Table 16 and Figure 19 show the number of patients eligible but not on ART by location.

Figure 16. Timeline of patients registered on ART, by WHO stage

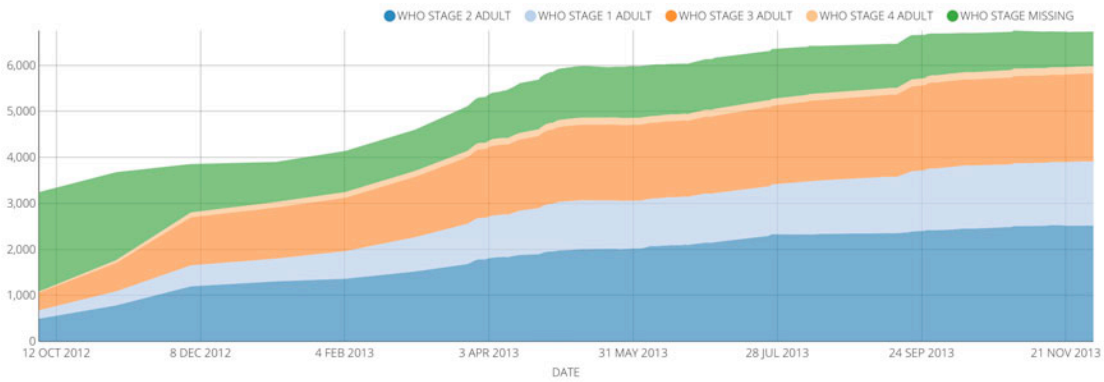


Figure 17. Active patients currently on ART

Figure 18. Active patients eligible for ART based on CD4 count/WHO Stage but not on ART

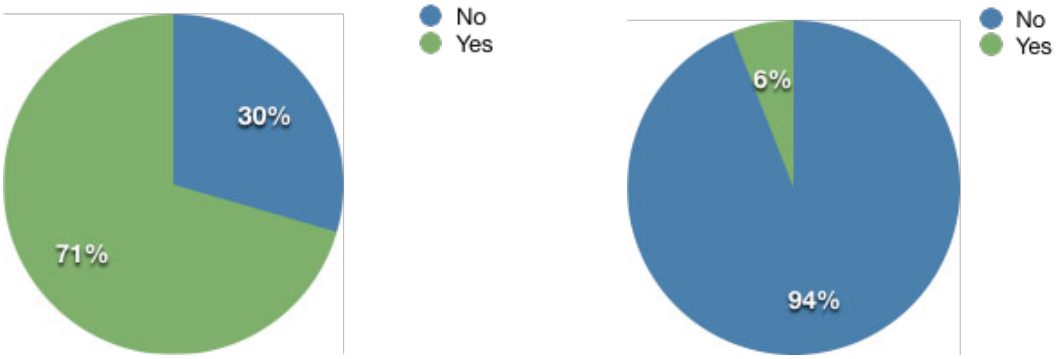
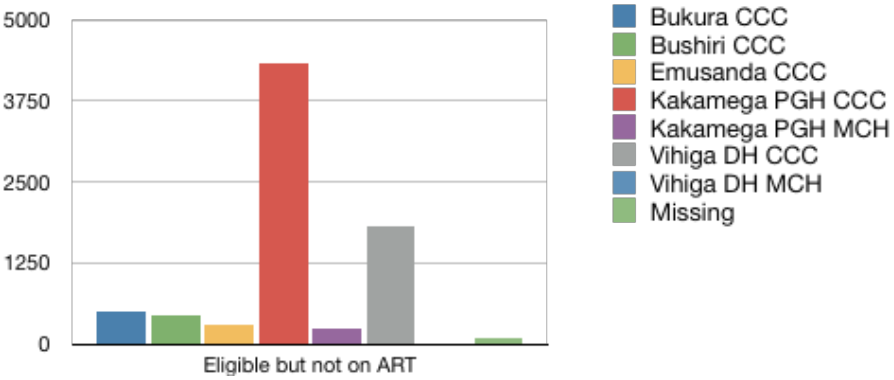


Figure 19. Active patients eligible for ART but not on ART, by location



3.2.4 Follow Up

A successful HIV program must ensure all patients are retained in care. The HIV EMR automatically flags and provides a list of patients who have not attended clinic. The EMR also automatically sends out SMS text message reminders to these patients and a phone call can be made from the clinic to ensure the patients are retained in care and followed up appropriately.

4,539 (26.5%) of patients previously lost to follow up were followed up through the EMR (Table 17, Figure 20). 1,318 (29.0%) of these patients were willing to return to clinic (Table 18, Figure 21).

Table 19 and Figure 22 show the reasons for loss to follow up of these patients. Table 20 and Figure 23 show the status (active or inactive) of patients who were followed up.

Figure 20. Patients followed up through the EMR

Figure 21. Patients followed up who are willing to return to clinic

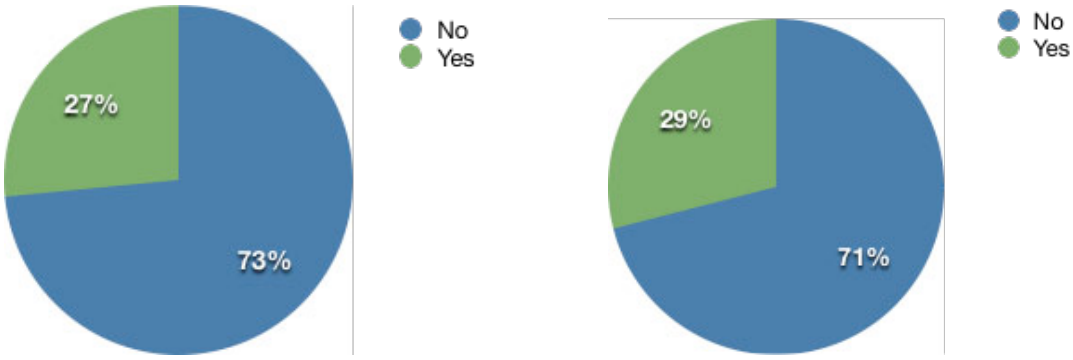


Figure 22. Reason for loss to follow-up

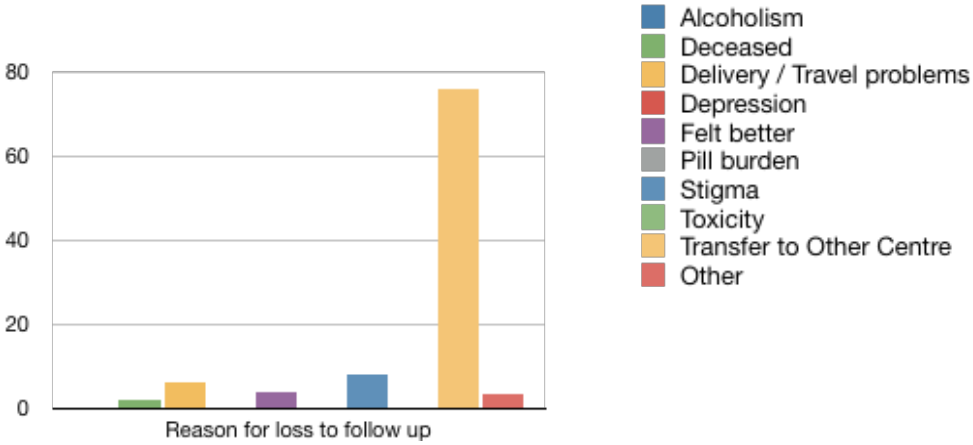
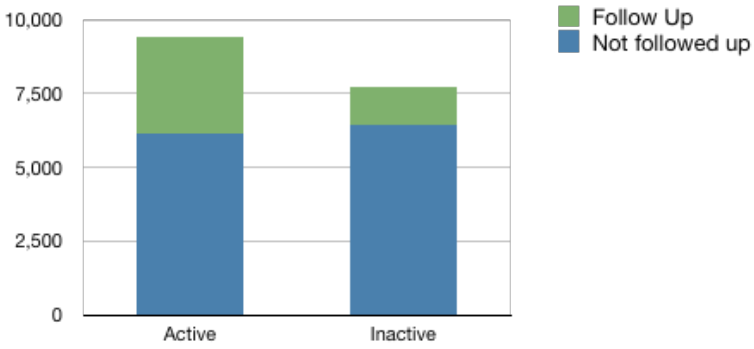


Figure 23. Status of follow-up patients



3.3 Impact

3.3.1 Data Quality

The impact of the HIV EMR on data quality was measured by comparing the amount and quality of data stored pre- and post-EMR implementation (i.e. before and after 5 October 2012). A significant reduction in missing data was recorded pre- and post-EMR implementation through database verification and correction of important data variables (Table 1).

Table 1. Selected missing data recorded pre- and post-EMR implementation

Missing Data	**Pre N. (%)**	**Post N. (%)**	**% change**	**P ***
Location	607 (13.4)	84 (1.8)	-86.6%	0.000
Age	42 (0.9)	1 (0.01)	-98.9%	0.000
Sex	44 (1.0)	1 (0.01)	-99.0%	0.000
Patient Source	375 (8.3)	105 (1.4)	-83.1%	0.000
First CD4	826 (18.2)	129 (1.7)	-90.1%	0.000
First WHO Stage	2,258 (49.7)	679 (8.8)	-82.3%	0.000
HIV Positive Date	574 (12.6)	989 (12.8)	+1.6%	0.79
ART Eligibility Date	2,374 (52.2)	4,287 (55.3)	+5.9%	0.001

* Two-sample test of proportions

3.3.2 Clinical Care

The impact of the HIV EMR on clinical care was measured by comparing the change in core clinical indicators pre- and post-EMR implementation (i.e. before and after 5 October 2012). A 50.6% increase in patients on ART and 79.7% decrease in patients eligible for but not ART, who subsequently started ART, was recorded pre- and post-EMR implementation through clinical verification (Table 2).

Table 2. Eligible patients on ART or not on ART pre- and post-EMR implementation

Patients	**Pre N. (%)**	**Post N. (%)**	**% change**	**P ***
On ART	2,127 (46.8)	5,463 (70.5)	+50.6%	0.000
Eligible but not on ART	1,346 (29.6)	466 (6.0)	-79.7%	0.000

* Two-sample test of proportions

SECTION 4

Maternal and Child Health EMR

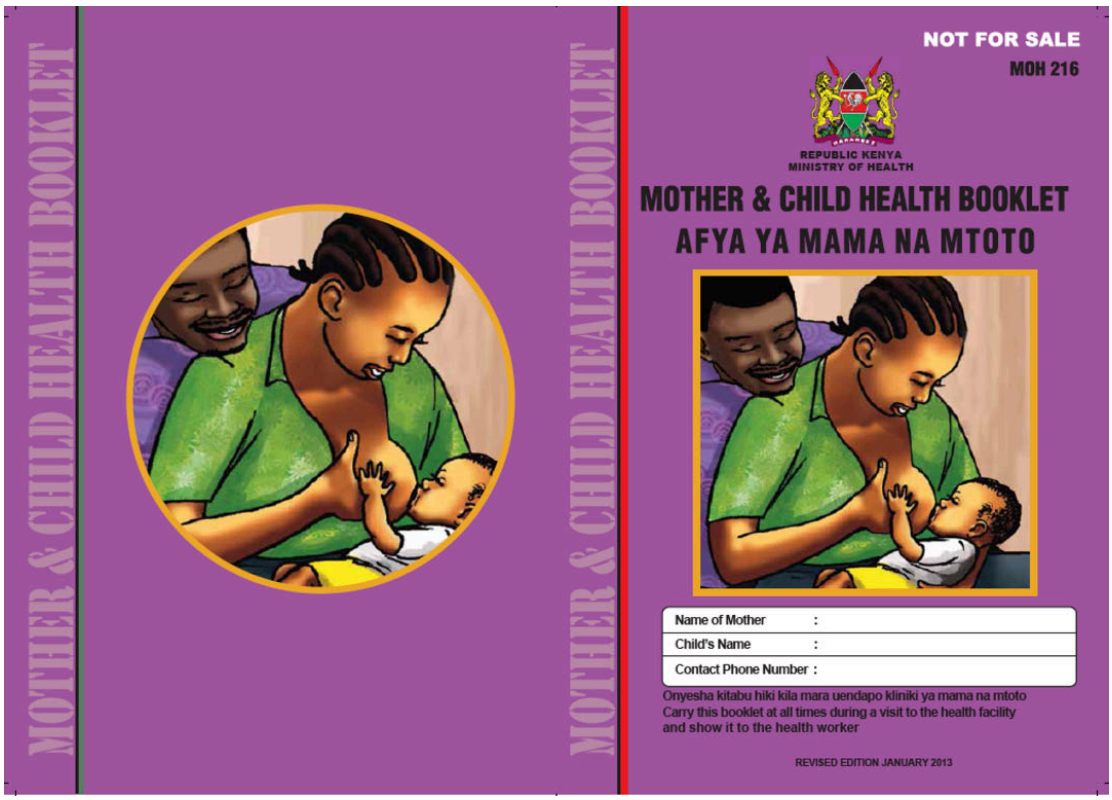
4.1 Introduction

In November 2012, the Director of the Ministry of Public Health and Sanitation requested that Uamuzi Bora extend the scope of the EMR to include Maternal and Child Health, to capture patients testing positive for HIV via this service and to support improved delivery of services and clinical care for mothers and their babies. The Director requested that Uamuzi Bora partner with the Japanese International Cooperation Agency (JICA) to pilot a MCH EMR in selected antenatal care (ANC) facilities in Kisumu West district, Nyanza Province.

In February 2013, JICA and Ministry of Health led a technical working group, including partners and stakeholders, to agree on the content of the MCH EMR modules, indicators and reporting framework for the pilot. The MCH EMR adheres to national standards and pathways of care and replicates information currently collected in the MCH handbook (MOH216), which is provided to every pregnant woman who attends ANC in Kenya (Figure 24).

The Ministry of Health, in partnership with JICA and Uamuzi Bora, selected five health facilities in Kisumu West district (Kombewa District Hospital, Manyuanda Health Centre, Bar Korwa Health Centre, Bodi Health Centre and Rodi Dispensary) to implement the pilot between April and June 2013. A pilot report was published at the end of June 2013 and presented at the second national eHealth meeting in Nairobi in July 2013.

Figure 24. Mother and Child Health Booklet (MOH216)



4.2 Descriptive Analysis

4.2.1 Women enrolled

946 pregnant women and mothers were registered in the MCH EMR, from the five clinics, between 2 April and 24 June 2013 (Table 21, Figure 25). The mean age of women attending clinic was 23.6 years (Table 22, Figure 26).

Each woman attended the ANC an average of 1.9 times during the pilot period (Table 23, Figure 27).

Figure 25. Women registered, by Location

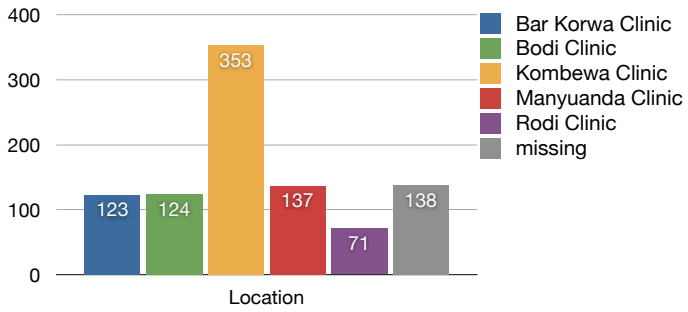


Figure 26. Age Group of women registered

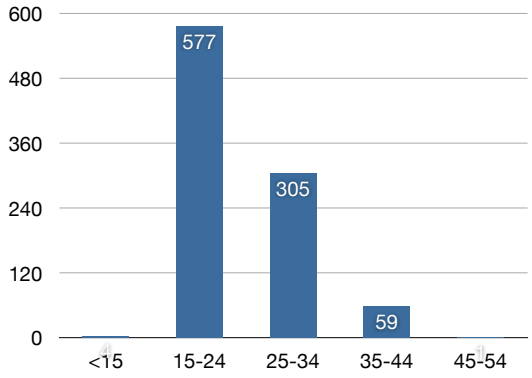
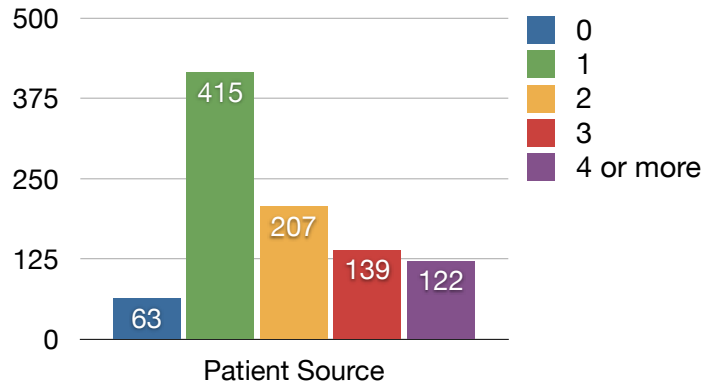


Figure 27. Number of clinic visits attended



4.2.2 Deliveries registered

206 deliveries were registered in the MCH EMR, from the five clinics, between 2 April and 24 June 2013 (Table 24). 107 (52.0%) deliveries were attended by a midwife (Table 25, Figure 28) and 136 (66.0%) deliveries took place in hospital (Table 26, Figure 29). 195 (94.7%) of deliveries were spontaneous vaginal delivery (Table 27, Figure 30).

Figure 28. Deliveries conducted by

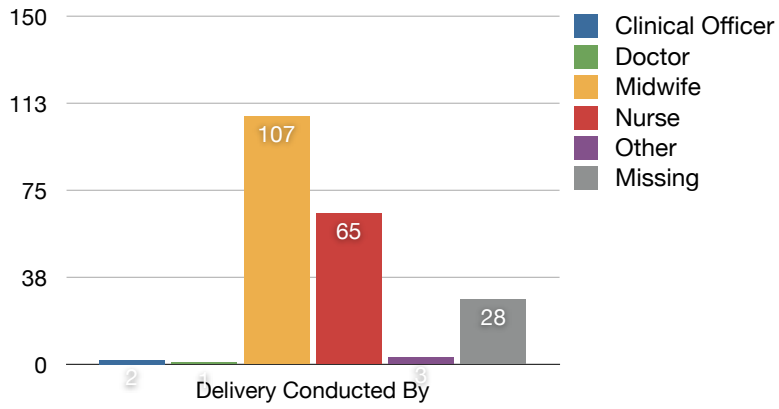
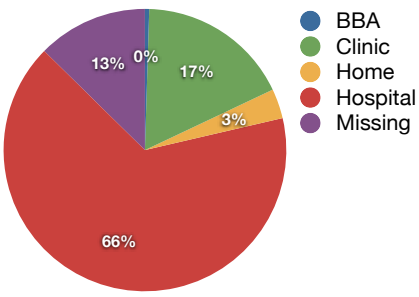
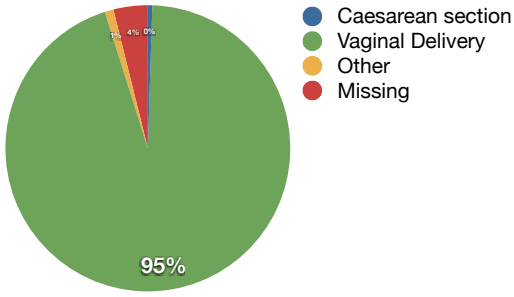


Figure 29. Place of Delivery

Figure 30. Method of Delivery



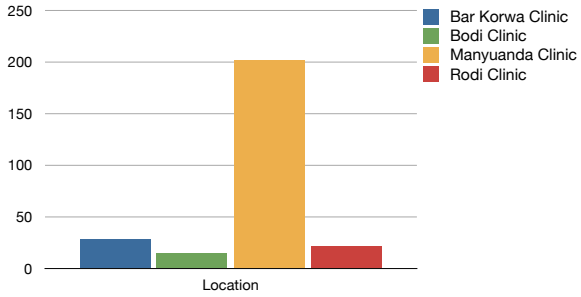


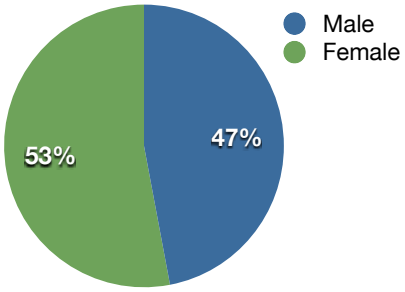
4.2.3 Children enrolled

302 babies were registered in the MCH EMR, from the five clinics, between 2 April and 24 June 2013 (Table 28, Figure 31). 160 (53.0%) were girls (Table 29, Figure 32).

Figure 31. Children registered, by location

Figure 32. Gender of children registered





4.2.4 Record Keeping

Table 30 and Figure 33 shows the percentage of patient records missing data according to screening for hypertension, tuberculosis, malaria and HIV. Table 31 and Figure 34 shows this missing data according to facility.

Figure 33. % of records missing data among registered women

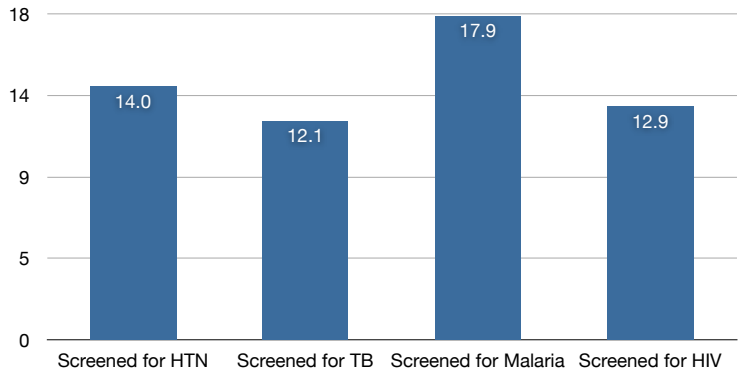
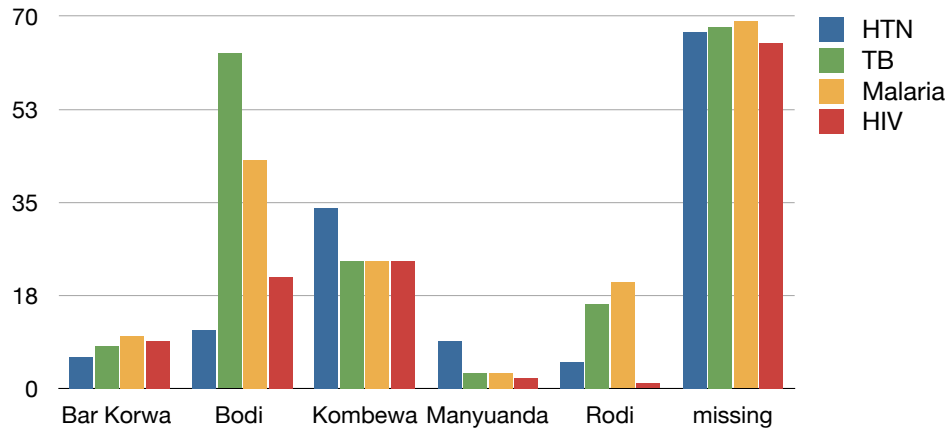


Figure 34. % of records missing data among registered women, by location



4.2.5 Clinical Care

Clinical reminders are designed to ensure standardised care is provided that will ultimately improve the quality of care delivered.

Only 5 (0.5%) of patients were screened for hypertension during the pilot period (Table 32). 2 women (0.2%) were receiving tuberculosis treatment (Table 33), 44 women (4.7%) registered had confirmed malaria (Table 34) and 132 women (14.0%) were HIV positive (Table 35). Only 68 (50.4%) of women confirm HIV positive were recorded as being on ART during the pilot period (Table 36).

4.3 Impact

4.3.1 Data Quality

We measured the impact of the MCH EMR across the five clinics, by comparing the amount and quality of data stored pre- and post-EMR implementation (i.e. before and after 6 May 2013).

A significant reduction in missing data was recorded pre- and post-EMR implementation through database verification and correction of core data including screening and status of hypertension, tuberculosis, malaria and HIV (Table 3).

Table 3. Selected missing data recorded for pregnant women registered

Missing Data	**N. (%)**	**N. (%)**	**% change**	**P ***
Screened for HTN	219 (39.0)	132 (14.0)	-64.1%	0.000
Screened for TB	271 (48.3)	182 (12.1)	-74.9%	0.000
Screened for Malaria	266 (47.4)	169 (17.9)	-62.2%	0.000
Screened for HIV	201 (35.8)	122 (12.9)	-64.0%	0.000

* Two-sample test of proportions

4.3.2 Clinical Care

Further evaluation of the impact of the MCH EMR on provision of care and retention in care is needed. With knowledge of the above data, the MCH EMR can now be used to follow up pregnant women who do not return to clinic and increase the average number of antenatal clinic visits attended, for example. The MCH EMR can also be used to flag those HIV positive women who are not receiving ART and increase coverage of ART prophylaxis during pregnancy.

SECTION 5

The Way Forward

5.1 EMR Scale Up and Sustainability

The project has demonstrated feasibility of implementation of a cloud-based EMR model and the ability to make real-time health information available at different levels of the health service to improve clinical and public health decision-making. Significant improvements in data quality and provision of clinical care are recorded through implementation of the EMR.

Proposals have been submitted to in-country partners and donors to support Ministry of Health ownership of the EMR in 2014 and to begin scale-up of implementation to other sites. The cloud-based EMR model is ultimately more cost-effective and scalable than local clinic models of EMR implementation. Technical support and training will be provided by Uamuzi Bora to support Ministry of Health ownership and sustainability for the long-term.

5.2 A Universal EMR

The cloud-based EMR model has demonstrated how data can be shared between different services in Kenya. Uamuzi Bora will continue to explore how the EMR can strengthen linkages and pathways of care between different services, through sharing of real-time health information. The concept of a ”Universal EMR” – whereby one common patient record is accessed by different health services – will be further explored and developed.

5.3 Access to Health Information

Uamuzi Bora will continue to program innovatively and further develop the cloud-based model of data sharing at different levels of care to improve clinical and public health decision-making. Further development of the cloud-based model of data sharing will be undertaken, including use of Google or Amazon server infrastructure and the ability to make use of this model “offline”.

SECTION 5

References cited

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3. Oluoch TT, Santas XX, Kwaro DD, Were MM, Biondich PP, Bailey CC, et al. The effect of electronic medical record-based clinical decision support on HIV care in resource-constrained settings: A systematic review. Int J Med Inform. 2012 Sep 30;81(10):e83–e92.

4. Mamlin BW, Biondich PG, Wolfe BA, Fraser H, Jazayeri D, Allen C, et al. Cooking up an open source EMR for developing countries: OpenMRS - a recipe for successful collaboration. AMIA Annual Symposium proceedings / AMIA Symposium AMIA Symposium. 2006;:529–33.

5. Ministry of Health. Standards and Guidelines for Electronic Medical Record Systems in Kenya. 2010.

List of Tables

Table 4. Patients registered by status

Status	**N.**	**%**
Inactive	9,399	54.8
Active	7,746	45.2
Total	**17,145**	**100.0**

Table 5. Active patients registered by location

Location	**N.**	**%**
Bukura CCC	517	6.7
Bushiri CCC	443	5.7
Emusanda CCC	286	3.7
Kakamega PGH CCC	4,344	56.1
Kakamega PGH MCH	235	3.0
Vihiga DH CCC	1,832	23.7
Vihiga DH MCH	5	0.1
Missing	84	1.1
Total	**7,746**	**100.0**

Table 6. Age group of active patients registered

Age Group	**N.**	**%**
<15 years	727	9.4
15-24 years	441	5.7
25-34 years	1,726	22.3
35-44 years	2,406	31.1
45-54 years	1,602	20.7
55-64 years	694	9.0
>65 years	149	1.9
Missing	1	0.01
Total	**7,746**	**100.0**

Table 7. Gender of patients registered

Gender	**N.**	**%**
Male	2,488	32.1
Female	5,257	67.9
missing	1	0.01
Total	**7,746**	**100.0**

Table 8. Source of testing of patients registered

Patient Source	**N.**	**%**
VCT	3,737	48.2
Outpatient	468	6.0
MCH-Child Clinic	41	0.5
PMTCT	703	9.1
Inpatient	358	4.6
TB clinic	164	2.1
Unknown	590	7.6
Other	1,580	20.4
missing	105	1.4
Total	**7,746**	**100.0**

Table 9. First CD4 count of patients registered

CD4 count	**N.**	**%**
<350	4,161	53.7
>350	2,747	35.5
missing	838	10.8
Total	**7,746**	**100.0**

Table 10. First WHO Stage of patients registered

WHO Stage	**N.**	**%**
WHO Stage 1	2,431	31.4
WHO Stage 2	2,962	38.2
WHO Stage 3	1,539	19.9
WHO Stage 4	135	1.7
missing	679	8.8
Total	**7,746**	**100.0**

Table 11. % selected missing data recorded for active registered patients

Missing Data	**N.**	**% records**
Location	84	1.8
Age	1	0.01
Sex	1	0.01
Patient Source	105	1.4
First CD4	838	10.8
First WHO Stage	679	8.8
HIV Positive Date	989	12.8
ART Eligibility Date	4,287	55.3

Table 12. Active patients currently on ART

On ART	**N.**	**%**
No	2,283	29.5
Yes	5,463	70.5
Total	**7,746**	**100.0**

Table 13. Active patients eligible for ART based on CD4 count but not on ART

Eligible but not on ART	**N.**	**%**
No	7,504	96.9
Yes	242	3.1
Total	**7,746**	**100.0**

Table 14. Active patients eligible for ART based on WHO Stage but not on ART

Eligible but not on ART	**N.**	**%**
No	7,562	97.6
Yes	184	2.4
Total	**7,746**	**100.0**

Table 15. Active patients eligible for ART based on CD4 count/WHO Stage but not on ART

Eligible but not on ART	**N.**	**%**
No	7,280	94.0
Yes	466	6.0
Total	**7,746**	**100.0**

Table 16. Active patients eligible for ART but not on ART, by location

Location	**Eligible but not on ART**	**Total**
Bukura CCC	32	517
Bushiri CCC	40	443
Emusanda CCC	17	286
Kakamega PGH CCC	270	4,344
Kakamega PGH MCH	23	235
Vihiga DH CCC	81	1,832
Vihiga DH MCH	0	5
Missing	3	84
Total	**466**	**7,746**

Table 17. Patients followed up through the EMR

Patients followed-up	**N.**	**%**
No	12,606	73.4
Yes	4,539	26.5
Total	**17,145**	**100.0**

Table 18. Patients followed up who are willing to return to clinic

Patients willing to return to clinic	**N.**	**%**
No	3,221	71.0
Yes	1,318	29.0
Total	**4,539**	**100.0**

Table 19. Reason for loss to follow-up

Reason for loss to follow-up	**N.**	**%**
Alcoholism	4	0.3
Deceased	26	1.9
Delivery / Travel problems	85	6.1
Depression	4	0.3
Felt better	52	3.7
Pill burden	2	0.1
Stigma	114	8.2
Toxicity	5	0.4
Transfer to Other Centre	1,059	75.9
Other	45	3.2
Total	**1,396**	**100.0**

Table 20. Status of follow-up patients

Status of FU patients	**Active**	**Inactive**	**Total**
Not followed up	6,160	6,446	12,606
Follow Up	3,239	1,300	4,539
Total	**9,399**	**7,746**	**17,145**

Table 21. Women registered, by location

Location	N.	%
Bar Korwa Clinic	123	13.0
Bodi Clinic	124	13.1
Kombewa Clinic	353	37.3
Manyuanda Clinic	137	14.5
Rodi Clinic	71	7.5
missing	138	1467
Total	**946**	**100.0**

Table 22. Age groups of women registered

Age	N.	%
<15 years	4	0.4
15-24 years	577	61.0
25-34 years	305	32.2
35-44 years	59	6.2
>44 years	1	0.1
Total	**946**	**100.0**

Table 23. Number of clinic visits registered

Number of clinic visits	N.	%
0	63	6.7
1	415	43.9
2	207	21.9
3	139	14.7
4 or more	122	12.9
Total	**946**	**100.0**

Table 24. Number of deliveries registered

Deliveries registered	**N.**	**%**
No	740	78.2
Yes	206	21.8
Total	**946**	**100.0**

Table 25. Deliveries conducted by

Conducted By	**N.**	**%**
Clinical Officer	2	1.0
Doctor	1	0.5
Midwife	107	52.0
Nurse	65	31.6
Other	3	1.5
Missing	28	14.0
Total	**206**	**100.0**

Table 26. Place of Delivery

Place of Delivery	**N.**	**%**
BBA	1	0.7
Clinic	36	12.6
Home	7	22.8
Hospital	136	57.6
Missing	26	6.3
Total	**206**	**100.0**

Table 27. Method of Delivery

Method of Delivery	**N.**	**%**
Caesarean section	1	0.5
Vaginal Delivery	195	94.7
Other	2	1.0
Missing	8	3.9
Total	**206**	**100.0**

Table 28. Children registered, by location

Location	N.	%
Bar Korwa Clinic	28	9.3
Bodi Clinic	14	4.6
Manyuanda Clinic	201	66.6
Rodi Clinic	21	7.0
missing	38	12.6
Total	**302**	**100.0**

Table 29. Gender of children registered

Sex	N.	%
Male	142	47.0
Female	160	53.0
Total	**302**	**100.0**

Table 30. Missing data among pregnant women

Missing data	N.	%
Screened for HTN	132	14.0
Screened for TB	182	12.1
Screened for Malaria	169	17.9
Screened for HIV	122	12.9

Table 31. Missing data among pregnant women, by location

	Missing Screening Data			
Location	**HTN**	**TB**	**Malaria**	**HIV**
Bar Korwa	6	8	10	9
Bodi	11	63	43	21
Kombewa	34	24	24	24
Manyuanda	9	3	3	2
Rodi	5	16	20	1
missing	67	68	69	65
Total	**132**	**182**	**169**	**122**

Table 32. Pregnant women screened for hypertension

Screened for HTN	**N.**	**%**
No	809	85.5
Yes	5	0.5
missing	132	14.0
Total	**946**	**100.0**

Table 33. History of TB among pregnant women

Screened for TB	**N.**	**%**
No signs of TB	749	79.2
Receiving TB treatment	2	0.2
TB status not assessed	13	1.4
missing	182	19.2
Total	**946**	**100.0**

Table 34. History of malaria among pregnant women

Screened for Malaria	**N.**	**%**
Not performed	146	15.4
Test Indeterminate	6	0.6
Malaria Negative	581	61.4
Malaria Positive	44	4.7
missing	169	17.9
Total	**946**	**100.0**

Table 35. History of HIV among pregnant women

Screened for HIV	**N.**	**%**
Not performed	83	8.8
HIV negative	609	64.4
HIV positive	132	14.0
missing	122	12.9
Total	**946**	**100.0**

Table 36. HIV positive women on ART

HIV+ women on ART	**N.**	**%**
No	23	17.0
Yes	68	50.4
Missing	44	32.6
Total	**135**	**100.0**

Appendix 1. SQL report queries

Active patient

select person_id from person where person_id not in (select person_id from obs where concept_id=6153 and voided=0 and obs_datetime<:endDate) and person_id in (select patient_id from patient_program where program_id=1 and voided=0 and date_enrolled<:endDate) and person_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

CD4 >500

select distinct p.patient_id from obs o inner join patient p on o.person_id = p.patient_id inner join (select person_id, max(obs_datetime) as max_datetime from obs where concept_id = 5497 and obs_datetime <:endDate and location_id=:location group by person_id) maximum on o.person_id = maximum.person_id and o.obs_datetime = maximum.max_datetime where o.value_numeric > 500

CD4 <200

select distinct p.patient_id from obs o inner join patient p on o.person_id = p.patient_id inner join (select person_id, max(obs_datetime) as max_datetime from obs where concept_id = 5497 and obs_datetime <:endDate and location_id=:location group by person_id) maximum on o.person_id = maximum.person_id and o.obs_datetime = maximum.max_datetime where o.value_numeric < 200

CD4 201-350

select distinct p.patient_id from obs o inner join patient p on o.person_id = p.patient_id inner join (select person_id, max(obs_datetime) as max_datetime from obs where concept_id = 5497 and obs_datetime <:endDate and location_id=:location group by person_id) maximum on o.person_id = maximum.person_id and o.obs_datetime = maximum.max_datetime where o.value_numeric > 201 and o.value_numeric < 350

CD4>350

select distinct p.patient_id from obs o inner join patient p on o.person_id = p.patient_id inner join (select person_id, max(obs_datetime) as max_datetime from obs where concept_id = 5497 and obs_datetime <:endDate and location_id=:location group by person_id) maximum on o.person_id = maximum.person_id and o.obs_datetime = maximum.max_datetime where o.value_numeric > 350

CD4<350

select distinct p.patient_id from obs o inner join patient p on o.person_id = p.patient_id inner join (select person_id, max(obs_datetime) as max_datetime from obs where concept_id = 5497 and obs_datetime <:endDate and location_id=:location group by person_id) maximum on o.person_id = maximum.person_id and o.obs_datetime = maximum.max_datetime where o.value_numeric < 350

Clinical Flag - EFZ and pregnant

select orders.patient_id from orders where concept_id=633 and voided=0 and discontinued=0 and patient_id in (select person_id from obs inner join (select max(encounter_datetime) as ma,patient_id from encounter where form_id=2 group by patient_id) as inn on person_id=patient_id and obs_datetime=inn.ma where obs.location_id=:location and concept_id=5272 and (value_numeric=1 or value_boolean=1))

Clinical Flag - Eligible for ART but not on ART

select patient.patient_id from patient where (patient_id in (select person_id from obs where location_id=:location and concept_id=5356 and (value_coded=1206 or value_coded=1207) and voided=0) or patient_id in(select

person_id from obs where concept_id=5497 and value_numeric<350 and voided=0)) and patient_id not in (Select patient_id from orders where voided=0)

Clinical Flag - On AZT and Anaemic

select orders.patient_id from orders where (concept_id=797 or concept_id=630) and voided=0 and discontinued=0 and patient_id in (select obs.person_id from obs inner join (select person_id,max(obs_datetime) as m from obs where concept_id=21 group by person_id) as a on a.person_id=obs.person_id and a.m=obs_datetime where obs.location_id=:location and concept_id=21 and value_numeric <9);

Clinical Flag - On d4T regimen

select patient_id from orders where ((concept_id=792 or concept_id=6251) and start_date<:endDate and (discontinued=0 or discontinued_date > :endDate)) and patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

Clinical Flag - On EFZ and Rifampacin

select orders.patient_id from orders where concept_id=633 and voided=0 and discontinued=0 and patient_id in (select person_id from obs inner join (select max(encounter_datetime) as ma,patient_id from encounter where form_id=2 group by patient_id) as inn on person_id=patient_id and obs_datetime=inn.ma where obs.location_id=:location and concept_id=1193 and value_coded in (768,1131,1194))

Clinical Flag - On NVP and CD4 >400

select orders.patient_id from orders where concept_id=792 or concept_id=631 and voided=0 and discontinued=0 and patient_id in (select person_id from obs where obs.location_id=:location and concept_id=5497 and value_numeric>400)

Currently started - 1st line ART

select t. patient_id from (select sum(concept_id) as s,patient_id,start_date from orders where (start_date > :startDate and start_date<:endDate) group by patient_id,start_date) as t where (t.s in (792,6884,1263,1261,6145,6144,2061,2063,6143)) and t.patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

Currently started - 2nd line ART

select t. patient_id from (select sum(concept_id) as s,patient_id,start_date from orders where (start_date > :startDate and start_date<:endDate) group by patient_id,start_date) as t where (t.s in(2387,2228,2404,2245,1424,2387,1444,2224,2244,2227,1609,2393,2404,7045,7065)) and t.patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

Currently Started - Alternative 1st Line

select t. patient_id from (select sum(concept_id) as s,patient_id,start_date from orders where (start_date > :startDate and start_date<:endDate) group by patient_id,start_date) as t where (t.s in (1263,1261,6884,6144,2061,792,6143)) and t.patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

Currently started – ART

select patient_id from orders where (start_date > :startDate and start_date<:endDate) and patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

Eligible for ART

select person_id from person where person_id in(select person_id from obs where concept_id=5356 and (value_coded=1206 or value_coded=1207) and location_id=:location) or person_id in(select person_id from obs where concept_id=5497 and value_numeric<350 and location_id=:location);

Enrolled in Care

select patient_id from patient_program where date_enrolled> :startDate and date_enrolled<:endDate and location_id=:location

Ever started - 1st line ART

select t. patient_id from (select sum(concept_id) as s,patient_id,start_date from orders where (start_date<:endDate and (discontinued=0 or discontinued_date > :endDate)) group by patient_id,start_date) as t where t.s in (792,6884,1263,1261,6145,6144,2061,2063,6143) and t.patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

Ever started - 2nd line ART

select t. patient_id from (select sum(concept_id) as s,patient_id,start_date from orders where (start_date<:endDate and (discontinued=0 or discontinued_date > :endDate)) group by patient_id,start_date) as t where t.s in(2387,2228,2404,2245,1424,2387,1444,2224,2244,2227,1609,2393,2404,7045,7065) and t.patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

Ever Started - Alternative 1st Line ART

select t. patient_id from (select sum(concept_id) as s,patient_id,start_date from orders where (start_date<:endDate and (discontinued=0 or discontinued_date > :endDate)) group by patient_id,start_date) as t where (t.s in(1263,1261,6884,6144,2061,792,6143)) and t.patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

Ever started – ART

select patient_id from orders where (start_date<:endDate and (discontinued=0 or discontinued_date > :endDate)) and patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

Ever started - PEP1

select t. patient_id from (select sum(concept_id) as s,patient_id,start_date from orders where (start_date<:endDate and (discontinued=0 or discontinued_date > :endDate)) group by patient_id,start_date) as t where (t.s=630 or t.s=1425) and t.patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

First CD4>350

select person_id from obs join patient_program on person_id=patient_id where concept_id=5497 and obs_datetime<date_add(date_enrolled,INTERVAL 6 MONTH) and value_numeric >350 and patient_program.location_id=:location;

First CD4<350

select person_id from obs join patient_program on person_id=patient_id where concept_id=5497 and obs_datetime<date_add(date_enrolled,INTERVAL 6 MONTH) and value_numeric < 350 and patient_program.location_id=:location;

FU Patient Contacted Directly

select person_id from obs where concept_id=6279 and voided=0 and (value_boolean=1 or value_numeric=1) and location_id=:location

FU Willing To Return To Clinic

select person_id from obs where concept_id=6286 and voided=0 and (value_boolean=1 or value_numeric=1) and location_id=:location

Missing CCC Enrollment date

select person_id from person where person_id not in (select patient_id from patient_program where program_id=1 and voided=0) and peraon_id in (select patient_id from encounter where form_id=1 and location_id=:location)

Missing CD4

select person_id from person where person_id NOT IN (select distinct(person_id) from obs where concept_id=5497)and person_id in (SELECT patient_id from patient_program where program_id=1 and location_id=:location and voided=0)

Missing Eligible ART date if Eligible

select person_id from person where person_id in(select person_id from obs where concept_id=5356 and (value_coded=1206 or value_coded=1207) and location_id=:location) or person_id in(select person_id from obs where concept_id=5497 and value_numeric<350 and location_id=:location) and person_id not in (Select person_id from obs where concept_id=6260 and voided=0)

Missing Entry Point

SELECT person_id from person where person_id not in (select distinct(person_id) from obs where concept_id=6245 and location_id=:location)

Missing first CD4

select person_id from person where person_id not in (select person_id from obs join patient_program on person_id=patient_id where concept_id=5497 and obs_datetime<date_add(date_enrolled,INTERVAL 6 MONTH)) and person_id in (SELECT patient_id from patient_program where program_id=1 and voided=0 and location_id=:location) and person_id not in (SELECT person_id from obs join patient_program on person_id=patient_id where concept_id=6375 and (value_boolean=0 or value_numeric=0) and obs_datetime<date_add(date_enrolled,INTERVAL 6 MONTH));

Missing first WHO Stage

select person_id from person where person_id not in (select person_id from obs join patient_program on person_id=patient_id where concept_id=5356 and obs_datetime<date_add(date_enrolled,INTERVAL 6 MONTH)) and person_id in (SELECT patient_id from patient_program where program_id=1 and location_id=:location and voided=0);

Missing HIV Positive date

select patient.patient_id from patient where patient_id not in (select person_id from obs where concept_id=6259 or (concept_id=6277 and (value_numeric=0 or value_boolean=0)) and voided=0) and patient_id in (SELECT patient_id from patient_program where program_id=1 and location_id= :location and voided=0)

Missing Initial Visit Form at time of SWS

select patient.patient_id from patient where patient_id not in (select patient_id from encounter where encounter_type=1 and location_id=:location);

Missing Return Visit Form at time of SWS survey

select patient.patient_id from patient where patient_id not in (select encounter.patient_id from encounter inner join (select patient_id, encounter_datetime from encounter where form_id=3) e2 on encounter.patient_id=e2.patient_id and encounter.encounter_datetime=e2.encounter_datetime where encounter.form_id=2) and patient_id in (select patient_id from encounter where form_id=3 and location_id=:location);

Missing WHO Stage

select person_id from person where person_id NOT IN (select distinct(person_id) from obs where concept_id=5356) and person_id in (SELECT patient_id from patient_program where program_id=1 and location_id=:location and voided=0)

No Follow-Up Form

select person_id from person where person_id not in (select patient_id from encounter where form_id=4) and person_id in (select patient_id from patient_program where program_id=1 and location_id=:location)

Not Currently Started – ART

select patient_id from patient where patient_id not in (select patient_id from orders where start_date < :endDate and discontinued = 0 and voided =0) and patient_id in (select patient_id from patient_program where location_id = :location and date_enrolled < :endDate)

On 12 months - 1st Line ART

select t.patient_id from (select sum(concept_id) as s,patient_id,start_date from orders where start_date < date_sub(:endDate,INTERVAL 1 YEAR) and discontinued=0 group by patient_id,start_date) as t where (t.s in (792,6884,1263,1261,6145,6144,2061,2063,6143)) and t.patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

On 12 Months - 2nd Line ART

select t.patient_id from (select sum(concept_id) as s,patient_id,start_date from orders where start_date < date_sub(:endDate,INTERVAL 1 YEAR) and discontinued=0 group by patient_id,start_date) as t where (t.s in (2387,2228,2404,2245,1424,2387,1444,2224,2244,2227,1609,2393,2404,7045,7065)) and t.patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

On 12 months - Alternative 1st Line ART

select t.patient_id from (select sum(concept_id) as s,patient_id,start_date from orders where start_date < date_sub(:endDate,INTERVAL 1 YEAR) and discontinued=0 group by patient_id,start_date) as t where (t.s in (1263,1261,6884,6144,2061,792,6143)) and t.patient_id in (select patient_id from patient_program where program_id=1 and location_id=:location);

On 12 months – ART

select patient_id from orders where start_date < date_sub(:endDate, INTERVAL 1 YEAR) and patient_id in (select patient_id from patient_program where location_id = :location)

On ART 1st line after 12 months

select person_id from obs join (select sum(concept_id) as s,patient_id, start_date,discontinued_date, discontinued from orders group by patient_id,start_date,discontinued_date,discontinued) as i on person_id=i.patient_id where concept_id=6260 and start_date<date_add(obs_datetime,interval 1 YEAR) and (discontinued_date>date_add(obs_datetime,interval 1 YEAR) or discontinued=0) and

date_add(obs_datetime,interval 1 YEAR)<:endDate and person_id in (select patient_id from patient_program where program_id=1 and voided=0 and location_id=:location) and i.s in (792,6884,1263,1261,6145,6144,2061,2063,6143)

On ART 2st line after 12 months

select person_id from obs join (select sum(concept_id) as s,patient_id, start_date,discontinued_date, discontinued from orders group by patient_id,start_date,discontinued_date,discontinued) as i on person_id=i.patient_id where concept_id=6260 and start_date<date_add(obs_datetime,interval 1 YEAR) and (discontinued_date>date_add(obs_datetime,interval 1 YEAR) or discontinued=0) and date_add(obs_datetime,interval 1 YEAR)<:endDate and person_id in (select patient_id from patient_program where program_id=1 and voided=0 and location_id=:location) and i.s in (2387,2228,2404,2245,1424,2387,1444,2224,2244,2227,1609,2393,2404,7045,7065)

On ART after 12 months

select person_id from obs join (select sum(concept_id) as s,patient_id, start_date,discontinued_date, discontinued from orders group by patient_id,start_date,discontinued_date,discontinued) as i on person_id=i.patient_id where concept_id=6260 and start_date<date_add(obs_datetime,interval 1 YEAR) and (discontinued_date>date_add(obs_datetime,interval 1 YEAR) or discontinued=0) and date_add(obs_datetime,interval 1 YEAR)<:endDate and person_id in (select patient_id from patient_program where program_id=1 and voided=0 and location_id=:location)

Pregnant

select person_id from obs where concept_id=5272 and voided=0 and (value_boolean=1 or value_numeric=1) and location_id=:location

Pregnant – Not

select patient_id from patient where patient_id not in (select person_id from obs where concept_id=5272 and voided=0 and (value_boolean=1 or value_numeric=1)) and voided=0 and patient_id in (SELECT patient_id from patient_program where program_id=1 and location_id=:location and voided=0)

Previously started – ART

select patient_id from orders where (start_date < :startDate and start_date<:endDate and voided=0) and patient_id in (SELECT patient_id from patient_program where program_id=1 and location_id=:location and voided=0);

Telephone number – Patient

select person_id from person_attribute where person_attribute_type_id = 8 and person_id in (SELECT patient_id from patient_program where program_id=1 and location_id=:location and voided=0);

ANC MSH Blood Transfusion

select person_id from obs where concept_id=6296 and voided=0 and(value_boolean=1 or value_numeric=1) and (obs_datetime > :startDate and obs_datetime<:endDate) and location_id=:location

ANC MSH Diabetes

select person_id from obs where concept_id=6294 and voided=0 and (value_boolean=1 or value_numeric=1) and (start_date > :startDate and start_date<:endDate) and location_id=:location

ANC MSH FH Twins

select person_id from obs where concept_id=6320 and voided=0 and (value_boolean=1 or value_numeric=1) and (start_date > :startDate and start_date<:endDate) and location_id=:location

ANC MSH Hypertension

select person_id from obs where concept_id=6295 and voided=0 and (value_boolean=1 or value_numeric=1) and (start_date > :startDate and start_date<:endDate) and location_id=:location

ANC MSH Tuberculosis

select person_id from obs where concept_id=6297 and voided=0 and (value_boolean=1 or value_numeric=1) and (start_date > :startDate and start_date<:endDate) and location_id=:location

ANC MSH Tuberculosis

select person_id from obs where concept_id=6321 and voided=0 and (value_boolean=1 or value_numeric=1) and (start_date > :startDate and start_date<:endDate) and location_id=:location

MCH Breastfeeding Counselling

select person_id from obs where concept_id=6309 and voided=0 and (value_boolean=1 or value_numeric=1) and (start_date > :startDate and start_date<:endDate) and location_id=:location

MCH HIV Infant Feeding Counselling

select person_id from obs where concept_id=6310 and voided=0 and (value_boolean=1 or value_numeric=1) and (start_date > :startDate and start_date<:endDate) and location_id=:location

MCH Infant Counselling

select person_id from obs where concept_id=6308 and voided=0 and (value_boolean=1 or value_numeric=1) and (start_date > :startDate and start_date<:endDate) and location_id=:location

Appendix 2. Calculation of HIV dashboard indicators

All **percentage change** indicators are calculated from start date of 5th October 2012.

2.1 Patients Enrolled

- Total number of patients enrolled
- Percentage change in the number of patients enrolled since the start date

$$PercentageChange = \frac{(PatientsEnrolled_{start})-(PatientsEnrolled_{today})}{PatientsEnrolled_{start}}\times100$$

2.2 On ART

- Total number of patients receiving ART
- Percentage change in the total number of patients receiving ART since the start date

$$PercentageChange = \frac{(OnART_{start})-(OnART_{today})}{OnART_{start}}\times100$$

2.3 Eligible not on ART

- Total number of patients who are eligible for ART, but are not receiving ART
- Percentage change in the fraction of eligible patients not receiving ART since the start date

$$PercentageChange = \frac{\frac{EligibleNotOnART_{start}}{EligibleForART_{start}}-\frac{EligibleNotOnART_{today}}{EligibleForART_{today}}}{\frac{EligibleNotOnART_{start}}{EligibleForART_{start}}}\times100$$

2.4 Lost to Follow Up

- Number of People lost to follow up
- Percentage change of the fraction of patients who are lost to follow up since the start date

$$PercentageChange = \frac{\frac{LostToFollowUp_{start}}{PatientsEnrolled_{start}}-\frac{LostToFollowUp_{today}}{PatientsEnrolled_{today}}}{\frac{LostToFollowUp_{start}}{PatientsEnrolled_{start}}}\times100$$

2.5 Followed Up

- Patients lost to follow up who have been contact

2.6 Complete Records

- Number of records without missing data
- Percentage change in the fraction of records that are complete since the start date

$$PercentageChange = \frac{\frac{CompleteRecords_{start}}{PatientsEnrolled_{start}}-\frac{CompleteRecords_{today}}{PatientsEnrolled_{today}}}{\frac{CompleteRecords_{start}}{PatientsEnrolled_{start}}}\times100$$

Appendix 3. Calculation of MCH dashboard indicators

All **percentage change** indicators are calculated from our MCH project start date of 2nd April 2013.

3.1 Women Enrolled

- Total number of pregnant women enrolled
- Percentage change in the total number of pregnant women enrolled from the start date

$$PercentageChange = \frac{WomenEnrolled_{start}-WomenEnrolled_{today}}{Women Enrolled_{start}}\times100$$

3.2 Deliveries

- Number of deliveries recorded
- Percent change in the fraction of enrolled women with a recorded delivery from the start date

$$PercentageChange = \frac{\frac{Deliveries_{start}}{WomenEnrolled_{start}}-\frac{Deliveries_{today}}{WomenEnrolled_{today}}}{\frac{Deliveries_{start}}{WomenEnrolled_{start}}}\times100$$

3.3 Children Enrolled

- Total number of Children
- Percentage change in the number of enrolled children from the start date

$$PercentageChange = \frac{ChildrenEnrolled_{start}-ChildrenEnrolled_{today}}{ChildrenEnrolled_{start}}\times100$$

3.4 Women on ART

- Total number of HIV+ women on ART
- Percentage change in the fraction of HIV positive women who receive ART since the start date

$$PercentageChange = \frac{\frac{WomenOnART_{start}}{WomenHIVPositive_{start}}-\frac{WomenOnART_{today}}{WomenHIVPositive_{today}}}{\frac{WomenOnART_{start}}{WomenHIVPositive_{start}}}\times100$$

3.5 Malaria Prophylaxis

- Number of women receiving Malaria Prophylaxis
- Percent change in the fraction of enrolled women receiving a complete course of Malaria Prophylaxis sicne the start date

$$PercentageChange = \frac{\frac{CompletedMalariaProphylaxis_{start}}{WomenEnrolled_{start}}-\frac{CompletedMalariaProphylaxis_{today}}{WomenEnrolled_{today}}}{\frac{CompletedMalariaProphylaxis_{start}}{WomenEnrolled_{start}}}\times100$$

3.6 Complete Records

- Number of records without missing data
- Percentage change in the fraction of records that are complete since the start date

$$PercentageChange = \frac{\frac{CompleteRecords_{start}}{WomenEnrolled_{start}}-\frac{CompleteRecords_{today}}{WomenEnrolled_{today}}}{\frac{CompleteRecords_{start}}{WomenEnrolled_{start}}}\times100$$

Appendix 4. Ministry of Health letters regarding the HIV EMR

4.1 Kakamega Provincial General Hospital

MINISTRY OF HEALTH

Telegram: "PROVMED", Kakamega.
E-mail: wpgh15@yahoo.com
Telephone: Kaka mega 056-30050/1/2
When replying, please quote:

REF:PGH/KAK/ST/18/VOL.II/62

PROVINCIAL GENERAL HOSPITAL
P.O. Box 15-G.P.O-50100
KAKAMEGA

DATE: 1ST NOVEMBER, 2013

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: UAMUZI BORA EMR SUPPORT

I write this to appreciate the support that has been given to us by Uamuzi Bora Project for the last one and a half years. It has been of great help as far as data and service provision to our clients is concerned.

We therefore agree to give the necessary support and to embrace the project in future to keep the service at its best.

Thank you.

Dr. John A. Akoto
For Medical Superintendent
PGH KAKAMEGA

4.2 Vihiga District Hospital

MINISTRY OF HEALTH

Telegram: "Medical" VIHIGA
Tel: 056-51558
E-mail: vihigahospital@yahoo.com
Mobile No: +254-723103564
Ambulance +254-722915987

OFFICE OF THE MEDICAL SUPERINTENDENT
VIHIGADISTRICTHOSPITAL
P. O. BOX 1069
MARAGOLI

Date 23ND OCT, 2013.

TO: UAMUZI BORA

RE: APPRECIATION FOR PARTNERSHIP

Vihiga District Hospital would like to thank Uamuzi Bora for partnering with our facility in enabling the process of Electronic Medical Records (EMR) start in our Comprehensive Care Centre, the process is on-going.

The Hospital would appreciate more if the data clerks and follow up team (Defaulter tracing team) could be continually supported as before.

Yours faithfully,

MEDICAL SUPERINTENDENT
VIHIGA DISTRICT HOSPITAL
P. O. Box 1069
MARAGOLI

Dr Francis Odira
Medical Superintendent
Vihiga District Hospital

4.3 Bushiri Health Centre

MINISTRY OF HEALTH

BUSHILI RURAL HEALTH DEMONSTRATION CENTRE
P.O BOX 750 -50100 KAKAMEGA

17TH OCTOBER 2013

Our Ref.....
Your Ref.....

Dear sir

REF: APPRECIATION FOR THE PARTNERSHIP BETWEEN FACILITY & UAMUZI BORA PROJECT.

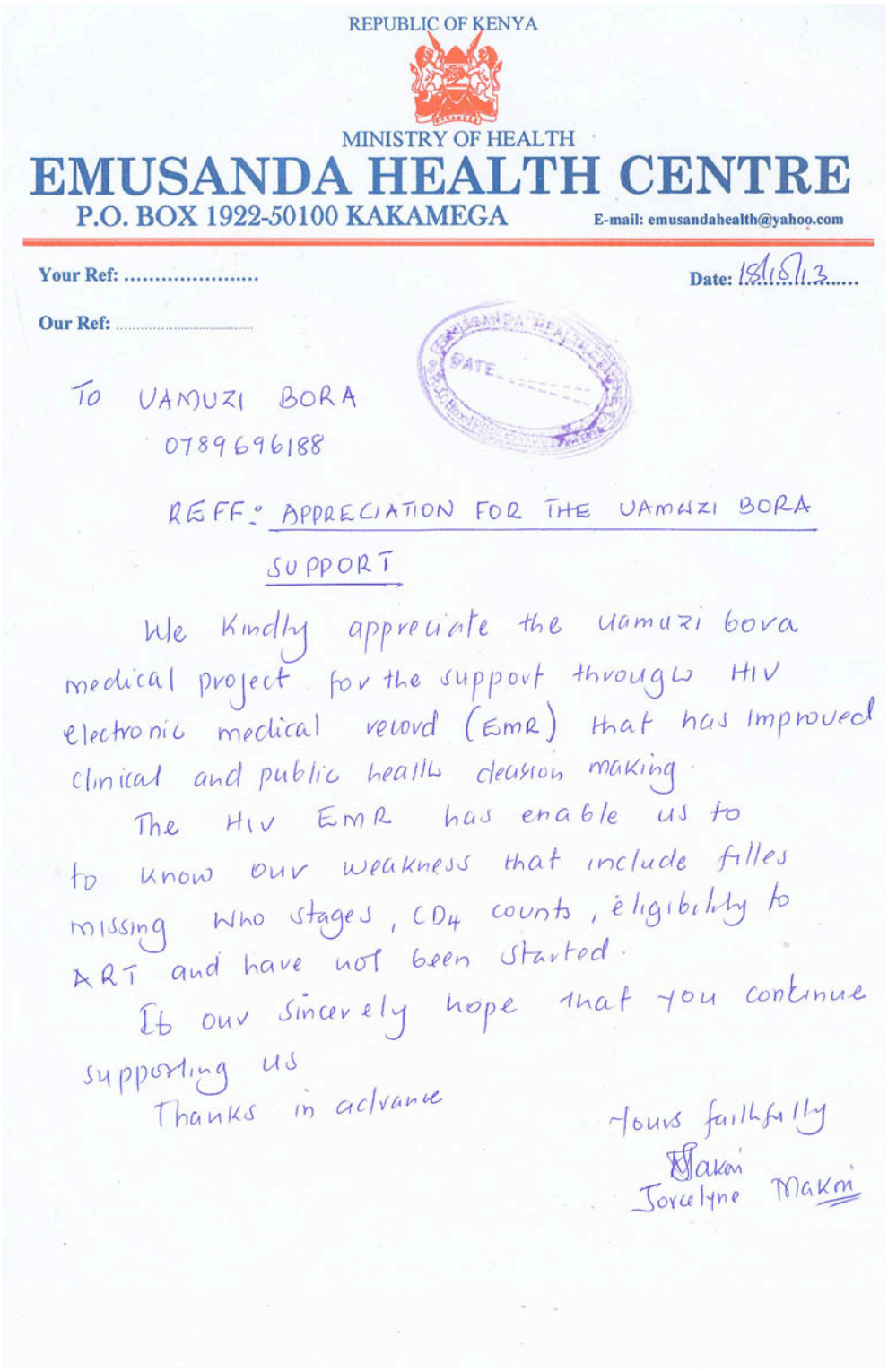
On behalf of the entire Bushili staff and community we would like to thank the partnership that has made significant improvement in clinical indicators of our patients.

I therefore agree to support the covering of staff as much as possible where we can.

Yours faithfully,

Janerose Juma
Nursing in charge
0721 712 413

4.4 Emusanda Health Centre



REPUBLIC OF KENYA

MINISTRY OF HEALTH

EMUSANDA HEALTH CENTRE

P.O. BOX 1922-50100 KAKAMEGA E-mail: emusandahealth@yahoo.com

Your Ref: .....

Date: 18/10/13.....

Our Ref: .....

GATE

TO UAMUZI BORA

0789696188

REFF: APPRECIATION FOR THE UAMUZI BORA SUPPORT

We kindly appreciate the uamuzi bora medical project for the support through HIV electronic medical record (EMR) that has improved clinical and public health decision making

The HIV EMR has enable us to to know our weakness that include filles missing who stages, CD_4 counts, eligibility to ART and have not been started.

It our sincerely hope that you continue supporting us

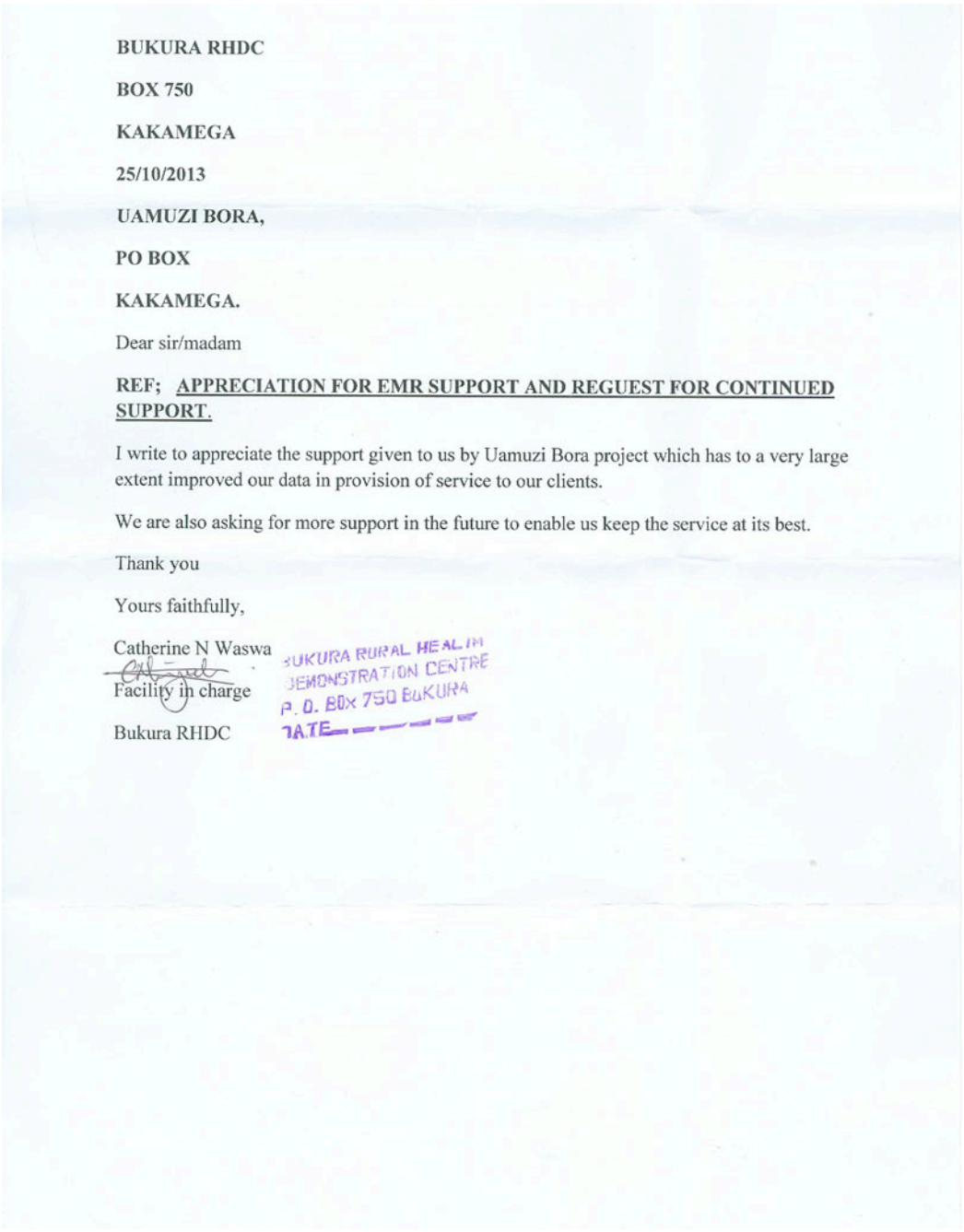
Thanks in advance

Yours faithfully

Makm

Joycelyne Makm

4.5 Bukura Health Centre



BUKURA RHDC

BOX 750

KAKAMEGA

25/10/2013

UAMUZI BORA,

PO BOX

KAKAMEGA.

Dear sir/madam

REF; APPRECIATION FOR EMR SUPPORT AND REGUEST FOR CONTINUED SUPPORT.

I write to appreciate the support given to us by Uamuzi Bora project which has to a very large extent improved our data in provision of service to our clients.

We are also asking for more support in the future to enable us keep the service at its best.

Thank you

Yours faithfully,

Catherine N Waswa
Facility in charge
Bukura RHDC

BUKURA RURAL HEALTH
DEMONSTRATION CENTRE
P. O. BOX 750 BUKURA
DATE

Appendix 5. Ministry of Health letters regarding the MCH EMR

5.1 Seme Sub-County Medical Officer of Health

MINISTRY OF HEALTH

Telegrams: "Health"
Tel: 020-2082363

E-mail:
mohsemesubcounty@gmail.com

MEDICAL OFFICER OF HEALTH
SEME SUB COUNTY
P.O. BOX 60
KOMBEWA

25rd Oct, 2011

The Director,
Uamuzi Bora Project
Kakamega **(Att. Dr. John Haskew)**

RE: MCH ELECTRONIC MEDICAL RECORDS (MCH EMR) IN SEME SUB-COUNTY

In regards to the above subject we wish to convey our sincere appreciation for the great support you offered to Seme Sub County (formerly Kisumu West District), during the pilot phase of MCH EMR project. The project was piloted in 5 health facilities in the sub county, namely; Kombewa, Manyuanda, Rodi, Bodi and Bar korwa.

The overall objective of MCH EMR project was to improve the quality of Maternal and Child Health Care through the use of electronic medical records.

Highlights on the achievements made as at 23.10.2013 are as below:-

- Total pregnant women enrolled 1182
- Total deliveries registered 269
- Total children enrolled 464
- HIV pregnant women on ART prophylaxis 81
- Complete records 753

The Sub County however has some challenges with regards to sustainability of the project some of which are as enumerated below:

- Low pace of dissemination of EMR system to other staff attributed to competing tasks and limited skills in computer operation by other staff members
- Continuity of data entry after exit of data entry assistants due to low staffing and therefore over stretched schedule
- Network connectivity fluctuation making it hard to register all clients on the affected days
- Sustainability and rolling out to other facilities due to lack of enough chrome books, airtime for internet connectivity and trained personnel

Faced with the reality of the above challenges and the need to sustain the system, the Sub County Health Management Team requests that;

JICA to continue supporting

- Data entry assistant in each health facility

- Further training of staff on MCH EMR system
- Continuous support supervision

Uamuzi Bora to further support:
- OJT, mentorship and support supervision
- maintenance of chrome books
- Provision of chrome books
- Airtime for internet connectivity
- To further improve on the system so that it could be used offline to take care of clients missing during poor internet connection times

Ministry of Health to support with:
- Additional technical staff (Nurses, HRIO's and RCOs) to the health facilities
- Support supervision, OJT and mentorship to lower level facilities

Attached please find scanned reports from individual pilot facilities on the same.

Thanks for your continued cooperation and support.

NICHOLUS PULE
Ag. Medical Officer of Health
Seme Sub County

5.2 Rodi Dispensary

RODI DISPENSARY
P.O BOX 10
PAW-AKUCHE
16/10/2013

DISTRICT MEDICAL OFFICER OF HEALTH,
SEME DISTRICT,
P.O BOX 60
KOMBEWA

RE: SUSTAINABILITY OF MCH EMR PROJECT

Following the MCH EMR piloting project at Rodi dispensary, the facility had the following achievements

i. Easy follow- up of ANC clients
ii. Easy access of clients records
iii. Monthly facility records is easily generated

The following challenges were also noted.

i. Lack of enough staff
ii. Insufficient funds for sustainability
iii. Network failure

Due to the above challenges the facility is unable to sustain the project due to insufficient funds to enable the facility deal with the challenges.
It is for this reason that we are requesting your office to assist the facility sustain the project.

Thanks in advance.

RODI DISPENSARY
P.O. BOX 10 PAW AKUCHE
DATE 16/10/13
SIGN

NORAH ODHIAMBO
FACILITY I/C
RODI DISPENSARY

5.3 Manyuanda Health Centre

MINISTRY OF PUBLIC HEALTH & SANITATION

Telegrams: "Health"
Tel: 073558700/0723862185

E-mail: pscmanyuanda@gmail.com

MANYUANDA HEALTH CENTRE
KISUMU WEST DISTRICT
P.O. BOX 94
KOMBEWA

16/10/2013.

To

The DMOH SEME SUB COUNTY

P.O BOX 60

KOMBEWA.

Dear Sir/Madam

RE:MOTHER CHILD HEALTH ELECTRONIC MEDICAL RECORDS.

Manyuanda health centre is a high work load facility serving a population of 13,524 clients annually with 3083 women of reproductive age and 475 children less than one year. We have one health records officer who also doubles up as a data entry clerk in the CCC with at list 2 nurses on duty each day having to rotate in the maternity, injection, Child welfare clinic, postnatal, antenatal and the PMTCT room.

We appreciate and embrace technology because it has helped us improve on client follow up and management. We have noted with a lot of concern that documentation is a challenge in our facility; having to use the register and at the same time do entries in the chrome book is a challenge. We as a facility are not able to employ the services of a data clerk because of financial constraints. We therefore request your humble office to consider employing us a data clerk for the betterment of our data caption in the facility to improve on clients' management and evidence based decision making.

Thank you in advance hoping this request is considered.

Zablon Kerimo

Clinical Officer I/C

5.4 Bodi Health Centre

BODI HEALTH CENTRE
P.O BOX 60,
KOMBEWA
16/10/2013

MOH SEME SUBCOUNTY
P.O. BOX 60,
KOMBEWA

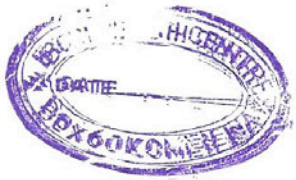
RE: MCH E.M.R

Following the introduction of MCH/ EMR in our facility, the activity went on very well and active for some months then it went sluggishly there after.

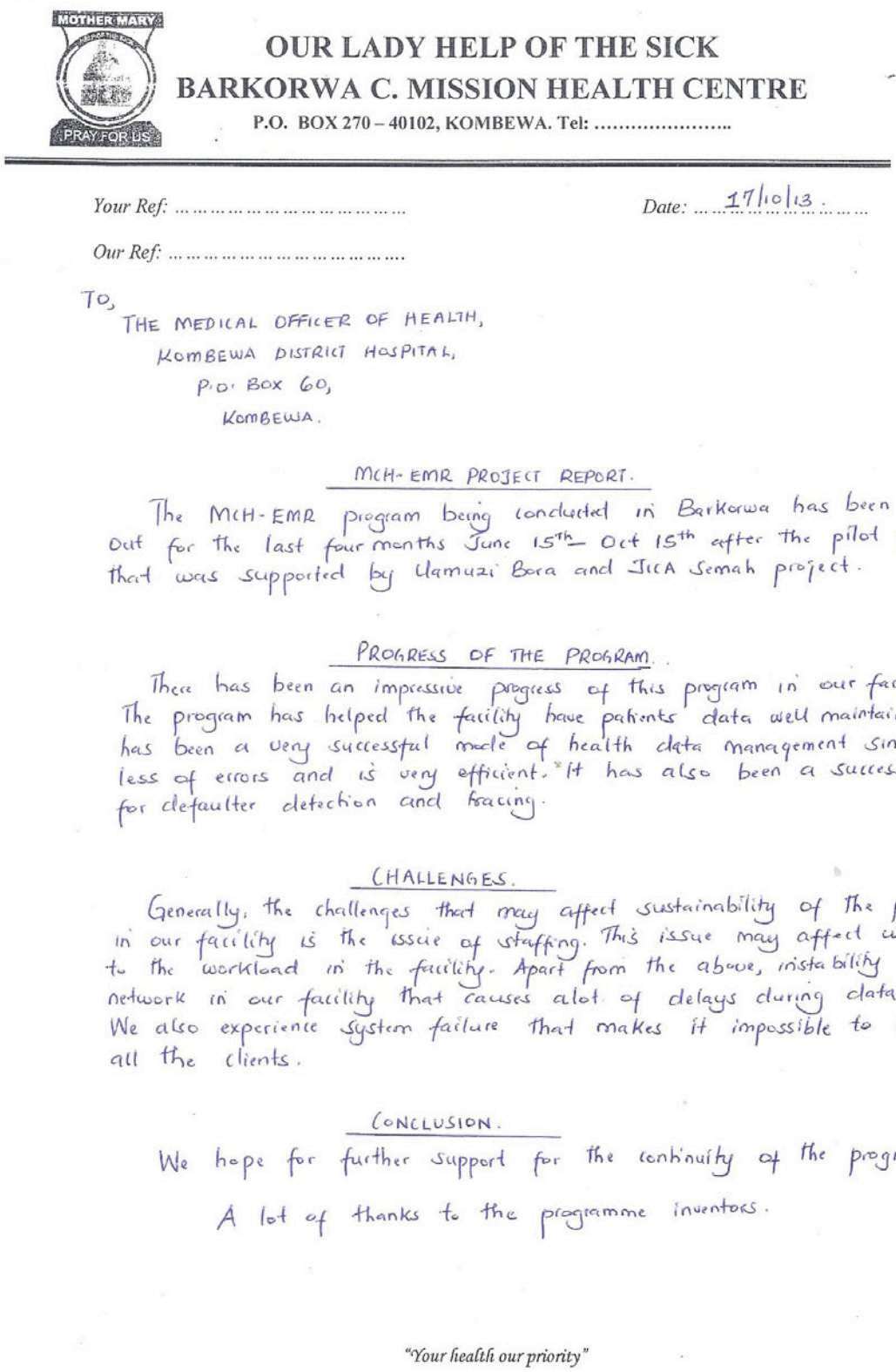
The activity is unsustainable given shortage of staffs and proper training on how to use the chrome book, coupled with lack of motivation for the persons doing the job.

Yours faithfully

ROSELYNE OMONDI
FACILITY IN- CHARGE



5.5 Bar Korwa Health Centre



OUR LADY HELP OF THE SICK
BARKORWA C. MISSION HEALTH CENTRE
P.O. BOX 270 – 40102, KOMBEWA. Tel: .....

Your Ref: ..... *Date:* 17/10/13

Our Ref: .....

TO,
THE MEDICAL OFFICER OF HEALTH,
KOMBEWA DISTRICT HOSPITAL,
P.O. BOX 60,
KOMBEWA.

MCH-EMR PROJECT REPORT.

The MCH-EMR program being conducted in Barkorwa has been carried out for the last four months June 15th – Oct 15th after the pilot phase that was supported by Uamuzi Bora and JICA Semah project.

PROGRESS OF THE PROGRAM.

There has been an impressive progress of this program in our facility. The program has helped the facility have patients data well maintained. It has been a very successful mode of health data management since it is less of errors and is very efficient. It has also been a successful tool for defaulter detection and tracing.

CHALLENGES.

Generally, the challenges that may affect sustainability of the project in our facility is the issue of staffing. This issue may affect us due to the workload in the facility. Apart from the above, instability of network in our facility that causes alot of delays during data entry. We also experience system failure that makes it impossible to capture all the clients.

CONCLUSION.

We hope for further support for the continuity of the programme.

A lot of thanks to the programme inventors.

"Your health our priority"

5.5 Kombewa Health Centre

MINISTRY OF MEDICAL SERVICES

Telegrams: "Health"
Tel: 0712077007

E-mail: medsupkombewa@gmail.com

MEDICAL SUPERINTENDENT
KOMBEWA DISTRICT HOSPITAL
P.O. BOX 60
KOMBEWA

Date: 15/10/2013

DEPARTMENT OF HEALTH RECORDS & INFORMATION

RE: MCH - ELECTRONIC MEDICAL RECORDS (EMR) PERFORMANCE REPORT

The electronic medical records - MCH piloting initially started at a low pace but gradually picked up and progressed well with a good population up to now having been captured.

The activity has been kept on-going, that is, data entry, by the HRIO i/c and his assistant (HRIT). However, the latter has been mostly hands on due to competing tasks to the former but this never contributed adversely to the quality of the information.

We (the facility) are now able to generate reports that show the performance and status as concerns the service.

Challenges

- Competing tasks
- High workload
- Staff shortage since those trained have additional professional responsibilities
- Inconsistent network that derails continuity of the service.

Way forward

- Deployment of at least one (1) permanent HRIT to man the service
- Introduction of dual simcard to alleviate frequent network loss.
- Motivation-Award of certificates to those trained.

Tom Odhiambo
For: Med.Supt.
KOMBEWA SUBCOUNTY HOSPITAL