

# 8th Medical Open Source Software Symposium

openEHR as A New Approach to Electronic Health  
Record System in  
Cambodia Maternity Care Program

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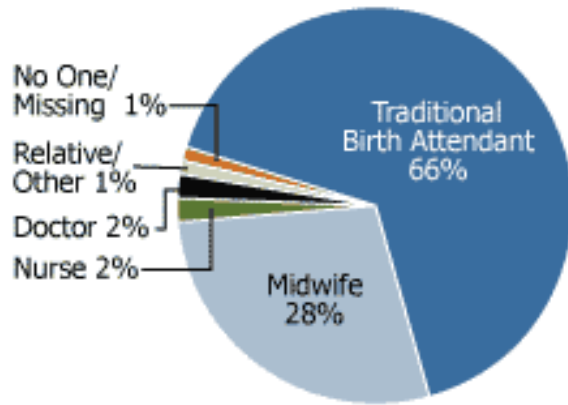
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# Objectives of the Research Study

- To identify the flow of medical information regarding Maternity care between two advanced hospitals: Calmette Hospital and National Maternal and Child Health Center
- To identify the needs for applying Electronic Health Records (EHRs) System
- To identify issues and challenges if EHRs have to be adopted in the hospital
- To test the interoperability and flexibility of openEHR based Maternity application in real practice
- To get feedback / level of satisfaction from health staff especially ob-gyns on the use of openEHR based Maternity application

# Maternity Care in Cambodia

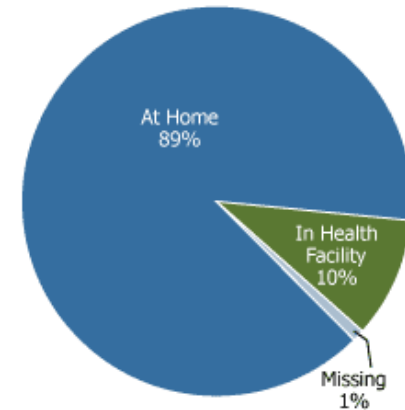
Skilled Assistance at Delivery



Regional differences in antenatal care is significant:

- Mondol Kiri/Rotanak Kiri, northern provinces: **20%**
- Phnom Penh capital city: **84%**

Access Health Facilities at Delivery



“Most births in Cambodia (89 percent) take place outside of health facilities. The proportion of births delivered in a health facility is low in all regions (14 percent or less), except in Phnom Penh (71 percent).”

\* Source: Department of Planning and Health Information, Ministry of Health, the Reproductive Health Association of Cambodia, and PRB, 2003

# Why is percentage of Skill Assistance and Access to Health Facilities low?

- ✘ Lacking of skills or equipments to manage obstetric emergencies,
- ✘ Poor condition of roads in rural limiting access to health centers,
- ✘ Cultural traditions and beliefs using traditional technique,
- ✘ Limited knowledge such as pregnancy age, family plan, maternal care

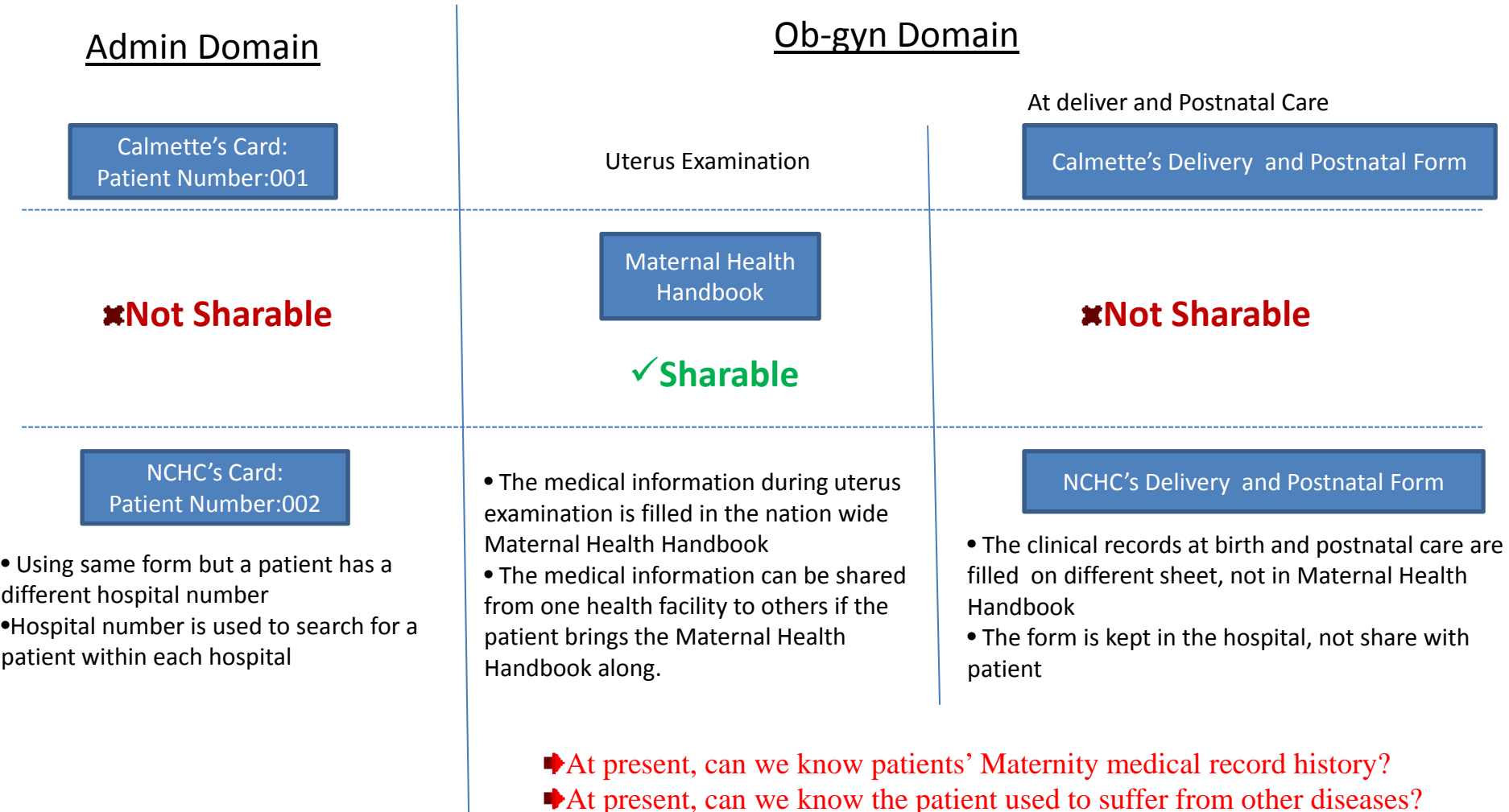
Supporting programs:

- ✓ Training midwives,
- ✓ Disseminating maternity care information to mothers,
- ✓ Offering family planning counseling
- ✓ Engaging the community through awareness ...

These are solutions of the above problems to help pregnant women access to health facilities to some extent.

➡ How do health staff manage the health record of 71% of pregnant women who have ability to access health facilities?

# The Current Information Flow between Calmette Hospital and National Maternal and Child Health Center



- ➡ At present, can we know patients' Maternity medical record history?
- ➡ At present, can we know the patient used to suffer from other diseases?

According to an ob-gyn works for Calmette Hospital

# Problem Statements

Though the use of maternal handbook has been recognized and successfully adopted in many countries around the world but in some circumstances, the storage of information on paper based is not sustainable leading to:

- Unreadable of doctors' hand writing → wrong interpretation → inaccuracy of information
- The lost of longitudinal health history information → The quality treatment is limited due to lack of important information
- Duplication of lab test → Wasting time and money
- Duplication of health history questioning → Wasting time
- Healthcare providers have no enough space for storing the paper-based records. → Remove some old health records??
- Lack of information in research study
- Slow down the data collection process (not efficient and on time)
- The statistical data is not reliable

➡ Which EHRs application is suitable for our hospital?



New Medical Record Entry

Select Template: Cambodia Uterus Examination

Demographic

Last name: Heng  
First name: Bopha  
Gender: Female  
DOB: 01-07-1980  
Address: Phnom Penh, Cambodia

Composition

Encounter

admin entry for outpatient

Next appointment date: 02-09-2009

Antenatal checkup

maternity health history

Any event

Vaginal bleeding during 2 weeks before?:

Any fever?:

Any caught with mucus lasting more than 3 weeks?:

Any Headache/dizzy/irritated hand or face?:

seriously Pale?:

Body weight

Any event

Weight: 45 kg

Blood Pressure

Save Medical Record

# Which EHRs application is suitable for our hospital?



## Build Own EHRs. System

- Meet requirements of our hospital
- Time consuming
- High level of expertise
- Meet standard? → Semantic interoperability with other system? Flexible to deal with new disease?

## Buy from Vendor: Fujitsu, NEC...

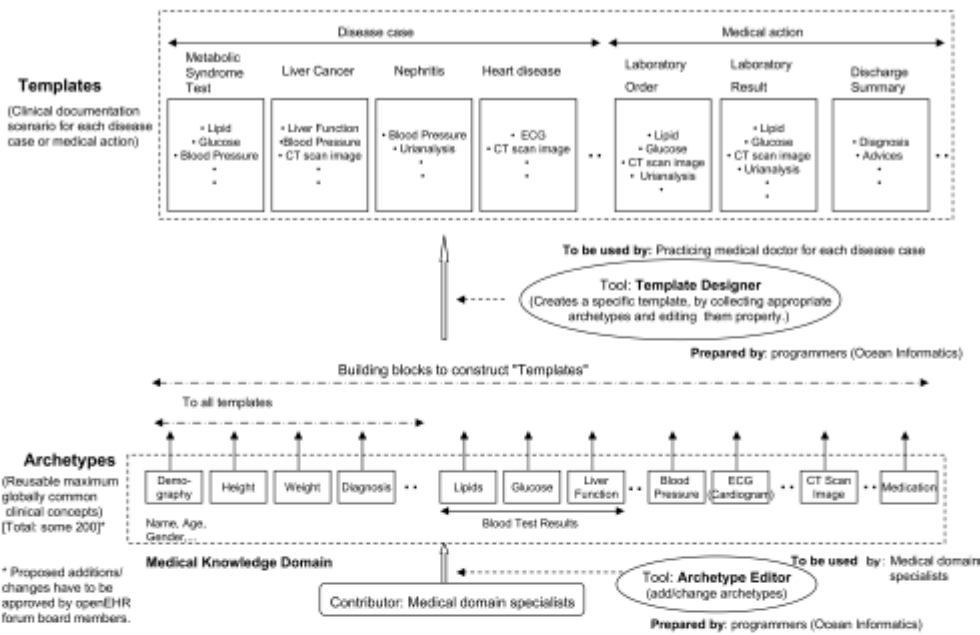
- Too Expensive, most hospitals in developing countries cannot afford the high cost

## Use OSS → openEHR???

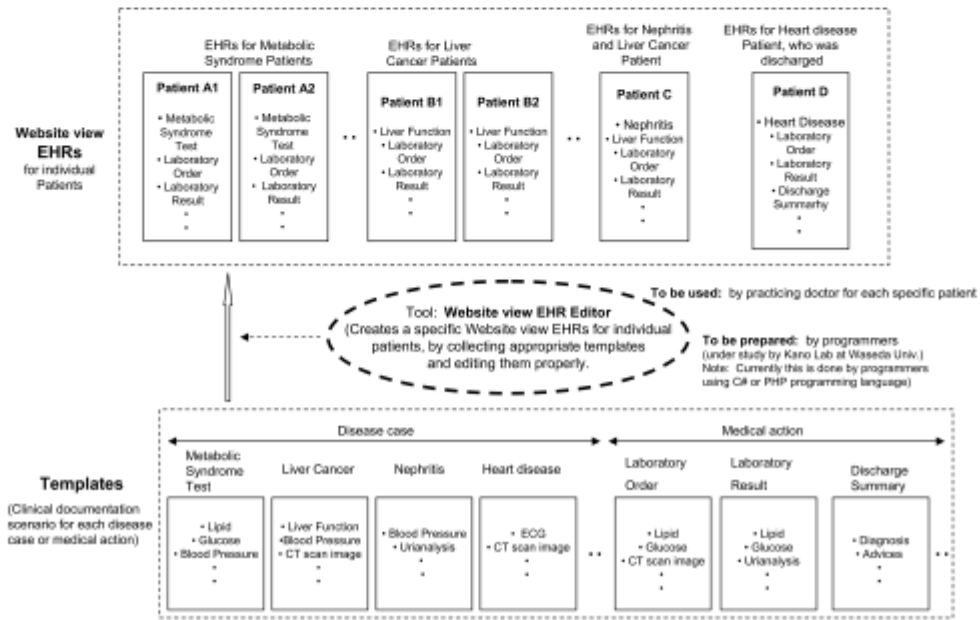
The screenshot shows a web-based medical record form. At the top, it says 'Medical Record Entry' and 'Select Template: Cambodia Ulcer Examination'. The 'Demographic' section includes: Last name: Heng, First name: Bopha, Gender: Female, DOB: 01-01-1980, and Address: Phnom Penh, Cambodia. A callout bubble points to the 'First name' field with the text 'Choose another template for "Bopha"'. The 'Complaint' section has a 'Next appointment date' set to 12-09-2001. Under 'Antenatal checkup', there are several checkboxes for symptoms like 'vaginal bleeding during 2 weeks before?', 'Any fever?', 'Any cough with mucus lasting more than 3 weeks?', 'Any headache/sizzy/swollen hand or face?', and 'swollen Pink?'. At the bottom, there are fields for 'Weight' (25) and 'Blood Pressure'. A 'Save Medical Record' button is visible at the bottom right.

- Low cost software (open source) and maintenance due to the software robustness. (suitable for developing countries' economy)
- Open, Customizable, Centralized, High quality, Secure,
- Building block structure based on hierarchical layering, Scalable
- Aiming at a new business model for electronic medical records (EMRs)
- Already an international standard adopted by ISO (ISO13606)
- Implementation has already started in European countries, Australia and Asia (Singapore), also under development for Indonesia and Cambodia (Waseda University, Kano Lab) (See openEHR adoption list at the end of presentation.)

**- from Archetypes to Templates -**



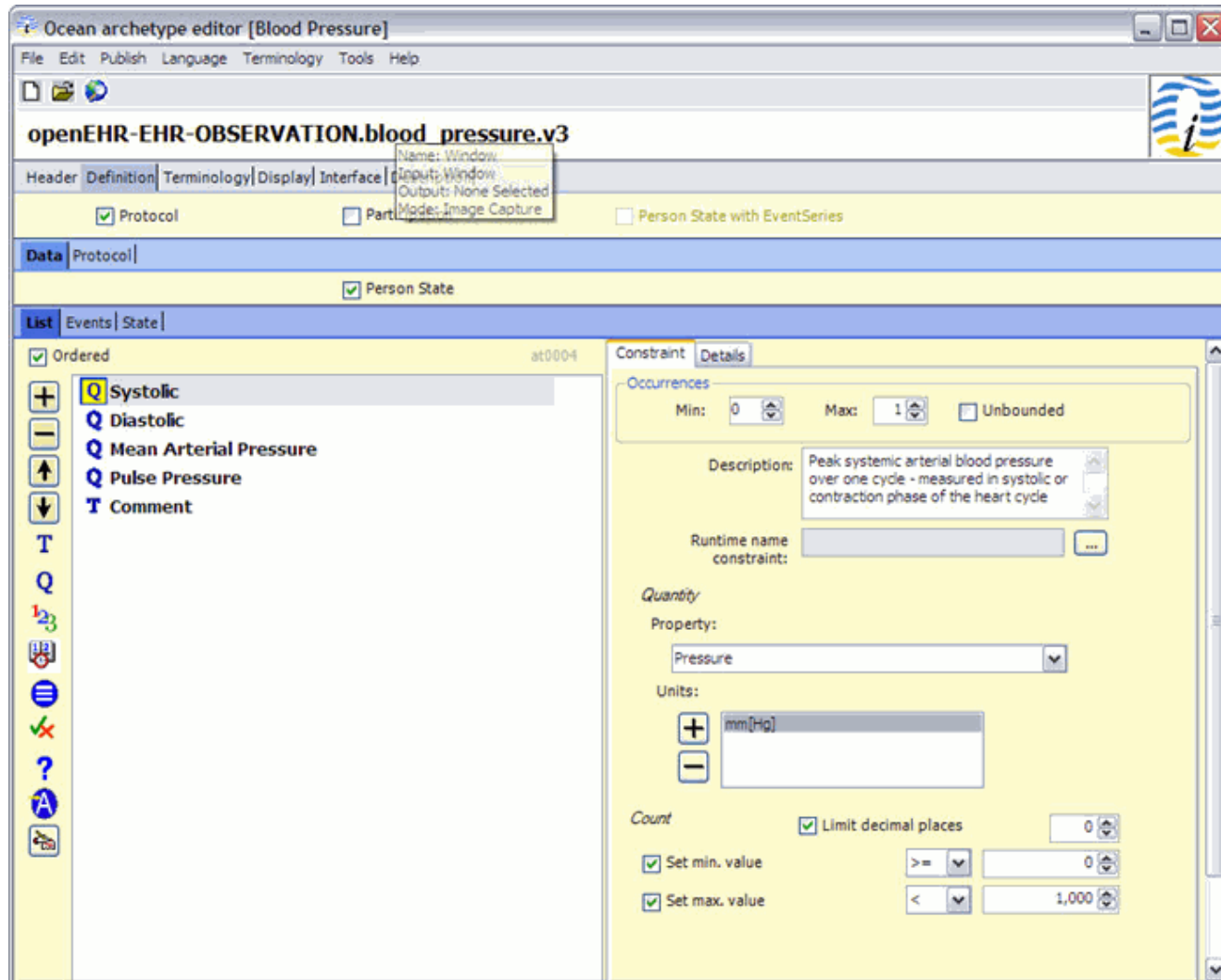
**- from Templates to Website view EHRs -**



See the original of openEHR Introduction in an attached sheet



# Example : Blood Pressure Archetype Using Archetype Editor (Free)



# Example : Uterus Examination Template Using Template Designer

The screenshot displays the Ocean Template Designer - 2.5 Alpha interface. The main workspace shows a hierarchical tree structure for the template [Uterus Examination.oet]. The tree is organized as follows:

- any event
  - data
    - Systolic
    - Diastolic
    - Mean Arterial Pressure
    - Pulse Pressure
    - Comment
  - state
    - Position
    - Confounding factors
    - Exertion
    - Sleep status
    - Tilt
  - 24 hour average
  - protocol
  - Pregnancy
    - data
      - Maternity states
    - Conception
    - Previous pregnancies
      - Any prior pregnancy
      - Number of prior pregnancies
      - Parity
      - Miscarriages
      - Terminations of pregnancy
    - Current pregnancy

The right-hand side of the interface features a Repository pane showing a tree of archetypes and observations. The 'entry' folder is expanded, showing sub-folders like 'observation' and 'evaluation'. The 'observation' folder contains several items, including 'Blood Pressure (v1)', 'Blood pressure (Training sample) (v1)', 'Intravascular pressure (v1)', and 'Jugular venous pressure (v1)'. The 'evaluation' folder contains 'Pregnancy (v1)' and 'pregnancy profile (v1)'. Below the Repository pane is the Template Node Properties pane, which is currently displaying the properties for the selected 'Uterus Examination' template:

Template Identification	
ID	ce5984f1-4797-4978-b90d-c
Name	Uterus Examination
Purpose	

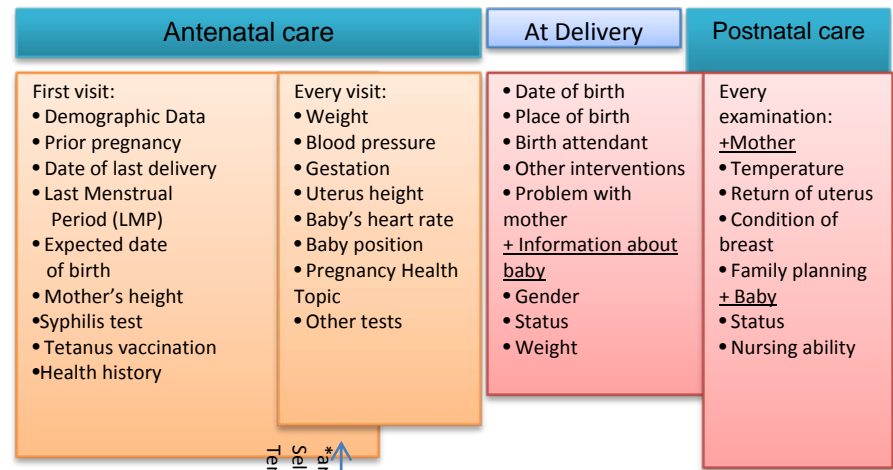
The Name field is currently empty, and the description below it reads: "The name of this template."

# Methodology

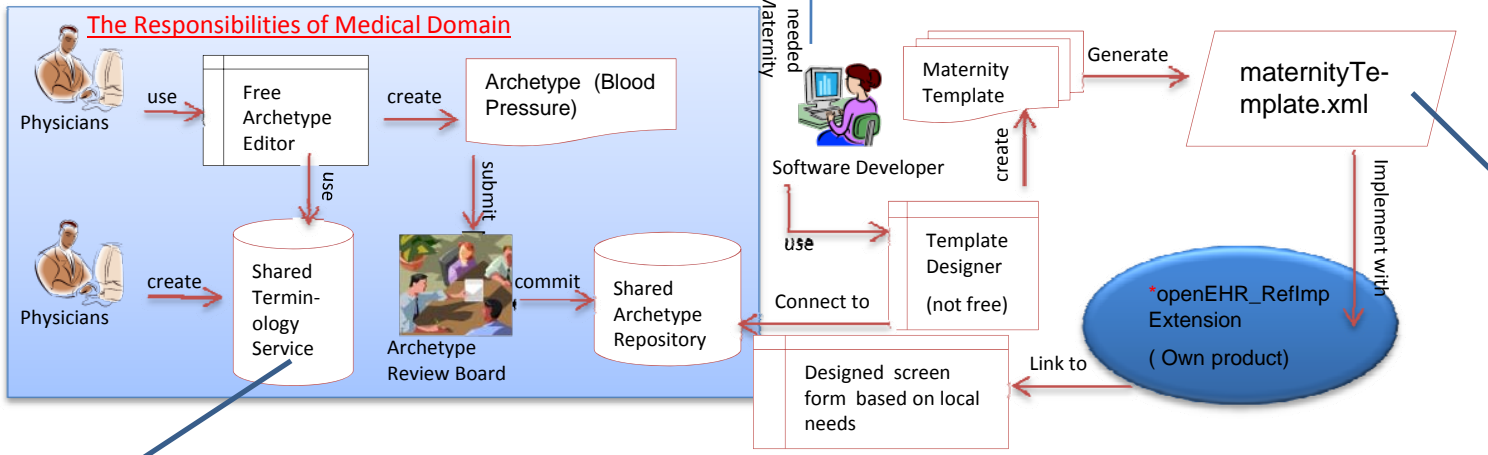
- One time pregnancy: early pregnancy, late pregnancy, birth, postnatal care
- A woman is more likely to have more than one child in Cambodia
- A longitudinal history health record is need to improve the quality of care

\*See a list of archetypes used of Maternity care

## ◆ Maternity Journey (based on Cambodian Maternal Handbook)



## ◆ Architecture Overview



Standard terminology: Health practitioners complete the medical records using standard terminology? → YES

Flexible to the existence of diseases: other diseases: TB, Metabolic syndrome, Diabetes ...can be easily added to the system without affecting the existing system and medical records history → longitudinal health information of a patients

# Demo

# List of Archetypes Used for Maternity Application

## **Demographic archetypes (downloaded from CKM)**

openEHR-DEMOGRAPHIC-ORGANISATION.organisation.v1

openEHR-DEMOGRAPHIC-PARTY\_IDENTITY.organisation\_name\_iso.v1

openEHR-DEMOGRAPHIC-ADDRESS.address\_iso.v1

openEHR-DEMOGRAPHIC-PERSON.person.v1

openEHR-DEMOGRAPHIC-PARTY\_IDENTITY.person\_name\_iso.v1

openEHR-DEMOGRAPHIC-CLUSTER.person\_additional\_data\_iso.v1

openEHR-DEMOGRAPHIC-CLUSTER.person\_birth\_data\_iso.v1

# List of Archetypes Used for Maternity Application

## Existing archetypes downloaded from:

- **openEHR Archetype Repository**  
<http://www.openehr.org/svn/knowledge/archetypes/dev/adl/openehr/>
- **Clinical Knowledge Manager**  
<http://openehr.org/knowledge/>

openEHR-EHR-COMPOSITION.encounter.v1  
openEHR-EHR-SECTION.history.v1  
openEHR-EHR-OBSERVATION.height.v1  
openEHR-EHR-OBSERVATION.body\_weight.v1  
openEHR-EHR-OBSERVATION.blood\_pressure.v1  
openEHR-EHR-OBSERVATION.urinalysis.v1draft  
openEHR-EHR-OBSERVATION.heart\_rate-fetal.v1  
openEHR-EHR-OBSERVATION.fetal\_movement.v1draft  
openEHR-EHR-EVALUATION.pregnancy.v1  
openEHR-EHR-SECTION.antenatal\_check.v1draft  
openEHR-EHR-OBSERVATION.exam.v1draft  
openEHR-EHR-CLUSTER.exam-uterus.v1  
openEHR-EHR-CLUSTER.exam-fetus.v1

## EHR archetypes (self-designed according to paper report received from National Maternal Handbook)

openEHR-EHR-ADMIN\_ENTRY.admin\_entry\_for\_outpatient.v1  
openEHR-EHR-EVALUATION.pregnancy\_profile.v1"  
openEHR-EHR-OBSERVATION.maternity\_health\_history.v1  
openEHR-EHR-EVALUATION.problem\_list.v1  
openEHR-EHR-INSTRUCTION.tetanus\_vaccination.v1  
openEHR-EHR-EVALUATION.medicine\_list.v1  
openEHR-EHR-EVALUATION.problem\_list.v1  
openEHR-EHR-OBSERVATION.postnatal\_maternity.v1

# Adoption of openEHR (1/2)

## Specific implementations (Source: Dr. Sam Heard, private communication)

- The nursing application at the **Alkmaar Hospitals (Netherlands)** are using an *openEHR repository (OceanEHR)* to store the personal health information.
- **Queensland Health (Aus)** has a clinical repository (Extensia) for 5m patients that consolidates many reports and results and makes these available over the web or for use in discharge summaries.
- **The Cancer Council of Victoria (Aus)** has consolidated 20 years of research data on 45,000 people into an *openEHR repository (OceanEHR)* .
- **The Ambulance services (Aus)** are currently developing an *openEHR template schema (Ocean's Template Designer)* based on *openEHR archetypes* to allow transfer of computerized records between ambulances in the field and also to hospitals in the future.
- **Queensland Health (Aus)** is developing a state-wide infection control system based on the *openEHR record (OceanEHR)*.
- **Cambio (Sweden)** is a major clinical system vendor specializing in regional solutions. Their clinical specifications utilize *openEHR archetypes and templates*. *Cambio support the open source Java effort.*

# Adoption of openEHR (2/2)

## Specific implementations (Source: Dr. Sam Heard, private communication)

- **Bert Verhees (Netherlands)** has a proprietary implementation of *openEHR* which is used in a clinical application in Hospital.
- **NexJ Systems of Canada and Ocean** are leading the Open Health Tools effort to provide a common health platform based on the *openEHR specifications*.
- **National eHealth Programs (Sweden)** uses the openEHR methodology, where a decision to base the national program on ISO 13606/openEHR has been taken.
- **Denmark** –where a national pilot is nearing completion using *openEHR archetypes*.
- **Singapore** –where the national requirements for shared data will be specified using *openEHR archetypes and templates*.
- **Great Britain** –where the clinical specifications for data to be shared is being specified using *openEHR archetypes and templates*.



Thank You!