Implementing an Electronic Medical Record in Kenya: *Lessons from Eldoret*

William M. Tierney, MD

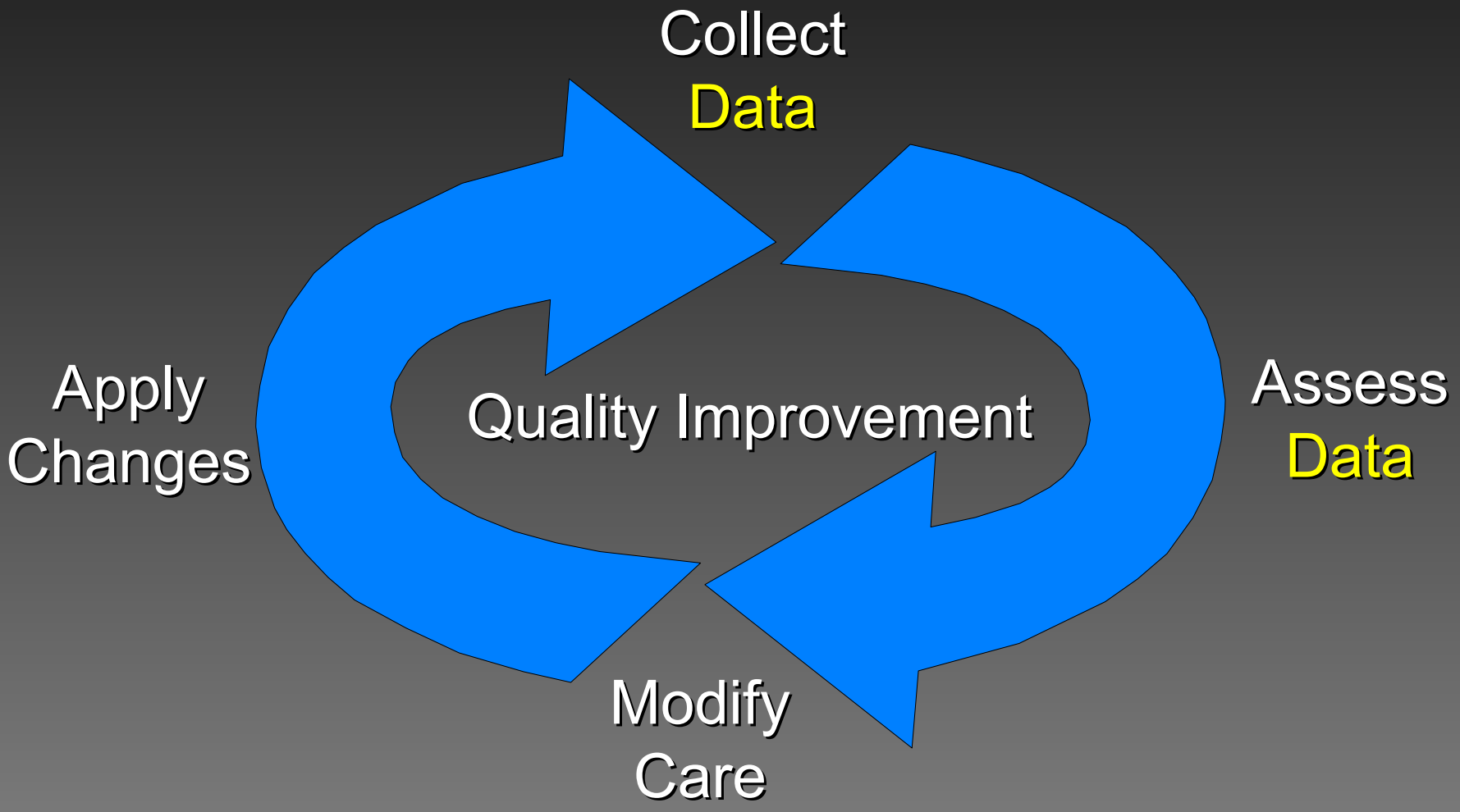
Indiana University School of Medicine
and the Regenstrief Institute
-- Indianapolis, IN --

Moi University Faculty of Health Sciences
-- Eldoret, Kenya --

Information is care.

Don Berwick

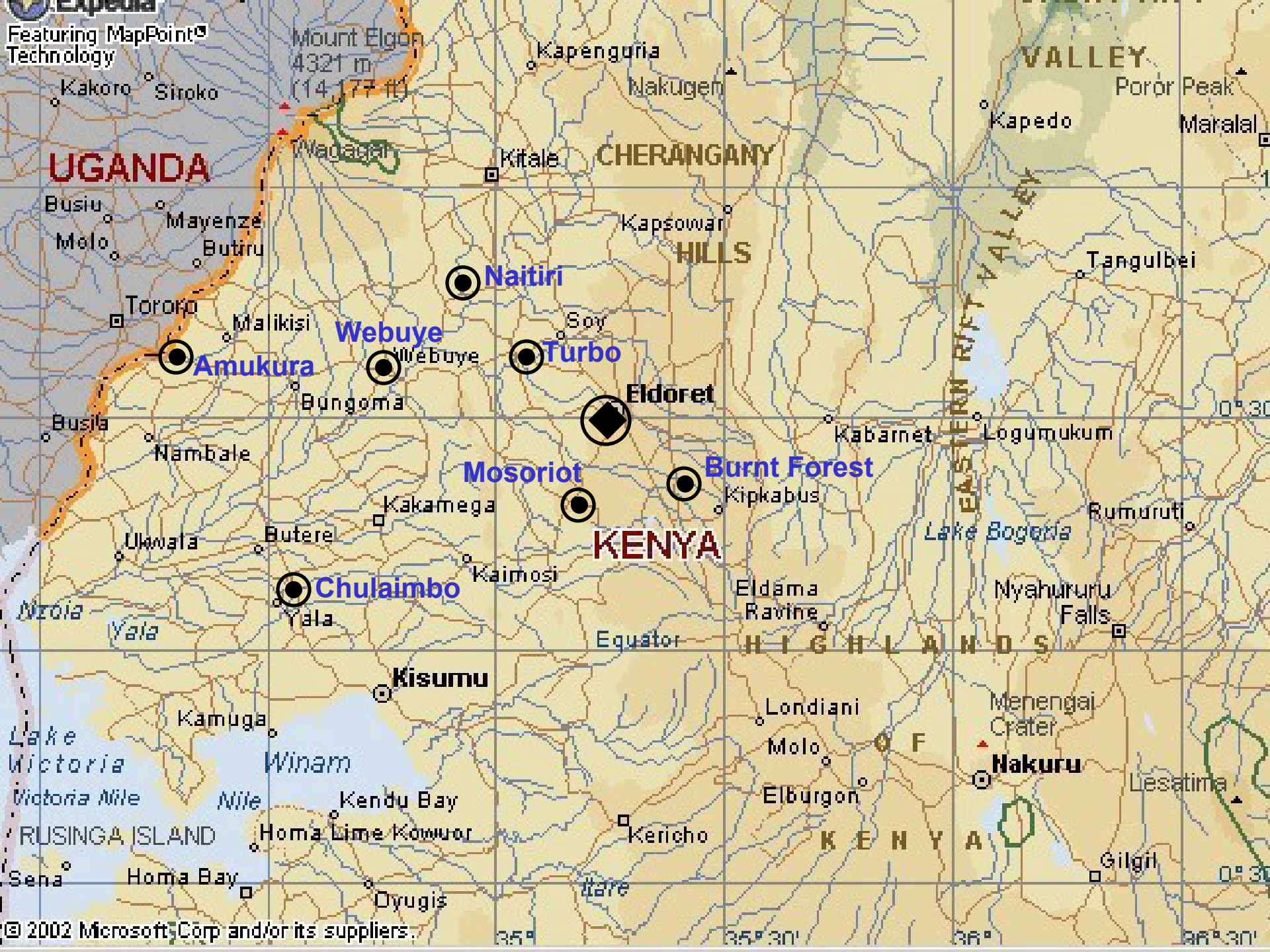
Continuous quality improvement



Informatics initiative

- NIH Fogarty Center's ITMI program ('98-'05)
  - informatics training in sub-Saharan Africa
  - focus on educating a small # of African fellows
- Indiana proposal: use informatics to support
  - a model EMR at the Mosoriot Rural Health Center
  - use it to support clinical care and research


SUDAN
ETHIOPIA
Lodwar
Lake Rudolf
Moyale
Marsabit
UGANDA
Wajir
GREAT RIFT VALLEY
SOMALIA
KENYA
Eldoret
Mount Kenya
Meru
Kisumu
Nakuru
Garissa
HIGHLANDS
Lake Victoria
NAIROBI
Machakos
Lamu
Malindi
TANZANIA
INDIAN OCEAN
Mombasa
0 100 200 km
0 100 200 mi


Expedia
Featuring MapPoint® Technology
Mount Elgon
4321 m
(14,177 ft)
Kapenguria
Nakugen
VALLEY
Poror Peak
Kakoro
Siroko
Kapedo
Maralal
UGANDA
Wadagali
Kitale
CHERANGANY
Busiu
Mayenze
Molo
Butiru
Kapsowar
HILLS
Naitiri
Tangulbei
Tororo
Malikisi
Webuye
Soy
Amukura
Webuye
Turbo
EASTERN RIFT VALLEY
Bungoma
Eldoret
Busia
Nambale
Kabarnet
Logumukum
Mosoriot
Burnt Forest
Kipkabus
Kakamega
Rumuruti
Lake Bogoria
Ukwala
Butere
KENYA
Kaimosi
Chulaimbo
Eldama Ravine
Nyahururu Falls
Nzoia
Yala
Yala
Equator
HIGHLANDS
Kisumu
Londiani
Menengai Crater
Kamuga
Lake Victoria
Winam
Molo
OF
Nakuru
Victoria Nile
Nile
Kendu Bay
Elburgon
Lesatima
RUSINGA ISLAND
Homa Lime
Kowuor
Kericho
KENYA
Sena
Homa Bay
Oyugis
Gilgil
Itare
© 2002 Microsoft Corp and/or its suppliers.
35°
35° 30'
36°
36° 30'
0° 30
0° 30

Why Mosoriot?

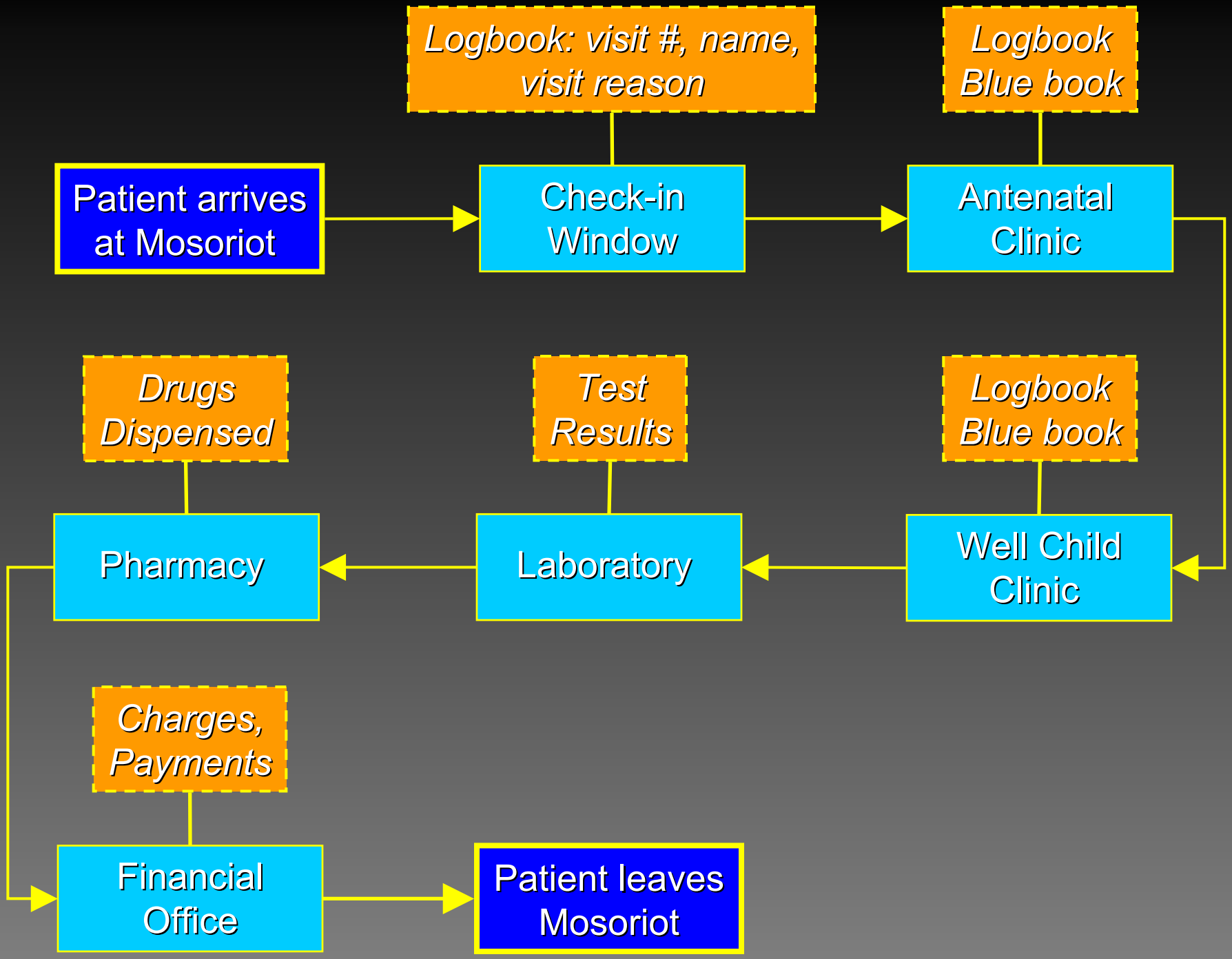
- Closest rural health center to Eldoret (25 km)
- Full-service primary care health center
  - adult medicine
  - pediatrics, well child
  - antenatal, family planning, STI
  - 20-bed inpatient unit
- Progressive leaders → interested in an EMR
- Small enough to accomplish our goals


APC
ELDORET
D. ALI O. BK.


REPUBLIC OF KENYA
REPUBLIC OF KENYA
REPUBLIC OF KENYA
REPUBLIC OF KENYA
Back-UPS Pro

Conceptualizing the MMRS

- Understand current care processes, needs
- Identify inefficiencies in care
- Anticipate problems with conversion to EMR
- Get input from Mosoriot personnel
  - approaches to design and implementation
  - likely problems, barriers
  - potential solutions
  - feeling of ownership → buy-in!

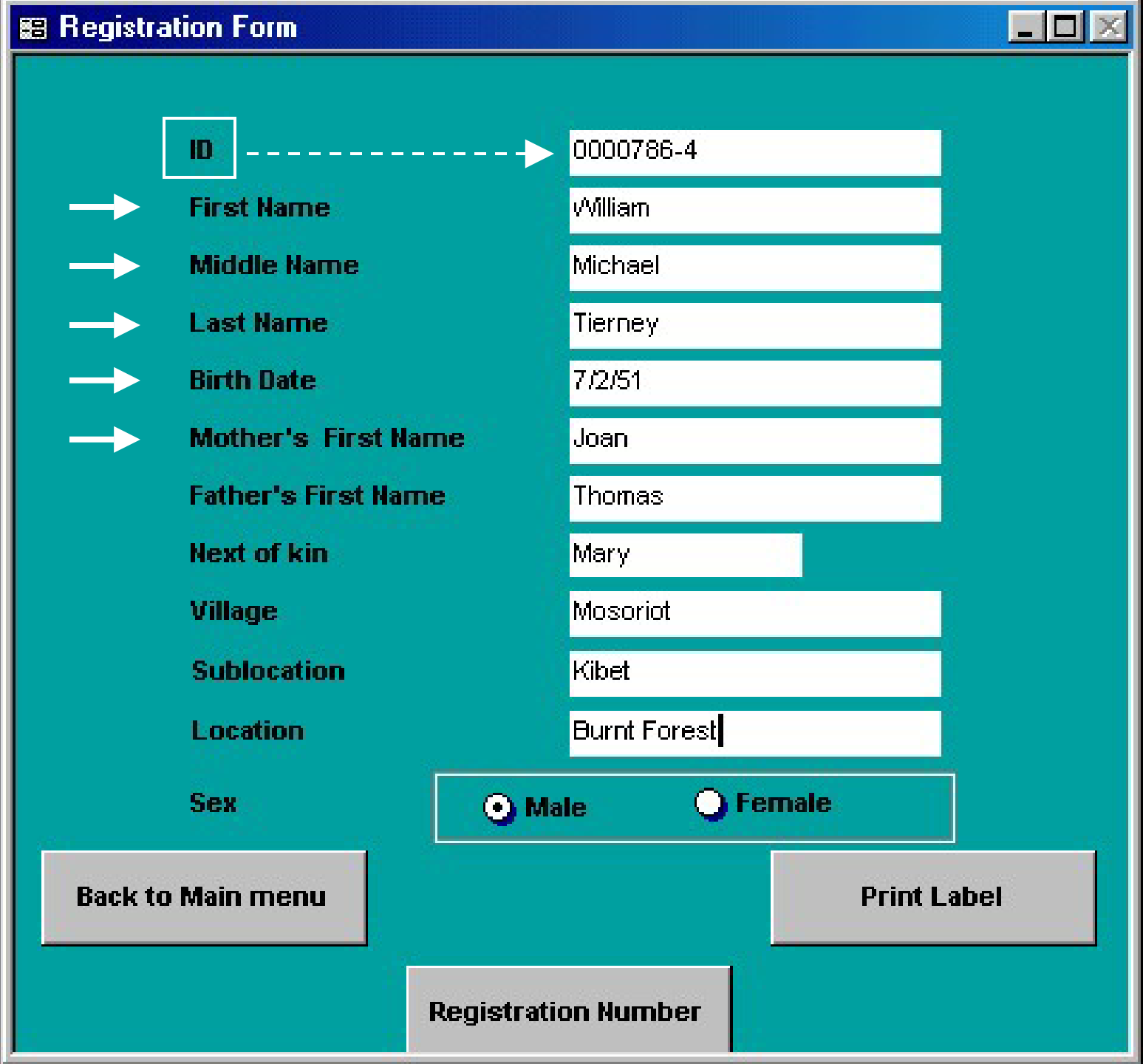

Logbook: visit #, name, visit reason
Logbook Blue book
Patient arrives at Mosoriot
Check-in Window
Antenatal Clinic
Drugs Dispensed
Test Results
Logbook Blue book
Pharmacy
Laboratory
Well Child Clinic
Charges, Payments
Financial Office
Patient leaves Mosoriot

Conceptualizing the MMRS

- Design decisions
  - keep it simple, inexpensive → sustainable
  - run on a single microcomputer
  - multiple redundant power sources
  - frequent back-up of data
  - program in MS-Access®

Designing the MMRS

- Structure
  - registration module


Registration Form
ID
0000786-4
First Name
William
Middle Name
Michael
Last Name
Tierney
Birth Date
7/2/51
Mother's First Name
Joan
Father's First Name
Thomas
Next of kin
Mary
Village
Mosoriot
Sublocation
Kibet
Location
Burnt Forest
Sex
Male
Female
Back to Main menu
Print Label
Registration Number


MOSORIOT Rural Health Centre
Mary Meringo Shiunira
40111-7
Langas Village

Designing the MMRS

- Structure
  - registration module
  - paper encounter form

Mosoriot Health Center Encounter Form

Number: _____

Name: _____

Age: _____

SEX: M F

Reason for Visit:

- ☐ Antenatal care
- ☐ Child under 5
- ☐ Family Planning

Problems: _____

_____

_____

Ancillary Services Used:

Laboratory:

- ☐ HB: _____
- ☐ Urinalysis
- ☐ Stool Exam
- ☐ HIV antibody

☐ X-ray: _____

Final Diagnosis:

_____

_____

_____

Antenatal Care:

Est. Delivery Date: _____

Blood Pressure: _____

Weight: _____

Fetal Height: _____

Blood Sugar: _____

Child Care Under 5 Years:

Height: _____

Weight: _____

- ☐ DPT given
- ☐ Polio given:
- ☐ BCG given:
- ☐ Measles given
- ☐ Mumps given
- ☐ Other: _____

Family Planning:

- ☐ Counseling
- ☐ Depo-Provera
- ☐ Condoms
- ☐ Other: _____

Pediatric Notes:

_____

_____

_____

Adult Medicine Notes:

Blood Pressure: _____

_____

_____

_____

Drugs Dispensed:

_____

_____

_____

Injections Given:

- ☐ _____
- ☐ _____
- ☐ _____

Referral:

- ☐ Admit to Mosoriot inpatient unit
- ☐ Eldoret Teaching & Referral Hospital
- ☐ Kisumu District Hospital
- ☐ Kenyatta national Hospital, Nairobi
- ☐ Other: _____

Financial Office:

Paid

Item: _____ Ksh: _____ ☐

Item: _____ Ksh: _____ ☐

Item: _____ Ksh: _____ ☐

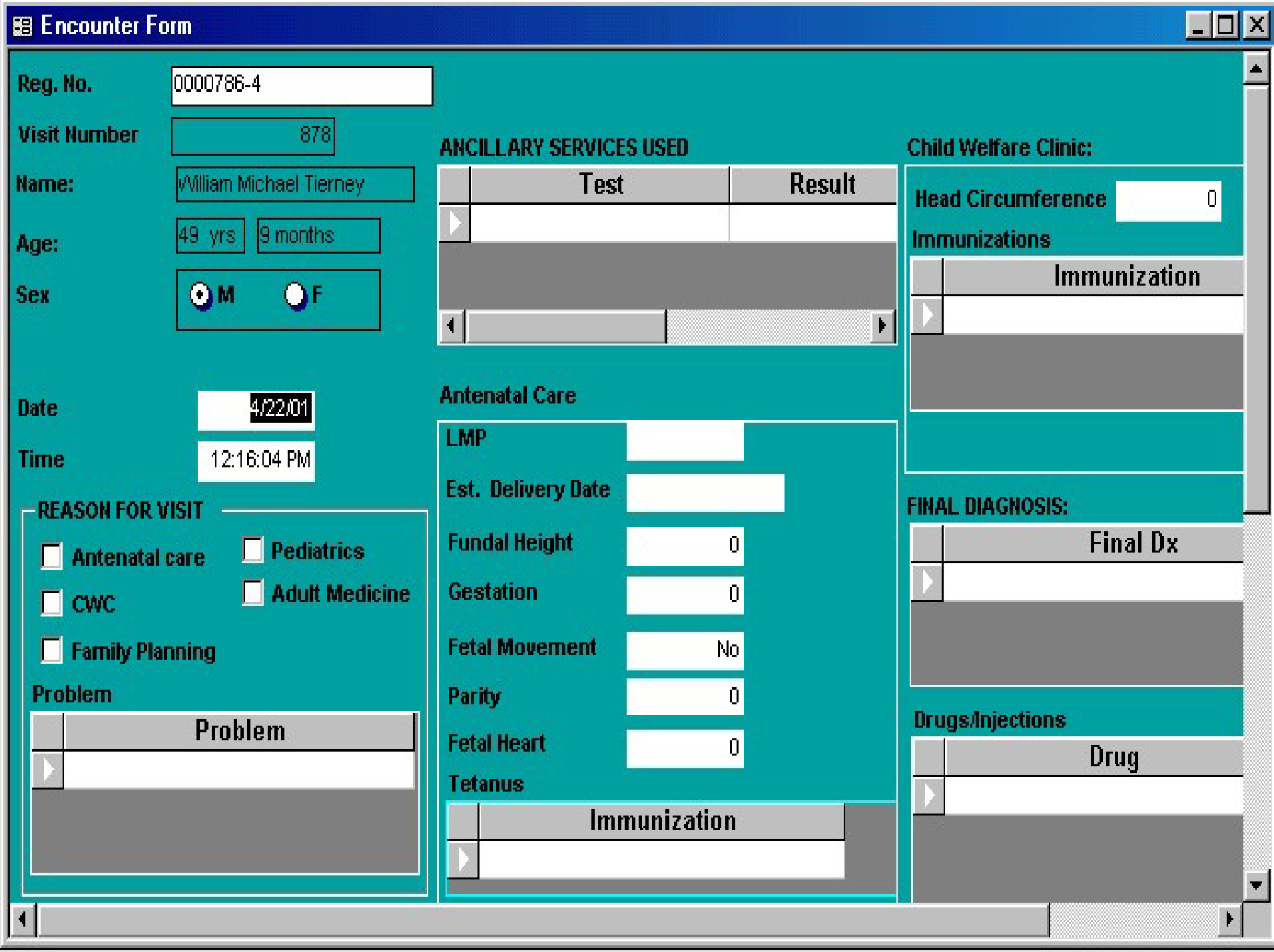
Item: _____ Ksh: _____ ☐

Next Visit:

Date: _____

Designing the MMRS

- Structure of the MMRS = modular
  - registration module
  - paper encounter form
  - data entry module


Encounter Form
Reg. No.
0000786-4
Visit Number
878
Name:
William Michael Tierney
Age:
49 yrs
9 months
Sex
M
F
Date
4/22/01
Time
12:16:04 PM
REASON FOR VISIT
Antenatal care
Pediatrics
CWC
Adult Medicine
Family Planning
Problem
Problem
ANCILLARY SERVICES USED
Test
Result
Antenatal Care
LMP
Est. Delivery Date
Fundal Height
0
Gestation
0
Fetal Movement
No
Parity
0
Fetal Heart
0
Tetanus
Immunization
Child Welfare Clinic:
Head Circumference
0
Immunizations
Immunization
FINAL DIAGNOSIS:
Final Dx
Drugs/Injections
Drug

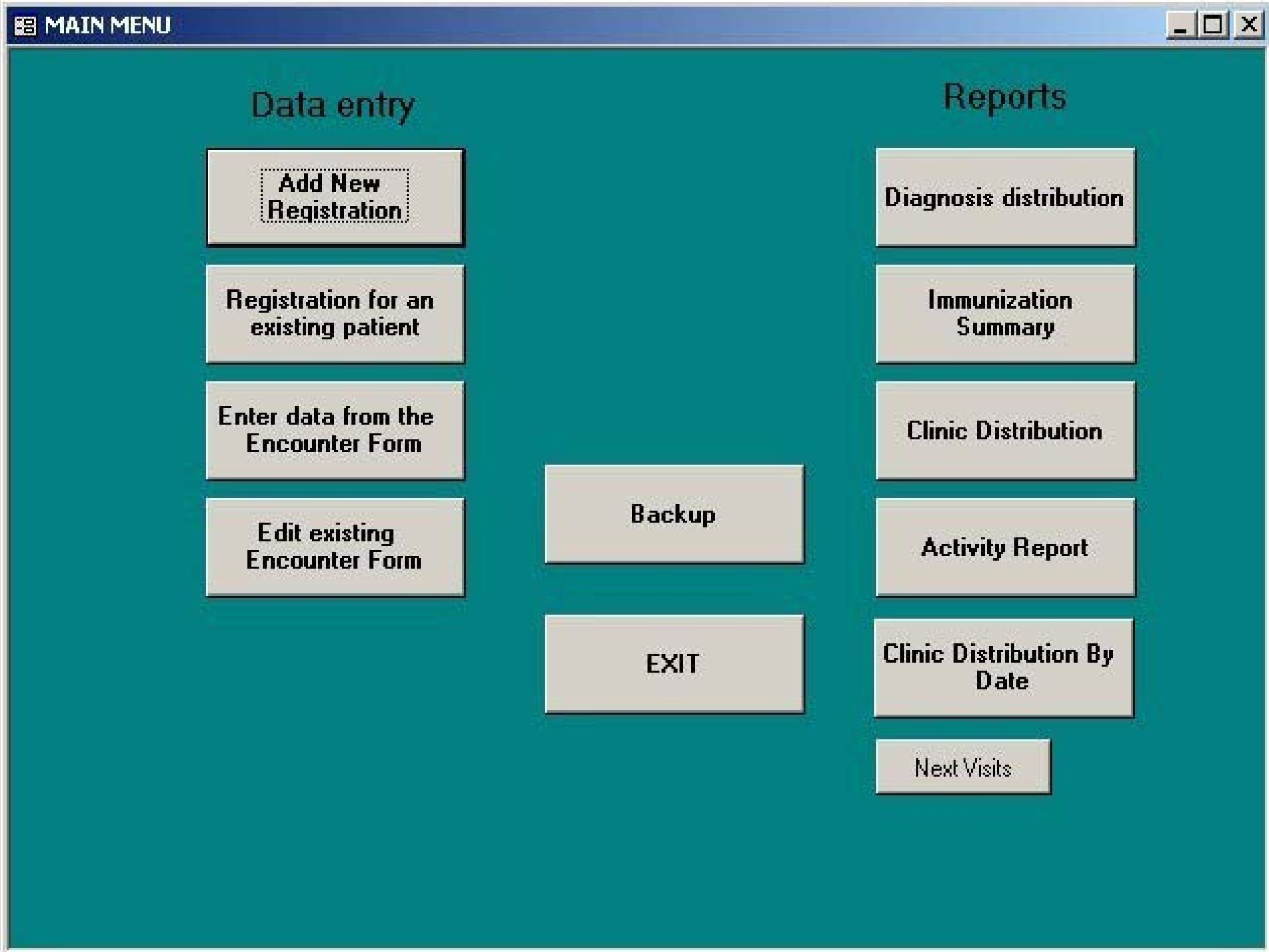
Designing the MMRS

- Structure
  - registration module
  - paper encounter form
  - data entry program
  - data dictionary

ID	TERM NAME	ReferenceTerm	TERM TYPE	SYSTEM	ICD10	TERM DESCRITPTORS	Defa
101	ABDOMINAL X-RAY	ABDOMINAL X-RAY	TEST	RADIOLOGY		radiograph of the abdomen	
514	ABNORMAL	ABNORMAL	DIAGNOSIS	TEST RESULT		non-specific abnormality on a test	0
186	ABORTION	ABORTION	DIAGNOSIS	OB-GYN	O06	loss of a fetus, either by miscarriage or extirpatio	0
187	ABORTION, INCOMPLETE	ABORTION, INCOMPLETE	DIAGNOSIS	OB-GYN	O06	miscarriage with incomplete evacuation of the ute	0
138	ABSCESS	ABSCESS	DIAGNOSIS	INFECTION	L02.9	loculated (closed space) infection of skin or other	0
84	ACCIDENT NOS	ACCIDENTS NOS	DIAGNOSIS	TRAUMA		non-purposeful trauma not specified elsewhere	
360	ACTIFED	ACTIFED	DRUG	DECONGESTANT		nasal decongestant	40
469	ACTIFED SYRUP	ACTIFED	DRUG	DECONGESTANT		nasal decongestant	40
406	ADALAT TABLETS	ADALAT	DRUG	ANTIHYPERTENSIV		drug for hypertension	40
346	ADRENALINE INJECTION	ADRENALINE INJECTION	DRUG	ANTIALLERGY		used for sever allergies with anaphylaxis	0
308	AFB SMEAR SPUTUM	SPUTUM FOR AFB	TEST	INFECTION		ZN stain for tuberculosis	70
104	AIDS	AIDS	DIAGNOSIS	INFECTION	B24	HIV positive with an AIDS-defining infection	
721	ALBUMIN POS	PROTEIN POS	TEST	TEST RESULT		presence of protein on dipstick exam	0
720	ALBUMIN POSITIVE	PROTEIN POS	TEST	TEST RESULT		presence of protein on dipstick exam	0
650	ALC	ALC	DIAGNOSIS	LABORATORY		Total lymphocyte count	0
251	ALDOMET	ALDOMET	DRUG	ANTIHYPERTENSIV		centrally acting alpha blocker	40
462	ALLERGIC RASH	ALLERGIC RASH	DIAGNOSIS	DERMATOLOGY		rash as a result of a cutaneous allergy	0
372	ALLERGIC REACTION	ALLERGY NOS	DIAGNOSIS	IMMUNOLOGY	T78.4	unspecified allergic reaction	0
369	ALLERGIC RHINITIS	RHINITIS, ALLERGIC	DIAGNOSIS	INFECTION	J30.4	inflammation of the nasal passage due to infectio	0
142	ALLERGY NOS	ALLERGY NOS	DIAGNOSIS	IMMUNOLOGY	T78.4	unspecified allergic reaction	0
347	AMINOPHYLINE INJECTION	AMINOPHYLINE INJECTION	DRUG	BRONCHODILATOR		injection used for sever asthma	0
241	AMODIAQUIN	AMODIAQUIN	DRUG	ANTIBIOTIC		antimalarial	40
315	AMODIAQUIN SYRUP	AMODIAQUIN	DRUG	ANTIMALARIAL		antimalarial medication	0
124	AMOEBIASIS	AMOEBIASIS	DIAGNOSIS	INFECTION	A06.9	intestinal infection with amoebae	0
723	AMORPHOUS PHOS CRYSTALS	AMORPHOUS PHOS CRYSTALS	TEST	TEST RESULT		non-specific phosphate crystals on urinalysis	0
722	AMORPHOUS PHOSPHATE CRYS	AMORPHOUS PHOS CRYSTALS	TEST	TEST RESULT		non-specific phosphate crystals on urinalysis	0
265	AMOXICILLIN	AMOXICILLIN	DRUG	ANTIBIOTIC		penicillin-based antiobitic used in upper respiratory	40
264	AMOXYL	AMOXICILLIN	DRUG	ANTIBIOTIC		penicillin-based antiobitic used in upper respiratory	40
352	AMOXYL SYRUP	AMOXICILLIN	DRUG	ANTIBIOTIC		oral antibiotic in syrup form	0
269	AMPICILLIN	AMPICILLIN	DRUG	ANTIBIOTIC		penicillin-based antiobitic used in upper respiratory	40
293	AMPICILLIN INJECTION	AMPICILLIN INJECTION	DRUG	ANTIBIOTIC		injectable broader spectrum penicillin-based antibic	40
294	AMPICLOX	AMPICLOX	DRUG	ANTIOTIC		combination antibiotic of Ampicillin 500mg + Cloxa	40
333	AMPICLOX NEONATAL DROPS	AMPICLOX	DRUG	ANTIBIOTIC		antibiotic drops for neonates	0
335	AMPICLOX SUSPENSION	AMPICLOX	DRUG	ANTIBIOTIC		Combination of Ampicillin and Cloxacillin in susper	0
3	ANAEMIA NOS	ANAEMIA NOS	DIAGNOSIS	HEMATOLOGY	D64.9	anemia not specified by other terms	
1	ANEMIA BLOOD LOSS	ANEMIA BLOOD LOSS	DIAGNOSIS	HEMATOLOGY	D50.0	anemia (low red blood count) due to bleeding-(CHF	
2	ANEMIA HEMOLYSIS	ANEMIA HEMOLYSIS	DIAGNOSIS	HEMATOLOGY	D58.9	anemia (low red blood count) due to cell lysis	
603	ANKLE REFELX	ANKLE REFLEX	DIAGNOSIS	NEUROLOGY		abnormalities of the ankle reflex	0
336	ANNUSOL SUPPOSITORIES	ANNUSOL SUPPOSITORIES	DRUG	ANTIINFLAMMATOR		rectal preparation for the treatment of hemorrhoids	0

Designing the MMRS

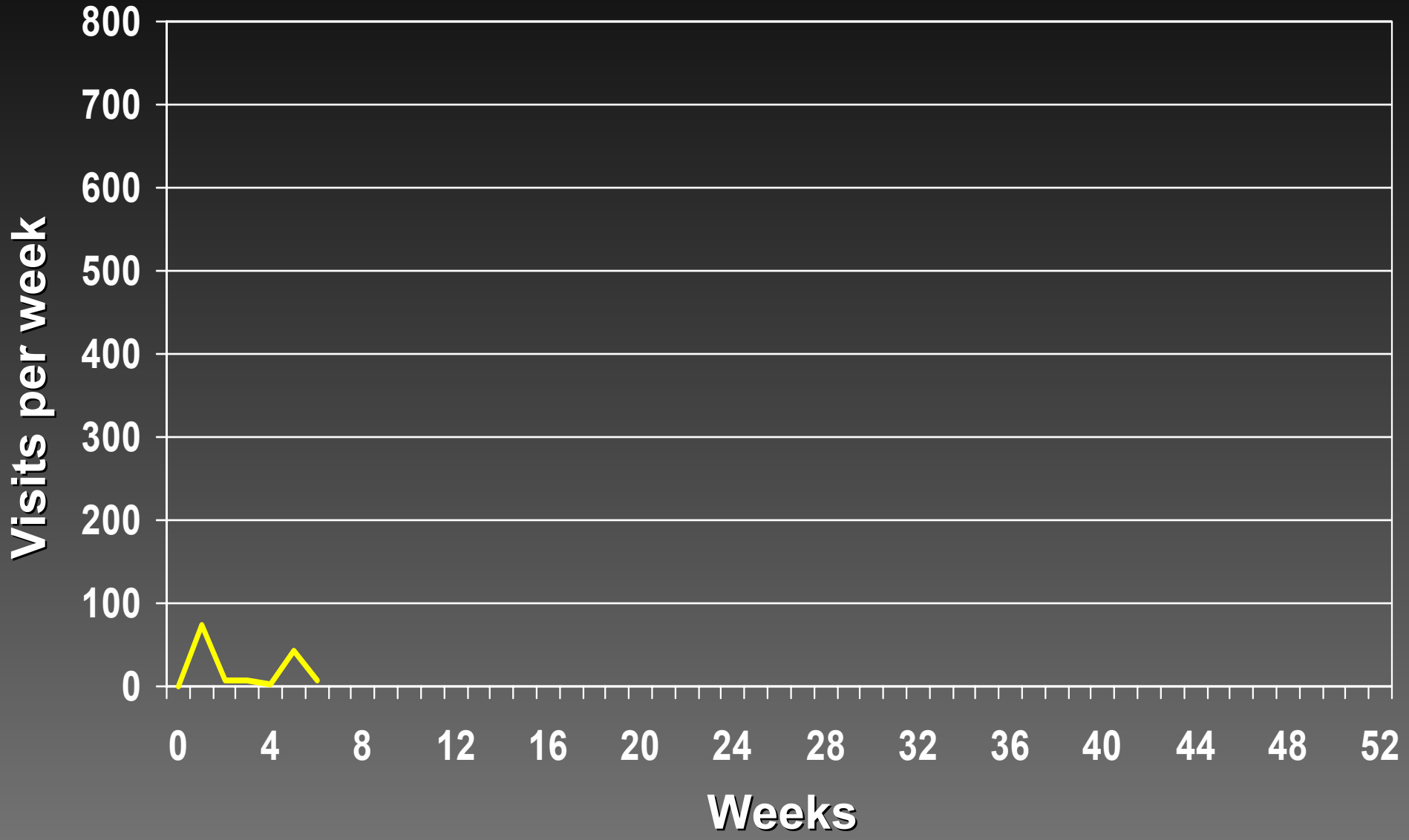
- Structure
  - registration module
  - paper encounter form
  - data entry program
  - data dictionary
  - report module


MAIN MENU
Data entry
Add New Registration
Registration for an existing patient
Enter data from the Encounter Form
Edit existing Encounter Form
Backup
EXIT
Reports
Diagnosis distribution
Immunization Summary
Clinic Distribution
Activity Report
Clinic Distribution By Date
Next Visits

Implementing the MMRS

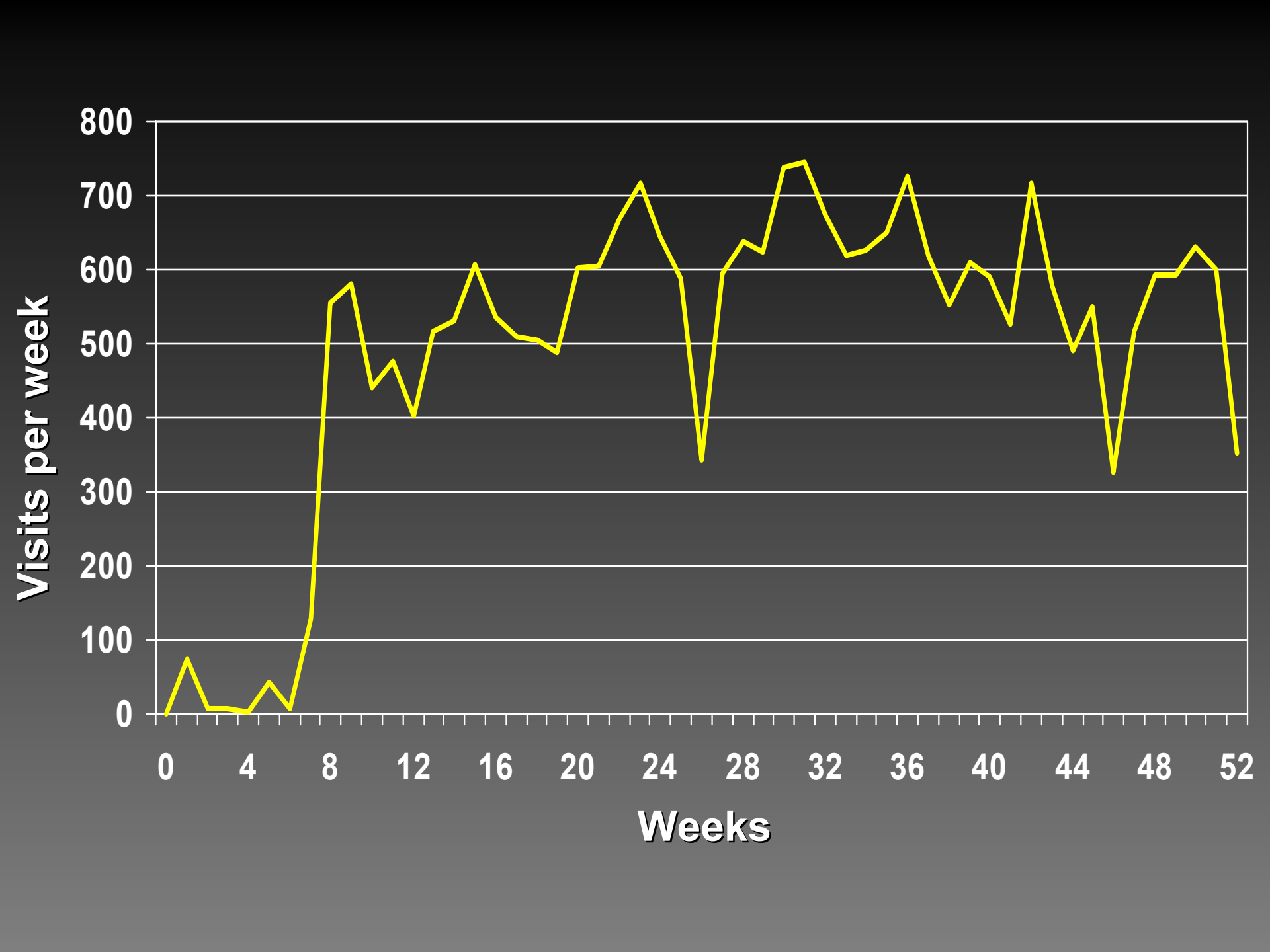
- Time line
  - Jan to Sept 2000 → program initial system
  - Sep to Dec 2000 → Mosoriot computer training
  - Dec to Feb 2001 → install and pilot test MMRS
  - February 3, 2001 → turn on MMRS


MINISTRY OF HEALTH
MOSORIOT RURAL HEALTH
TRAINING CENTRE
COMPAQ


800
700
600
500
400
300
200
100
0
Visits per week
0
4
8
12
16
20
24
28
32
36
40
44
48
52
Weeks

Implementing the MMRS

- Time line
  - Jan to Sept 2000 → program initial system
  - Sep to Dec 2000 → Mosoriot computer training
  - Dec to Feb 2001 → install and pilot test MMRS
  - February 3, 2001 → turn on MMRS
  - May 2001 → redesign MMRS, patient flow
    - add check-out computer linked to main MMRS
    - close a gate, preventing patient back exits
    - have Mosoriot employee direct patients


800
700
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500
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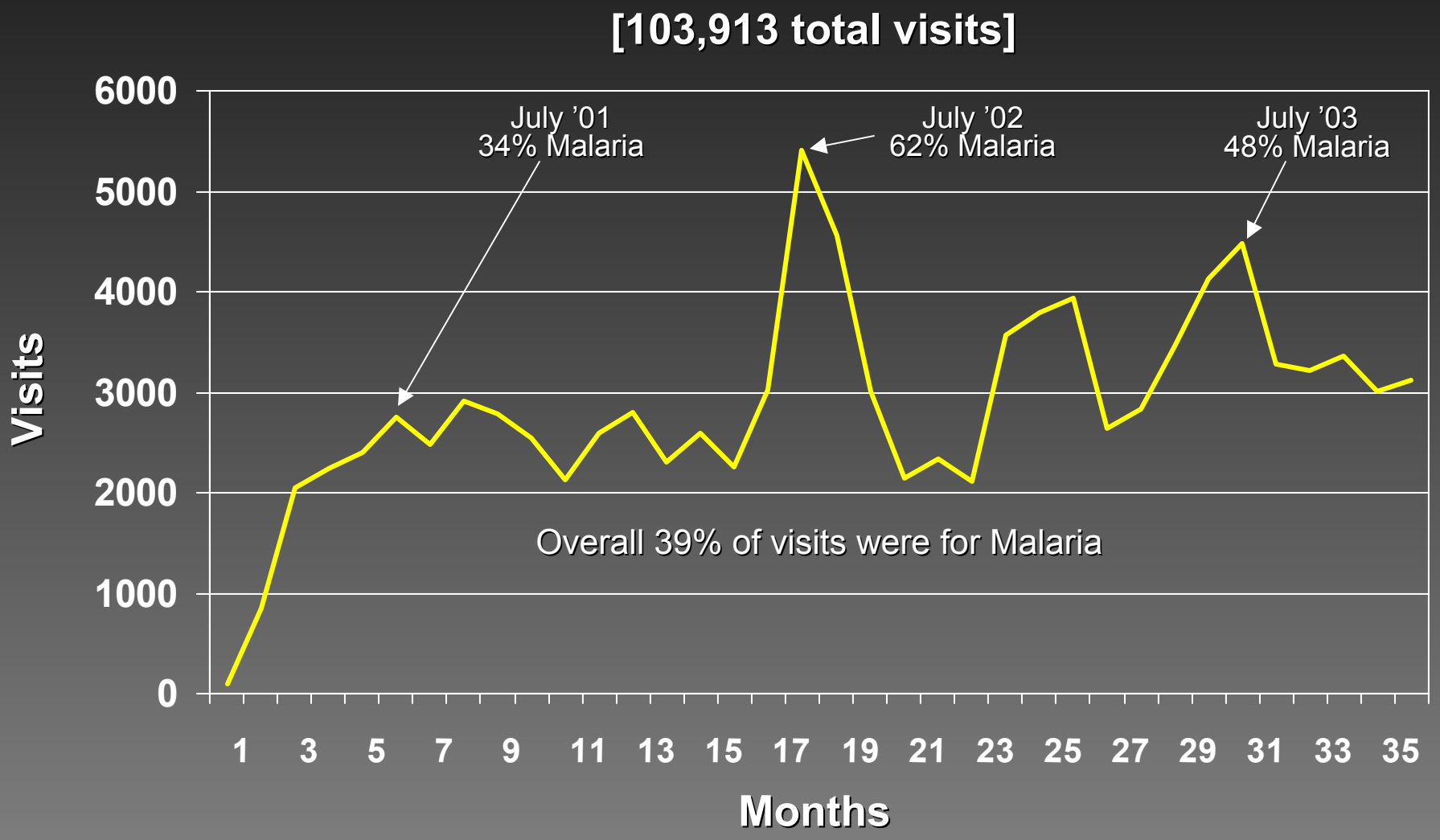
300
200
100
0
Visits per week
0
4
8
12
16
20
24
28
32
36
40
44
48
52
Weeks

Implementing the MMRS

- Time line
  - Jan to Sept 2000 → program initial system
  - Sep to Dec 2000 → Mosoriot computer training
  - Dec to Feb 2001 → install and pilot test MMRS
  - February 3, 2001 → turn on MMRS
  - May 2001 → redesign MMRS, patient flow
  - July 2001 → paper system discontinued
  - February 2004 → 103,910 visit records entered for more than 50,000 individual patients

Mosoriot Visits by Month
February 2001 to February 2004



MMRS data (2 years)

Clinic Site at Mosoriot	# Visits
Adult Medicine Clinic	22,103
Children Under 5 Clinic	11,946
Paediatric Clinic (≥5)	10,257
Antenatal Clinic	6,242
Family Planning Clinic	5,732
STI Clinic	395
Inpatient Ward	146

MMRS data (2 years)

Diagnoses	# Visits	Drugs	# Visits
Malaria	17,495	Paracetamol	24,944
URI	8,479	Fansidar	11,550
Septic wound	1,329	Quinine, injected	8,769
Gastroenteritis	964	Penicillin, injected	8,058
Tonsilitis	938	Quinine, oral	7,851
Wound (unspec.)	791	Penicillin, oral	4,753
Myalgia	700	Amoxicillin	4,725
Amebiasis	629	Depoprovera	4,443
Laceration	618	Piriton	3,766
Worms (unspec.)	544	Brufen	3,323

MMRS data (2 years)

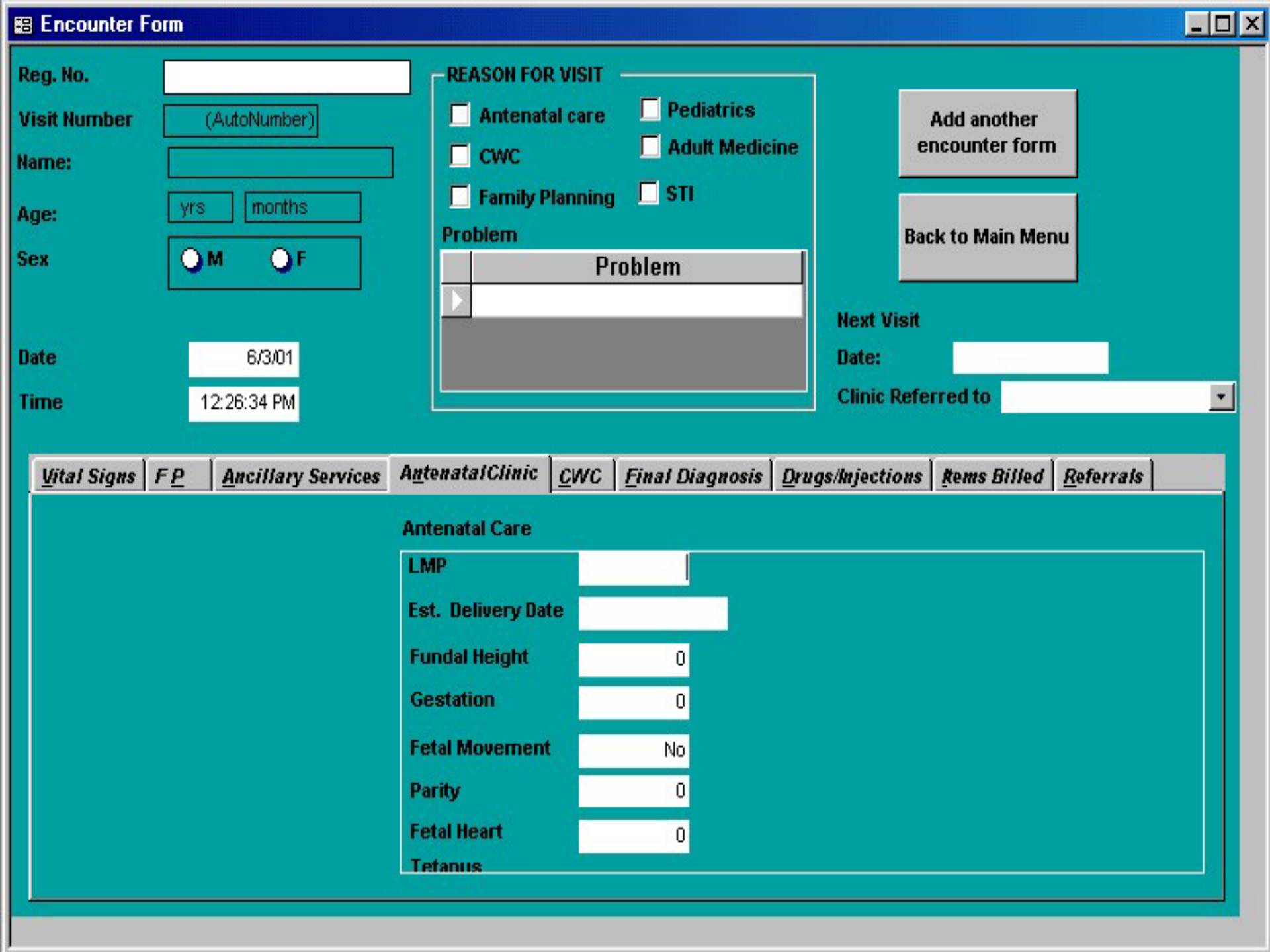
	Charges	Amount Paid
Drug Charges	4,260,398	692,691 (17%)
Test Charges	1,011,727	424,630 (42%)
Total Charges	5,272,605	1,117,580 (21%)

Effects on patients and clinicians

- Patient time (minutes per visit)
  - waiting: 21 → 13 minutes
  - with provider: 12 → 5 minutes
  - registering: 1.8 → 2.5 minutes
  - total time per visit: 42 → 32 minutes
- Clinician time (% of workday)
  - with patients: 33% → 16%
  - with other staff: 23% → 8%
  - personal activities: 15% → 46%
  - searching for information: 7% → 3%

Evolving the MMRS

- Add visit check-in to registration screen
- Use tabs rather than screen scrolling


Encounter Form
Reg. No.
Visit Number
(AutoNumber)
Name:
Age:
yrs
months
Sex
M
F
REASON FOR VISIT
Antenatal care
Pediatrics
CWC
Adult Medicine
Family Planning
STI
Problem
Problem
Add another encounter form
Back to Main Menu
Next Visit
Date:
Clinic Referred to
Date
6/3/01
Time
12:26:34 PM
Vital Signs
F P
Ancillary Services
AntenatalClinic
CWC
Final Diagnosis
Drugs/Injections
Items Billed
Referrals
Antenatal Care
LMP
Est. Delivery Date
Fundal Height
0
Gestation
0
Fetal Movement
No
Parity
0
Fetal Heart
0
Tetanus

Evolving the MMRS

- Add visit check-in to registration screen
- Use tabs rather than screen scrolling
- Add fields requested by MMRS staff to encounter form and data entry screens

Mosoriot Rural Health Centre Encounter Form

Date: ____/____/____
Reg. No.:_____--____
Name: _____
Date of Birth ___/____/_____
Age: _____ Yrs. _____ Months.
SEX: ☐M ☐F
Next of Kin _____
Residence _____
Occupation _____
Level of Education _____

Visit Episode: ☐ New ☐ Revisit

Reasons for Visit:
☐ Antenatal care ☐ C W C
☐ Family Planning ☐ Paediatrics
☐ Adult Medicine ☐ Injury

Prior care sought
☐ None ☐ Self medication
☐Traditional healer☐Private pharmacy
☐ Community heath worker
☐Private clinic ☐Other Hospital

Vital Signs:
Systolic BP: _____
Diastolic BP: _____
Pulse: _____
Weight: _____ Kg.
Height: _____cm
Temperature: _____ °C

Family Planning:
☐ Counselling
Method used: _____

OB/Family Planning Notes:
_____
_____
Other services
_____

Antenatal Care:
LMP: ____/____/____
Est. Delivery Date:____/____/____

Fundal Height: _____Cm
Gestation: _____Wks

Foetal Movement: YES | NO
Parity_____ Fetal heart beat _____
☐ TT1 ☐ TT2

Child Welfare Clinic:
Head circumference _____ cm

Immunization	*0*	*1*	*2*	*3*
DPT given				
Polio given:				
Measles given:				
Hepatitis B				
Hepatitis A:				
BCG: given:				
Scar (Present?)	Y	N		

Other: _____

Patient Notes:
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

_____
_____
_____
_____
_____
_____
_____
_____

Ancillary Services Used:
Laboratory Results
☐ HB: _____
☐ Urinalysis _____
☐ Stool Exam _____
☐ Blood Sugar _____
☐ VDRL _____
☐ HIV – antibody _____
☐ Malaria Smear _____
☐ Pregnancy Test _____
☐ Pap smear _____
☐ Brucella Test _____
☐ HVS Test _____
☐ Widal Test _____
☐ Sputum for AAFB _____
☐ Blood Grouping _____
☐ X-ray: **1** _____
2 _____

Respiratory Disease

Symptoms:
☐ Cough ☐ Chest pain
☐ Fever ☐ Sputum
☐ Short of breath ☐ Sore throat
☐ Nasal discharge

Tobacco use
☐ smoking ☐ sniffing
☐ chewing ☐ none

Fuel for cooking
☐ firewood ☐ charcoal
☐ paraffin ☐ gas
☐ Electricity ☐ other

Signs
☐ Dull percussion
☐ Bronchial breath sounds
☐ Wheeze ☐ Rhonchi ☐ Crackles

Peak expiratory flow _____

Final Diagnosis:
_____
_____
_____

Treatment:
Drugs/Injections & Other:
1. _____
2. _____
3. _____
4. _____
5. _____

Referral: _____

Financial Office:

		Paid
Item: _____	Ksh: _____	☐
Item: _____	Ksh: _____	☐
Item: _____	Ksh: _____	☐
Item: _____	Ksh: _____	☐
Item: _____	Ksh: _____	☐
Item: _____	Ksh: _____	☐

Next Visit:
Date: ____/____/_____
Reason for next visit/clinic to visit
_____

Evolving the MMRS

- Add visit check-in to registration screen
- Use tabs rather than screen scrolling
- Add fields requested by MMRS staff to encounter form and data entry screens
- Add fields specific to prospective studies
  - outcomes of acute respiratory infections
  - epidemiology of injuries

So what?

Administrative uses of MMRS data

- From 2 weeks → 1 hour to produce monthly MOH reports (#1 among rural health centers)
- Document drug use → order refills earlier
- Quantify amount of free care provided → increased funding from the Kenyan MOH
- MOH advisory committee recommended that the MMRS be used in all rural health centers

Clinical uses of MMRS data

- Noted a village with too few children being vaccinated → nurse sent to intervene: vaccinate, educate
- Noted a village with too many STIs → nurse sent to intervene: treat, educate
- Noted many dog bites in one area → rabid dog found biting dogs, humans → destroyed

New challenge: HIV/AIDS

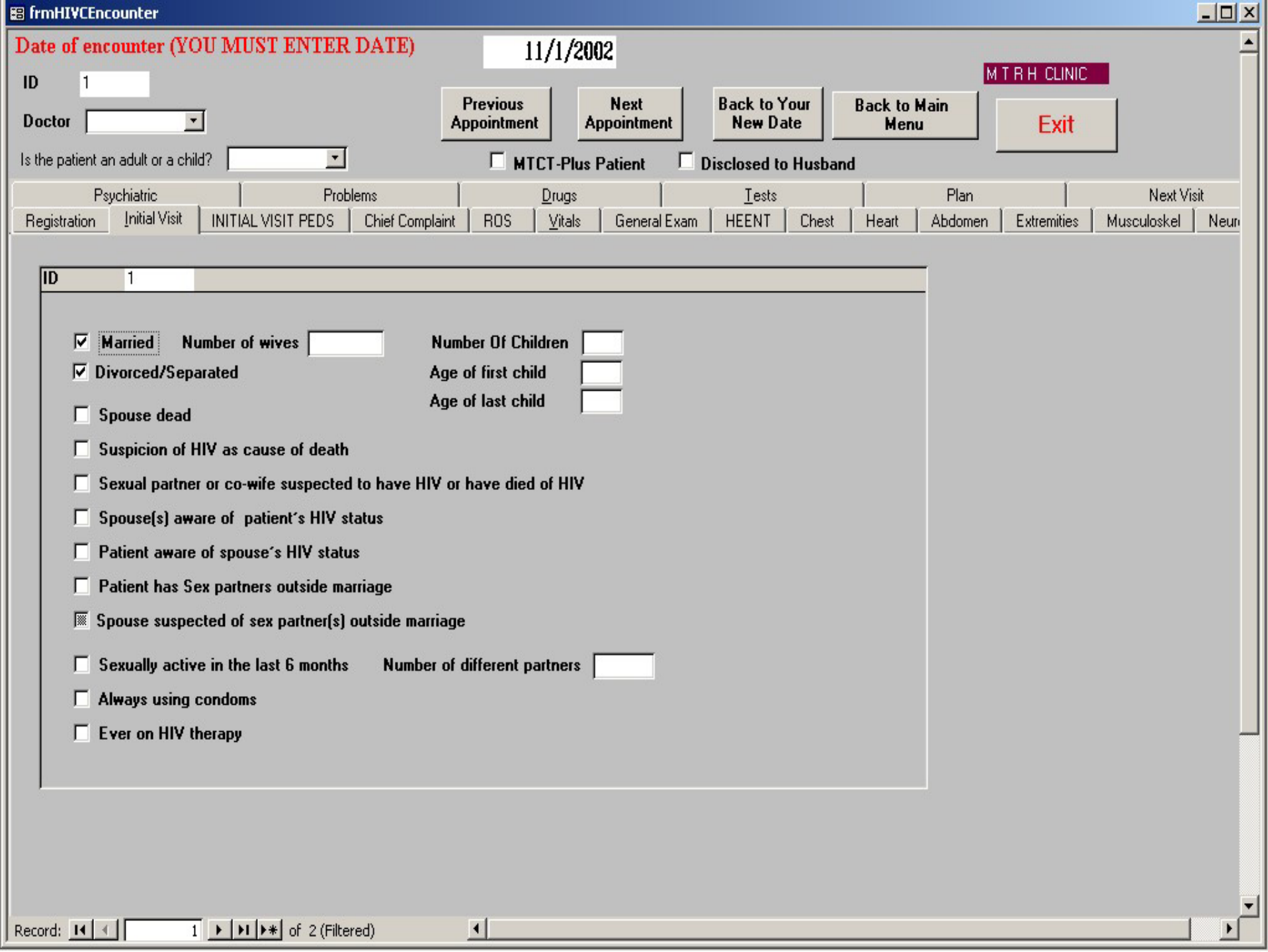
- New needs
  - greater number of clinics
    - Mosoriot
    - Moi Teaching and Referral Hospital
    - adults and pediatrics
  - much more detailed data required
    - focus on a specific disease
    - data for both treatment and prevention
    - more data required by funding agencies (MTCT-Plus, PEPFAR, etc.)

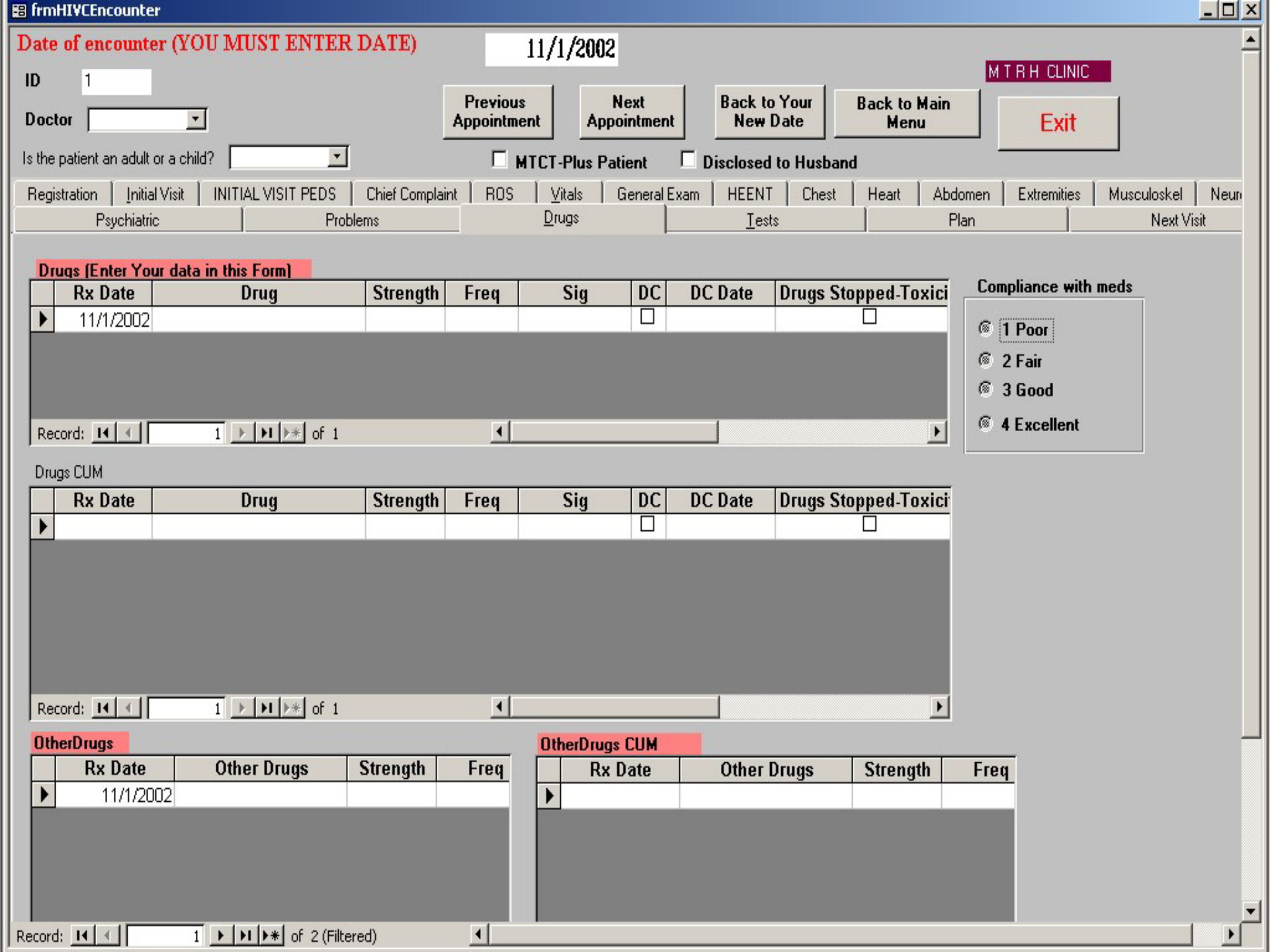
New challenge: HIV module

- New needs
- New approaches
  - central database not located at either clinic
  - paper encounter forms entered daily then returned to clinic → permanent paper record

HIV module

- Intensive initial and follow-up data on all patients visiting HIV clinics
  - chief complaint
  - exposure risks (patient, spouse)
  - past history, review of systems
  - physical examination
  - tests performed (with results)
  - problem list
  - drugs prescribed
  - subsequent appointments


frmHIVCEncounter
Date of encounter (YOU MUST ENTER DATE)
11/1/2002
ID
1
Doctor
Is the patient an adult or a child?
Previous Appointment
Next Appointment
Back to Your New Date
Back to Main Menu
M T R H CLINIC
Exit
MTCT-Plus Patient
Disclosed to Husband
Psychiatric
Problems
Drugs
Tests
Plan
Next Visit
Registration
Initial Visit
INITIAL VISIT PEDS
Chief Complaint
ROS
Vitals
General Exam
HEENT
Chest
Heart
Abdomen
Extremities
Musculoskel
ID
1
Married
Number of wives
Number Of Children
Divorced/Separated
Age of first child
Age of last child
Spouse dead
Suspicion of HIV as cause of death
Sexual partner or co-wife suspected to have HIV or have died of HIV
Spouse(s) aware of patient's HIV status
Patient aware of spouse's HIV status
Patient has Sex partners outside marriage
Spouse suspected of sex partner(s) outside marriage
Sexually active in the last 6 months
Number of different partners
Always using condoms
Ever on HIV therapy
Record:
1
of 2 (Filtered)


frmHIVCEncounter
Date of encounter (YOU MUST ENTER DATE)
11/1/2002
ID
1
Doctor
Is the patient an adult or a child?
Previous Appointment
Next Appointment
Back to Your New Date
Back to Main Menu
MTRH CLINIC
Exit
MTCT-Plus Patient
Disclosed to Husband
Registration
Initial Visit
INITIAL VISIT PEDS
Chief Complaint
ROS
Vitals
General Exam
HEENT
Chest
Heart
Abdomen
Extremities
Musculoskel
Psychiatric
Problems
Drugs
Tests
Plan
Next Visit
Drugs (Enter Your data in this Form)
Rx Date
Drug
Strength
Freq
Sig
DC
DC Date
Drugs Stopped-Toxici
11/1/2002
Record: 1 of 1
Compliance with meds
1 Poor
2 Fair
3 Good
4 Excellent
Drugs CUM
Rx Date
Drug
Strength
Freq
Sig
DC
DC Date
Drugs Stopped-Toxici
Record: 1 of 1
OtherDrugs
Rx Date
Other Drugs
Strength
Freq
11/1/2002
OtherDrugs CUM
Rx Date
Other Drugs
Strength
Freq
Record: 1 of 2 (Filtered)

HIV module

- Intensive initial and follow-up data on all patients visiting HIV clinics
- Computer-generated summary with reminders

AMPATH Guide Adult Summary as of: 09/06/2004

Personal History: [redacted]
for initial visit Age: ***43 Yrs 8 Months***
Initial AMPATH Visit ***26/11/2002***

AMPATH ID ***00366***
Marital Status: ***Married***
Benefit Category: ***MTCT-Plus***

Care Site: ***MTRH***
Number Of Children 4

Medical History:

DECREASING CD4 COUNT	05/05/2004
DIARRHEA	26/11/2002

Drug History

ARV treatment before AMPATH?
Yes None Or Not Indicated

Initial AMPATH ARV regimen?
03/09/2003 Lamivudine Stavudine Nevirapine

Current AMPATH ARV regimen?
Lamivudine Stavudine Nevirapine

Anti TB Drugs?

Current AMPATH OI regimen?
05/05/2004 Cotrimoxazole

Other drugs prescribed on last visit?
None

Adherence Perfect [Last Visit]?: ***Perfect***

	Initial Result	Last Three Results		
WEIGHT	26/11/2002 58	06/04/2004 75	07/04/2004 75	05/05/2004 74
SAO2	26/11/2002 98	06/04/2004 96	07/04/2004 95	05/05/2004 92
HEMOGLOBIN	12/09/2002 **12.1**	22/05/2003 **12.3**		
WHITE BLOOD CELLS	12/09/2002 5700	22/05/2003 5200		
CD4	12/09/2002 54	26/07/2003 175	07/04/2004 170	
CHEST X-RAY	26/11/2002 NAD			
ALC	12/09/2002 2200			
PLATELETS	12/09/2002 355000	22/05/2003 353000		
SGPT	26/11/2002 40.9	07/04/2004 14		

Clinical Reminders:

HIV module

- Intensive initial and follow-up data on all patients visiting HIV clinics
- Computer-generated summary with reminders
- In the first 33 months, 4950 patients were enrolled and made more than 30,000 visits

Patients and ART by site (N=4950)

Site	Adults	On ART	Children	On ART	Total
Moi Hospital	2532	63%	549	19%	3081
Mosoriot	878	51%	130	15%	1008
Turbo	320	56%	29	21%	349
Burnt Forest	187	52%	0	--	187
Webuye	137	40%	1	0%	138
Chulaimbo	96	34%	13	8%	109
Amakura	47	45%	2	0%	49
Naitiri	28	39%	1	0%	29

HIV clinic data

Demographics	Moi Hospital (urban)	Mosoriot (rural)
Age (years ± SD)	36 (± 9)	36 (± 8)
Female	65%	68%
Married	83%	81%
Wives (n) 1	73%	79%
2	26%	21%
≥ 3	1%	0%
Children (n)	3.7 (± 2.9)	3.7 (± 2.3)

HIV clinic data

HIV Exposure Hx, Risk Factors	Moi Hosp	Mosoriot
Spouse aware of patient's HIV status	38%	20%
Patient aware of spouse's HIV status	25%	11%
Spouse known HIV-positive	6%	4%
Spouse deceased	21%	30%
Sexual encounters during last 6 months	37%	33%
Extramarital sexual relations	17%	19%
Sexual partners (average)	1.1	1.3
Suspect spouse of extramarital sex	30%	32%
Condom use	4%	3%

HIV clinic data

Symptoms on Initial Visit	
Weight loss	59%
Fatigue	56%
Fever	39%
Chills	31%
Arthralgia	21%
Chest pain	18%
Diarrhea	16%
Exertional dyspnea	12%

HIV clinic data

Findings on Initial Physical Exam	
Weight (average)	57 kg
Rash	17%
Oral candidiasis (thrush)	13%
Temporal muscle wasting	10%
Lymphadenopathy	10%
Abnormal breath sounds	7%
Kaposi's sarcoma	7%
Splenomegaly	7%
Hepatomegaly	4%

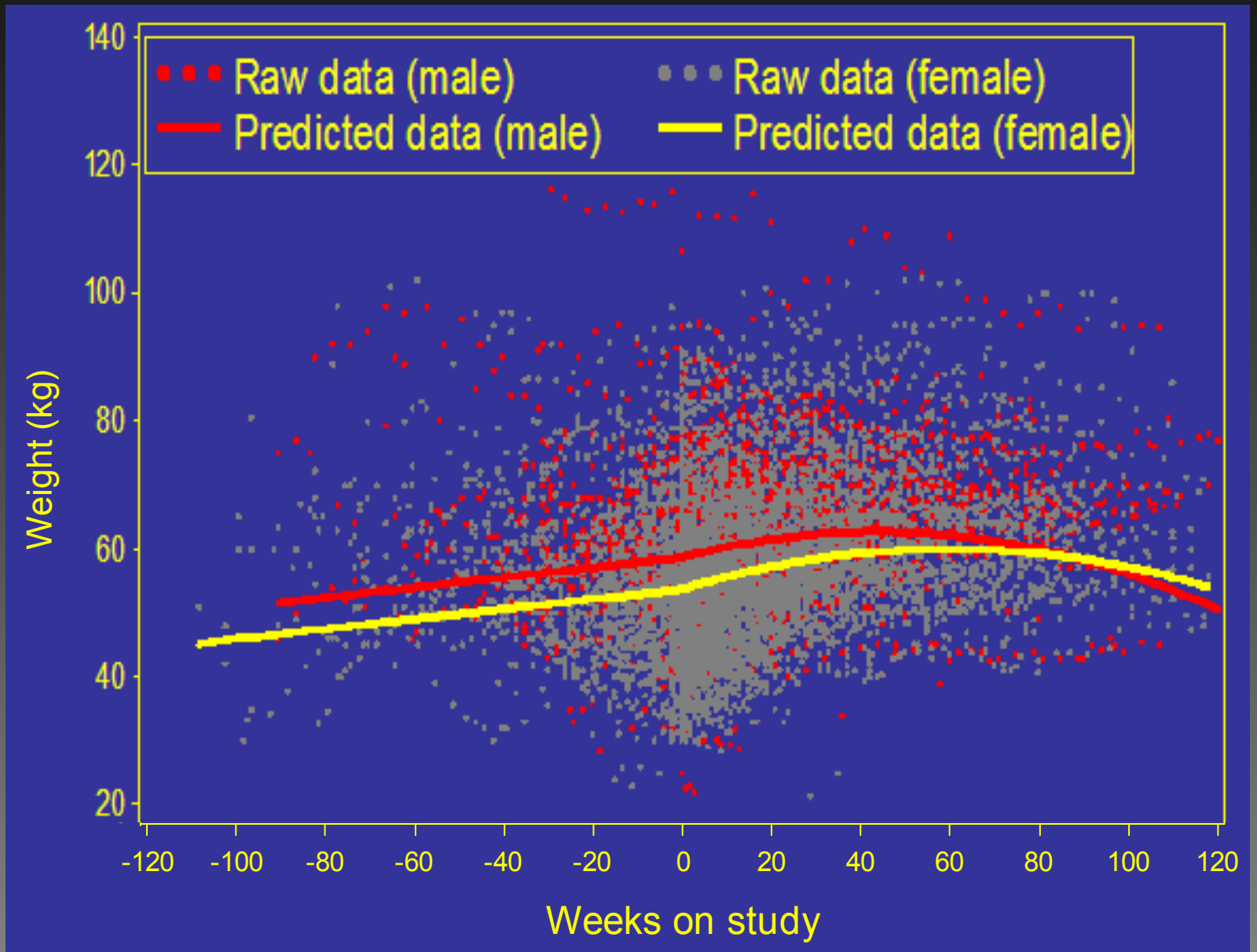
HIV clinic data

Initial Laboratory Test Results	
CD4 count (average)	215
CD4 count (ART patients)	117
Total lymphocyte count	1694
Hemoglobin	10.5
White blood cell count	4800
Platelet count	245,000
Alanine aminotransferase (IU)	26
Pneumonia on chest x-ray	18%

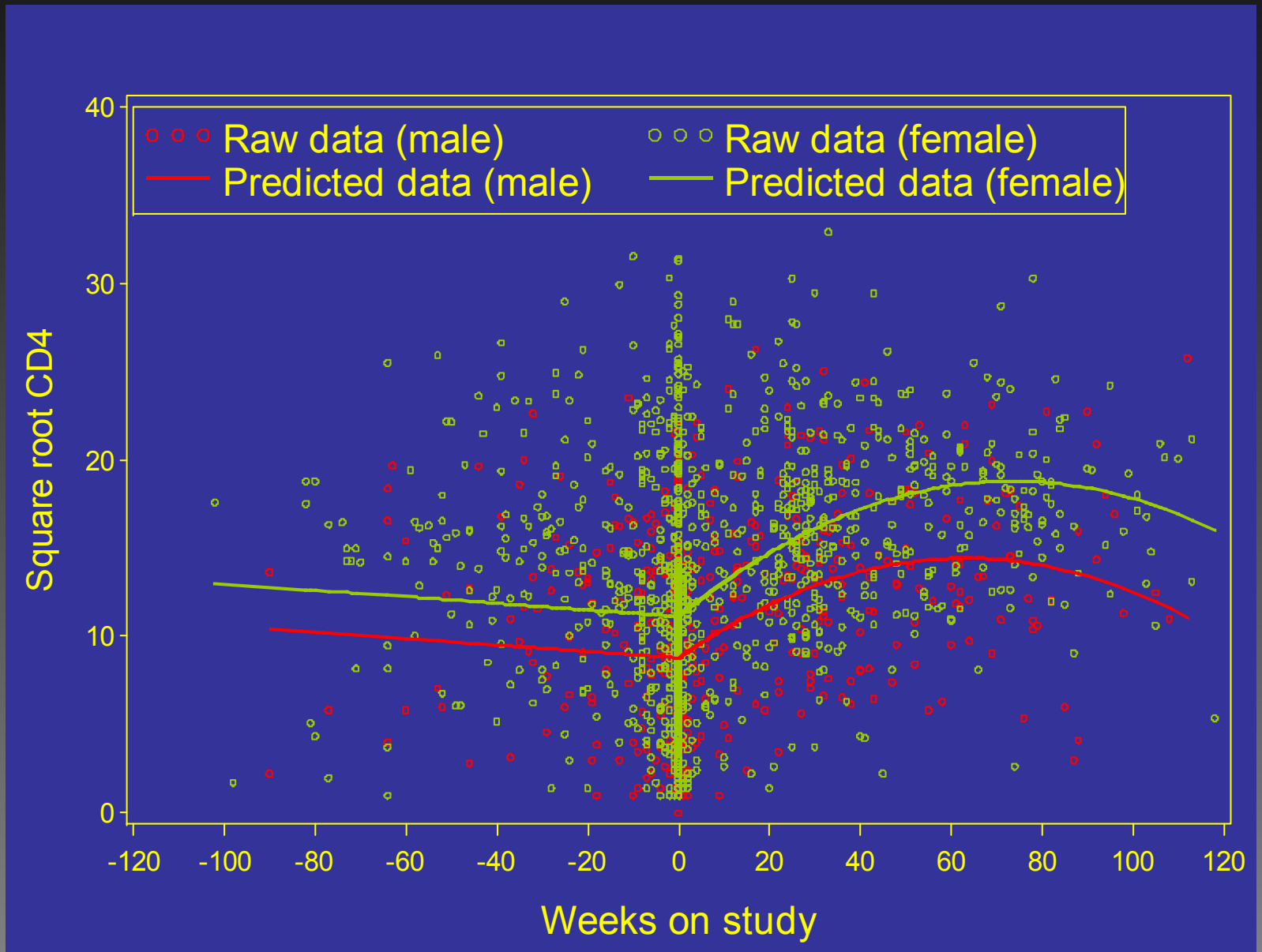
HIV clinic data

Initial Drug Therapy	Moi Hosp (N=790)	Mosoriot (N=294)
Lamivudine	40%	23%
Stavudine	39%	23%
Nevirapine	37%	22%
Efavirenz	4%	1%
ARV adherence ≥ 95%	*92%*	*88%*
Isoniazid	48%	54%
Trimethoprim-sulfa	48%	45%
Metronidazole	14%	10%
Fluconazole	9%	17%

Change in Weight: 1000 on ART

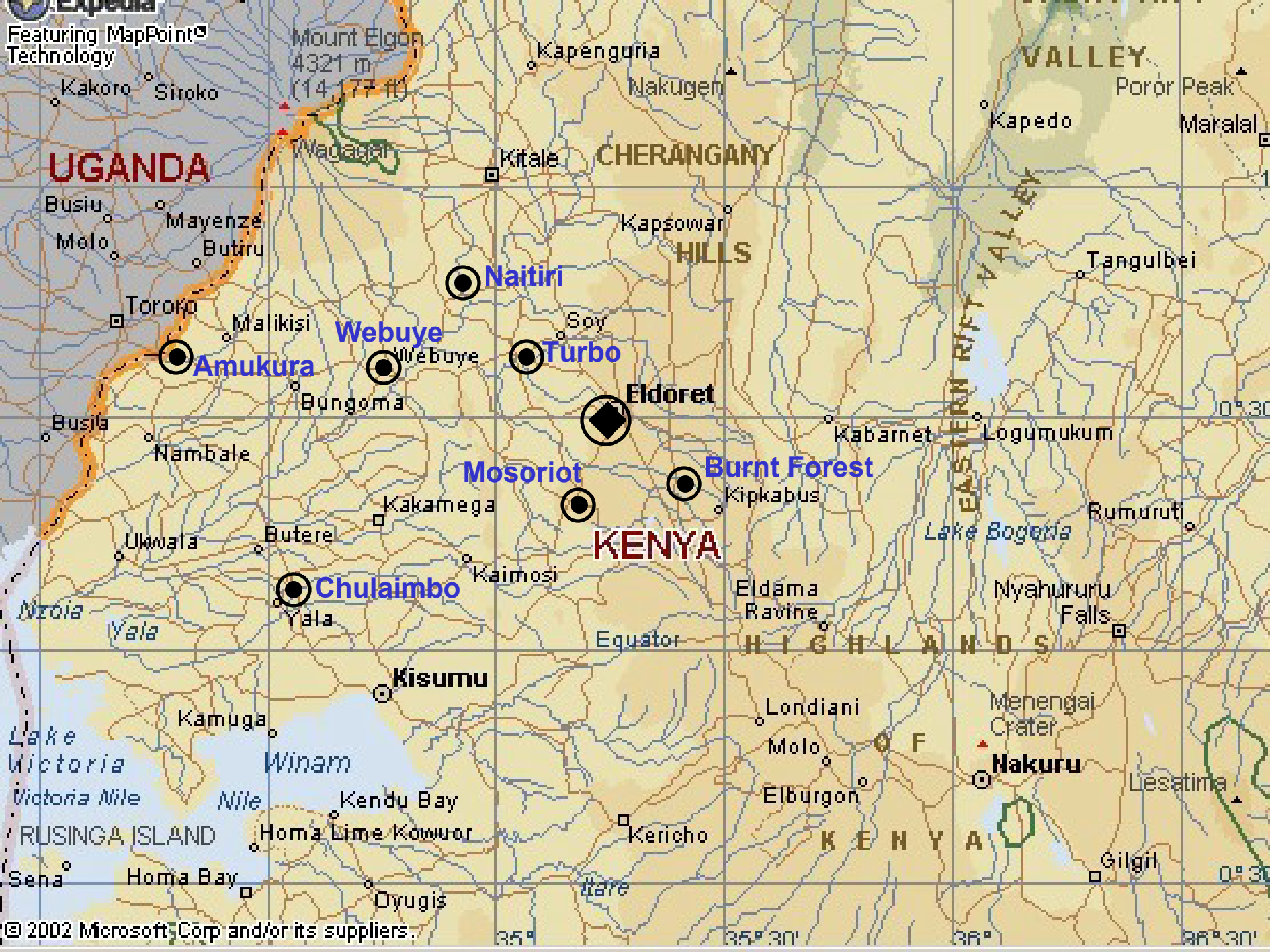


Change in CD4 Count: 1000 on ART



Next steps

- Add 3 district hospitals at Teso, Kitale, and Kapenguria


Expedia
Featuring MapPoint® Technology
Mount Elgon
4321 m
(14,177 ft)
Kapenguria
Nakugen
VALLEY
Poror Peak
Kakoro
Siroko
Kapedo
Maralal
UGANDA
Wadagali
Kitale
CHERANGANY
Busiu
Mayenze
Molo
Butiru
Kapsowar
HILLS
Naitiri
Tangulbei
Tororo
Malikisi
Webuye
Soy
Amukura
Webuye
Turbo
EASTERN RIFT VALLEY
Bungoma
Eldoret
Busia
Nambale
Kabarnet
Logumukum
Mosoriot
Burnt Forest
Kipkabus
Kakamega
Rumuruti
Lake Bogoria
Ukwala
Butere
KENYA
Kaimosi
Chulaimbo
Eldama Ravine
Nyahururu Falls
Nzoia
Yala
Yala
Equator
HIGHLANDS
Kisumu
Londiani
Menengai Crater
Kamuga
Lake Victoria
Winam
Molo
OF
Nakuru
Victoria Nile
Nile
Kendu Bay
Elburgon
Lesatima
RUSINGA ISLAND
Homa Lime
Kowuor
Kericho
KENYA
Sena
Homa Bay
Oyugis
Gilgil
Itare
© 2002 Microsoft Corp and/or its suppliers.
35°
35° 30'
36°
36° 30'
0° 30
0° 30

Next steps

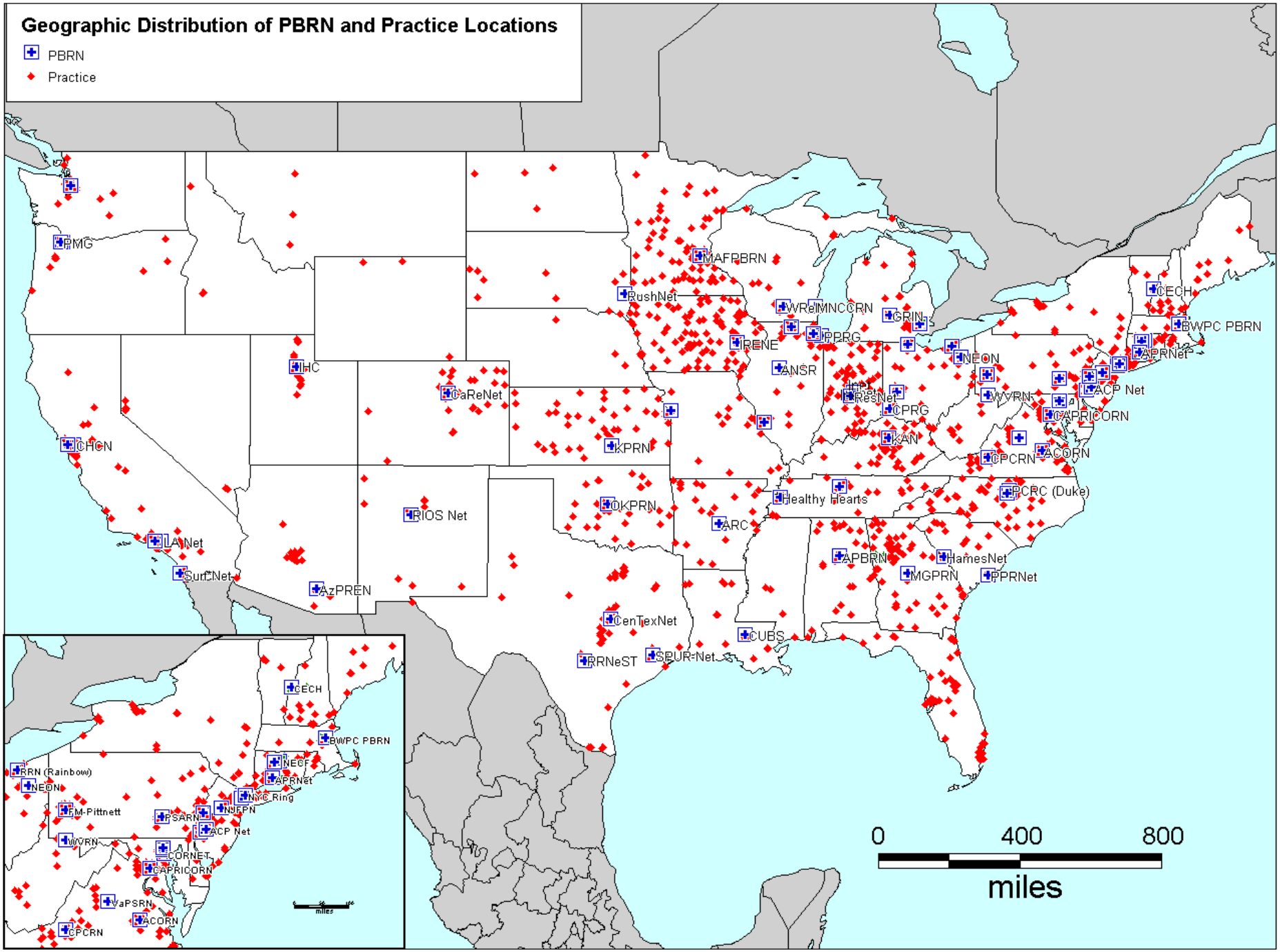
- Add 3 district hospitals at Teso, Kitale, and Kapenguria
- Enter data in HIV clinics using wireless tablet computers → flowsheets, care prompts
- Extend the AMRS to community-based health workers on hand-held devices
- Extend the AMRS to HIV clinics in other sub-Saharan Africa countries
  - software downloaded by clinics in Ethiopia, Kenya, Mozambique, Namibia, Nigeria, Rwanda, South Africa, Tanzania, Uganda, Zimbabwe

Next steps

- Move the AMRS to the Internet
  - more sophisticated data structure
  - Web server accessible from anywhere
  - migrate from MS-Access to SQL server…

Next steps

- Move the AMRS to the Internet
  - more sophisticated data structure
  - Web server accessible from anywhere
  - migrate from MS-Access to SQL server…
- Ultimate goal → international network of HIV clinics to
  - enhance coordination of HIV/AIDS care
  - perform collaborative research on cost-effective treatment of HIV/AIDS and assess outcomes and prevention efforts


Geographic Distribution of PBRN and Practice Locations
PBRN
Practice
PMG
MAFPBRN
RushNet
WReIMNCCRN
GRIN
IRENE
PPRG
NEON
ANSR
IHC
CaReNet
ResNet
CPRG
WVRN
ACP Net
CAPRICORN
CHCN
KPRN
KAN
ACORN
CPCRN
RIOS Net
Healthy Hearts
PCRC (Duke)
OKPRN
ARC
LA Net
SurfNet
APBRN
HamesNet
MGPRN
PPRNet
AzPREN
CenTexNet
CUBS
RRNeST
SPUR-Net
CECH
BWPC PBRN
APRNet
0
400
800
miles
RRN (Rainbow)
NECF
NYC Ring
NJFPN
FM-Pittnett
PSARN
VaPSRN
CORNET
0
miles

Lessons learned

- Clinical information systems are possible in even the most resource-constrained places
- Collaboration with established informatics programs is a must
- Primary goals → sustainability of the EMR, independence of the developing country
- Start small and build to ***serve local needs***
- Anticipate challenges and prepare for them
- Maintain hope and enthusiasm

Hope does not lie in a way out,
but in a way through.

Robert Frost