Mobile Technology Applications for Verbal Autopsy

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2012 Federal CASIC Workshops
27-29 March 2012

Outline

- Verbal Autopsy Instrument
- Context
- Choice of Data Collection Interface
- Cost
- Effectiveness

VERBAL AUTOPSY INSTRUMENT

AIM: Standardization of Vital Statistics Data

International Statistical Classification of Diseases and Related Health Problems (ICD)

- Adopted and published by WHO
- Only cases seen by physician
- Ideal source for international comparison
- International standard classification:
  - Epidemiology
  - Health management purposes

Cause of Death

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF DEATH

Cause of death		Approximate interval between onset and death
I Disease or condition directly leading to death *)	a).....	.....
	due to (or as a consequence of)	
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	b).....	.....
	due to (or as a consequence of)	
	c).....	.....
	due to (or as a consequence of)	
	d).....	.....
II Other significant conditions contributing to the death, but not related to the disease or conditions causing it	.....	.....
	.....	.....

**This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury, or complication that caused death.*

Verbal Autopsy

- **Used in areas lacking:**
  - **Civil registration system**
  - **Medical certification of cause of death**
- **Goal:** *to obtain probable cause of death*
- **Users:**
  - **Researchers**
  - **Policy-makers**
  - **Monitoring & evaluation**
  - **Civil registration & vital statistics systems**

Verbal Autopsy (cont'd)

- **Method:**
  - **Interview with family member or caregiver of deceased**
- **To obtain details on:**
  - **Signs**
  - **Symptoms**
  - **Complaints**
  - **Medical history**
  - **Events in period before death**

Standard Verbal Autopsy Questionnaires

- Developed to:
  - Permit certification and ICD coding
  - Ascertain certain causes of death

- Expert review for concensus on standard questions

- 3 Questionnaires
  1. Death of a child aged under 4 weeks
  2. Death of a child aged 4 weeks to 14 years
  3. Death of a person aged 15 years and above

Common Elements in Verbal Autopsy Questionnaires

- General information (first page)
  - Key identifying info
  - Form management data fields
  - Respondent info
  - Sociodemographic info of deceased
  - Death info
- Hx of medical conditions, injury or accident
- Treatment & health service used
- Generalized signs & symptoms during final illness
- Abstracted data from household records

Age- & Sex- Specific Sections:

- Distinguish among age-related:
  - Conditions
  - Causes of death
- Specific signs & symptoms during final illness
- Age-specific modules

A shortened questionnaire…

- Currently in development by WHO
- Aim: max 120 questions
  - Yes/No
  - Digits (time intervals)
- 2G / SMS text compatible

Analysis of Verbal Autopsy Findings

- Physician-certified verbal autopsy (PCVA)
- Various automated statistical approaches
- New methods continually developed

Limitations of Verbal Autopsy

- Cannot ascertain all causes of death
- Does not perform equally well for all causes
- May be subject to recall bias
- Local adaptation may:
  - Affect standardization
  - Bias results

CONTEXT

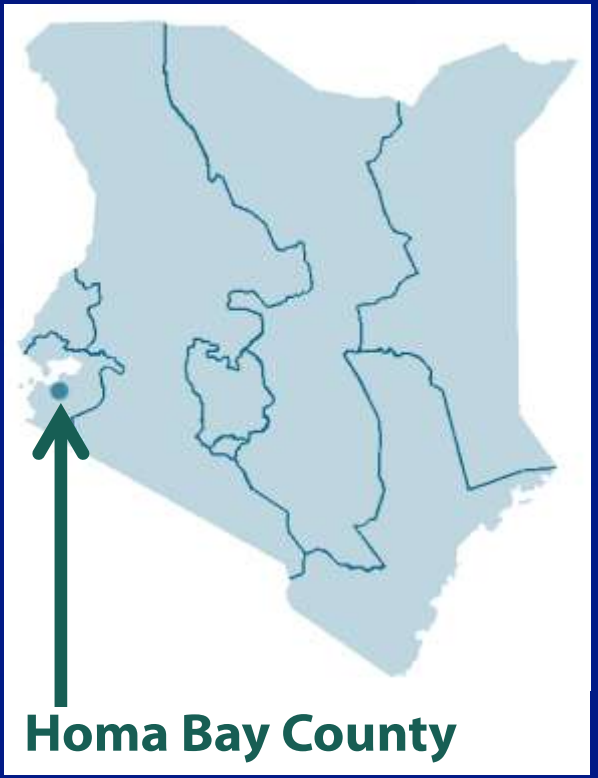
Our Context

- **Civil Registration & Vital Statistics System**
  - **Permanent system > need storage**
  - **Legal system: confidential but *not* de-identified**
- **International, low-resource settings**
  - **CHW mobile phone ownership: ~95%**
- **Narrative :** ***"Can you tell me about the illness/events that led to his/her death?"***

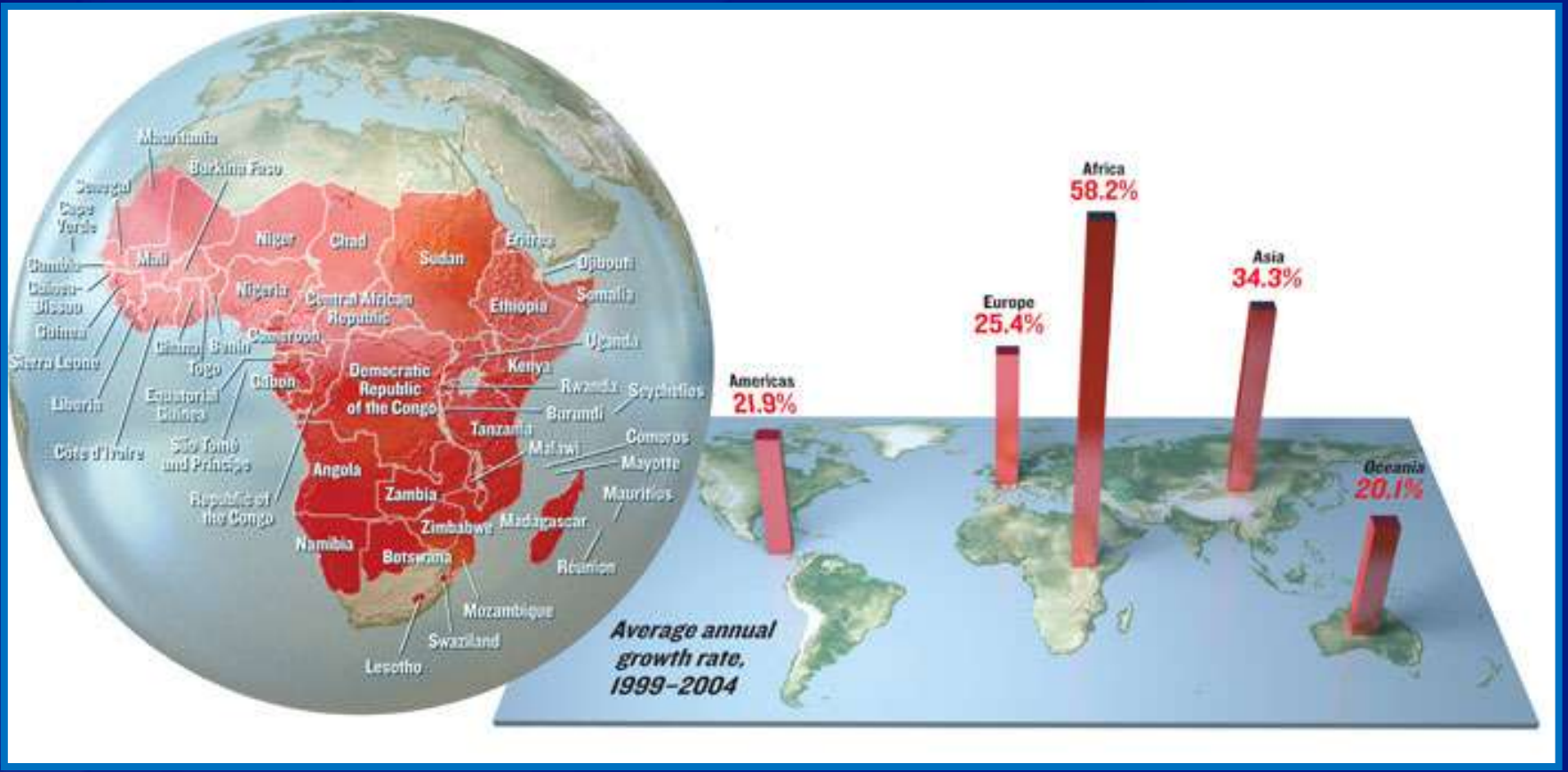
Homa Bay County, Kenya

- 6 districts
- ~2,500 Community Health Workers (volunteers)
- ~175 Community Health Extension Workers (CHEW, paid)
- Population:
  - ~ 1.07 million
  - ~ 221,000 households
- ~555 deaths / month:

  ~3-6 VAs / month for each CHEW



Why mobile data collection is now a reality:

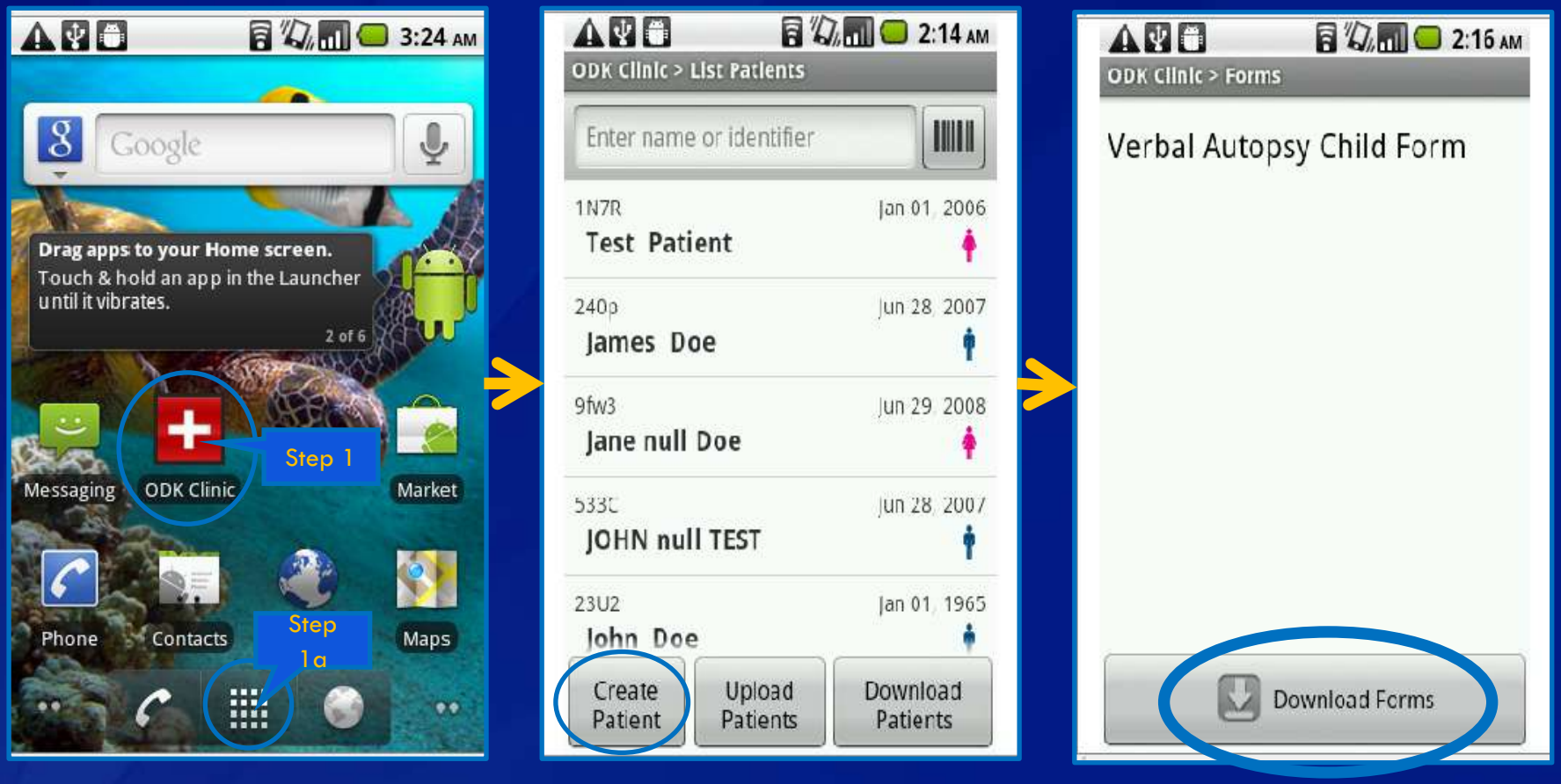


afroRise.

Other Mobile VA Projects

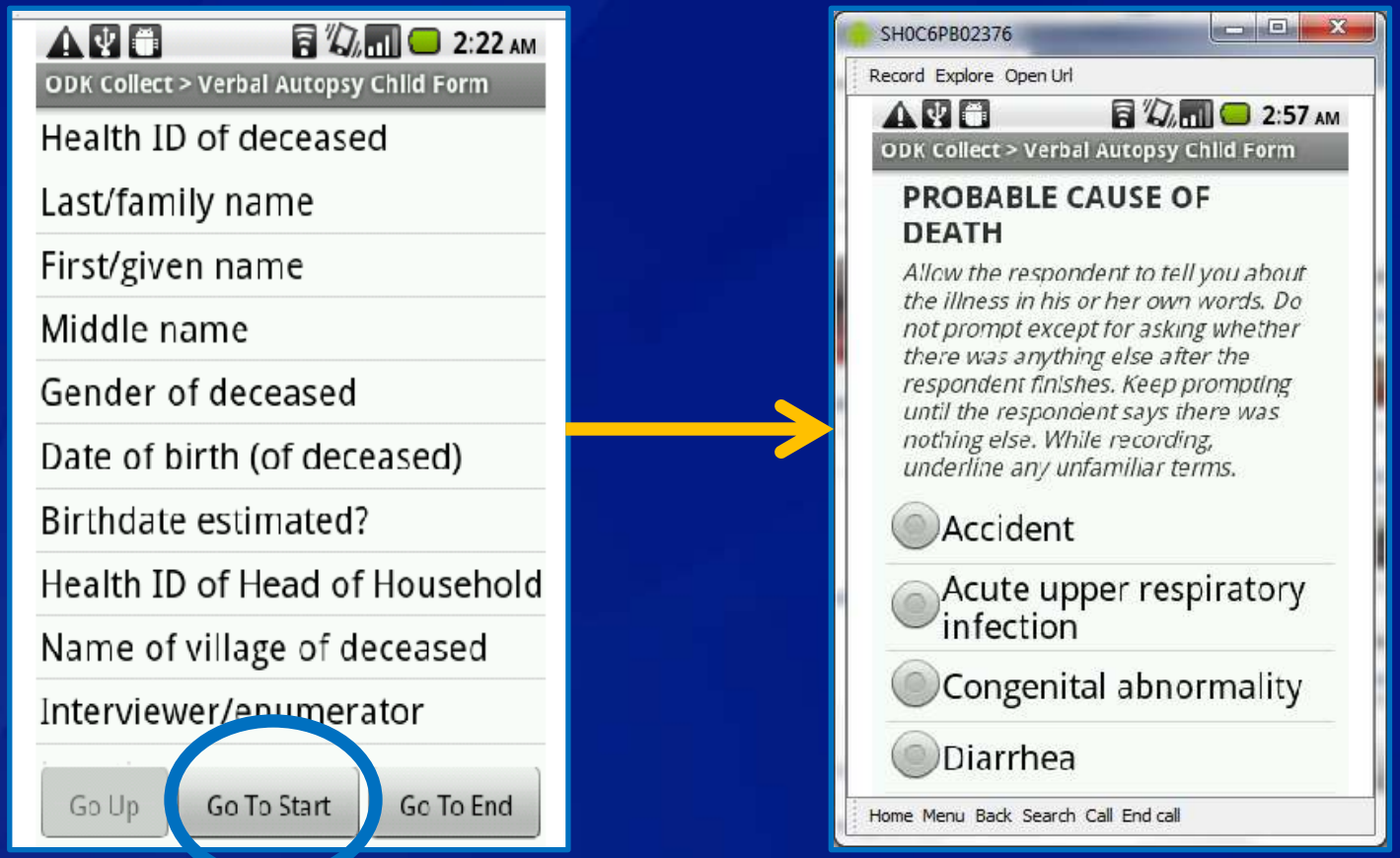
Group	Sites	Device	Configuration	Phase
Millennium Villages Project (MVP)	14 sites in sub-Saharan Africa	Android phone	ODK / cloud server	Deployed in all sites – September 2011
Int'l Health Metrics Evaluation (IHME)	1o sites: India, China, Zambia, Vietnam, Tanzania, Philippines	Site-specific; Galaxy Tab	ODK / server: site-specific	Currently deploying

Millennium Villages Project



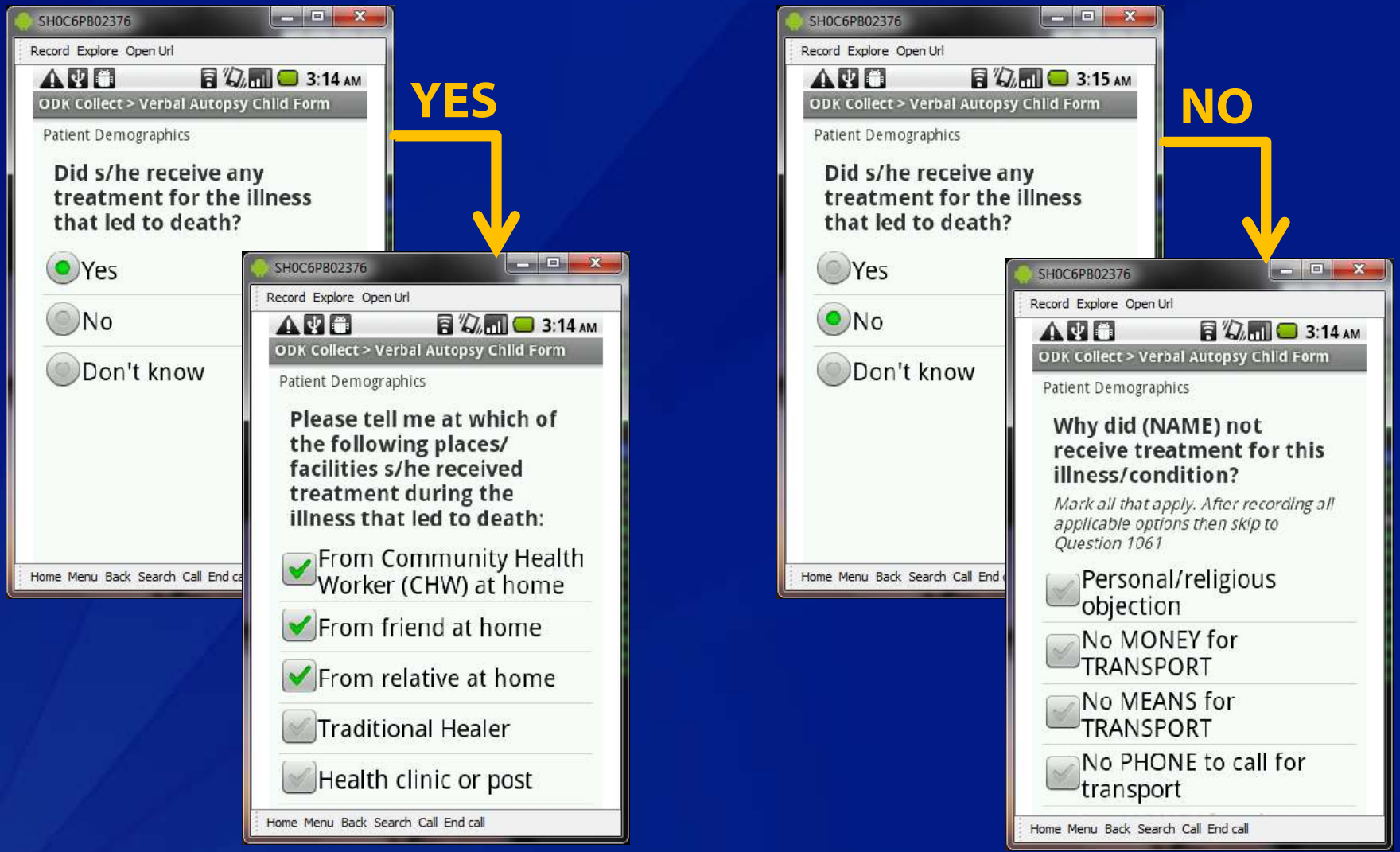
Opening a new form

Millennium Villages Project



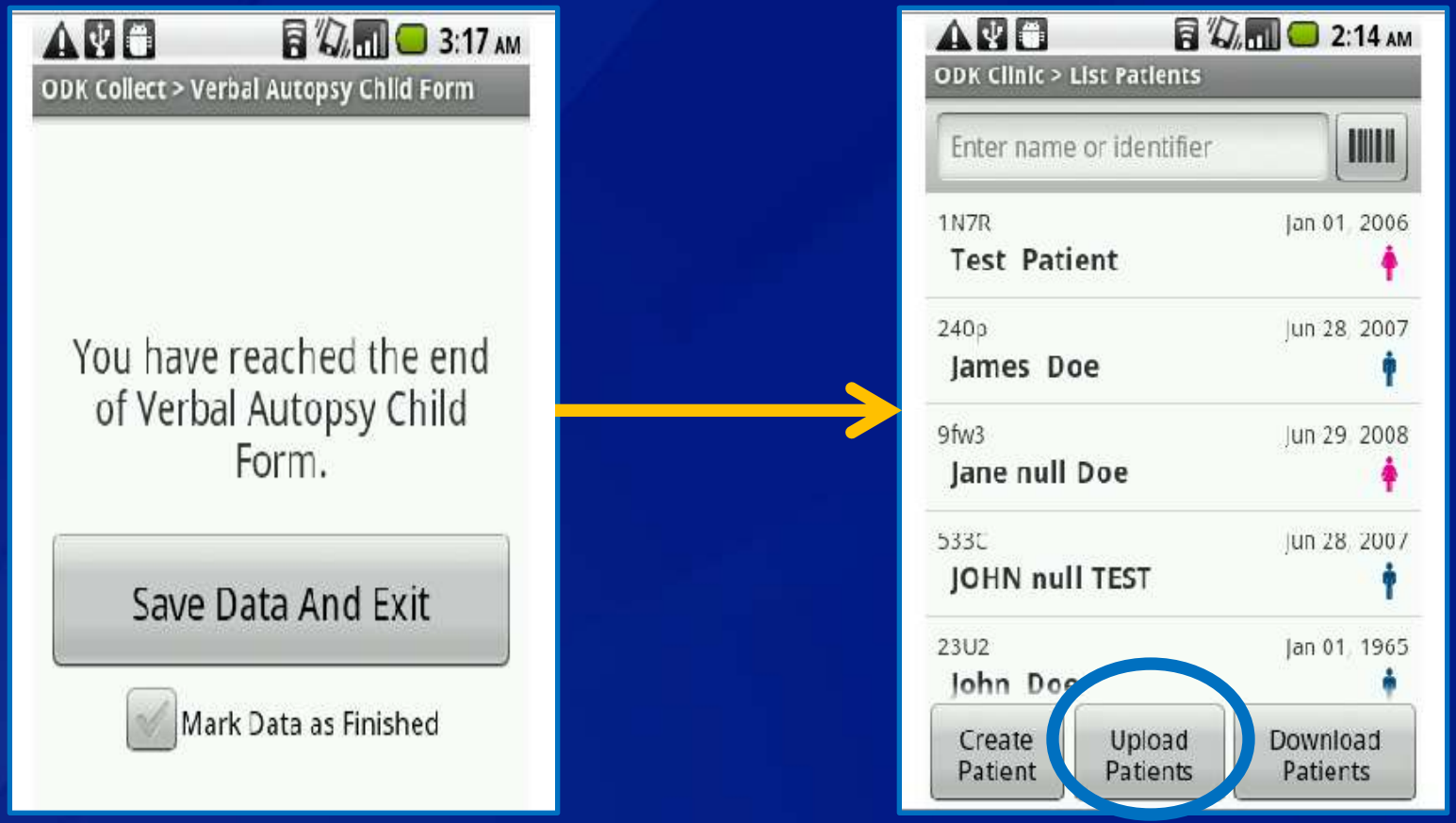
Conducting a verbal autopsy……closed-ended questions

Millennium Villages Project



Skip logic questions

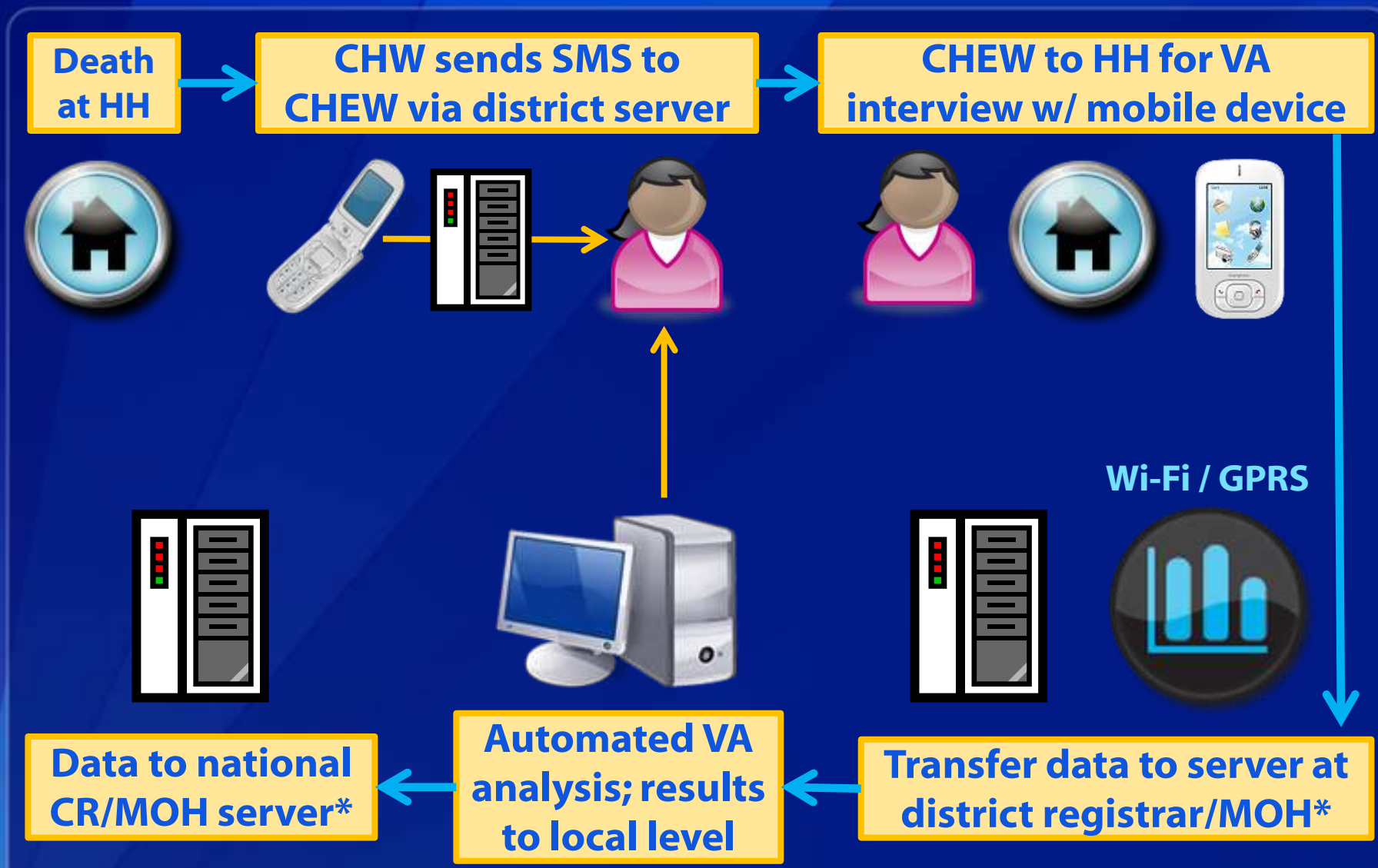
Millennium Villages Project



Saving a completed VA and uploading VA data

Operation * Effectiveness * Cost

CHOICE OF DATA COLLECTION INTERFACE


Death at HH
CHW sends SMS to CHEW via district server
CHEW to HH for VA interview w/ mobile device
Wi-Fi / GPRS
Transfer data to server at district registrar/MOH*
Automated VA analysis; results to local level
Data to national CR/MOH server*
CHW = Community Helath Worker (volunteer)
CHEW = Community Health Extension Worker (paid, supervisor)

Operation: Hardware / Device

2G phone (CHW's)

3G/4G Smartphone

Tablet PC

Operation: Software – Open Source Platform

Platform	Device	Configuration	Comments
Open Data Kit (ODK)	Android	Web-based system	Admin support in Swahili, French, English
JavaRosa	Java-enabled	ODK Build / openX data / XForms	Useable on low-resource devices
OpenXData	Java-enabled	ODK Build / XForms	Useable on low-resource devices

Operation: Features / Customization
(options vary by device)

- Multiple languages
- GPS
- Camera
- Voice recording for narrative:
  - Network coverage / cost of service
  - Quality: clarity / conciseness / background noise
  - Privacy
  - Linking to data file / device storage space
- Monitoring capabilities
- Durability & minimal glare (for outside use)

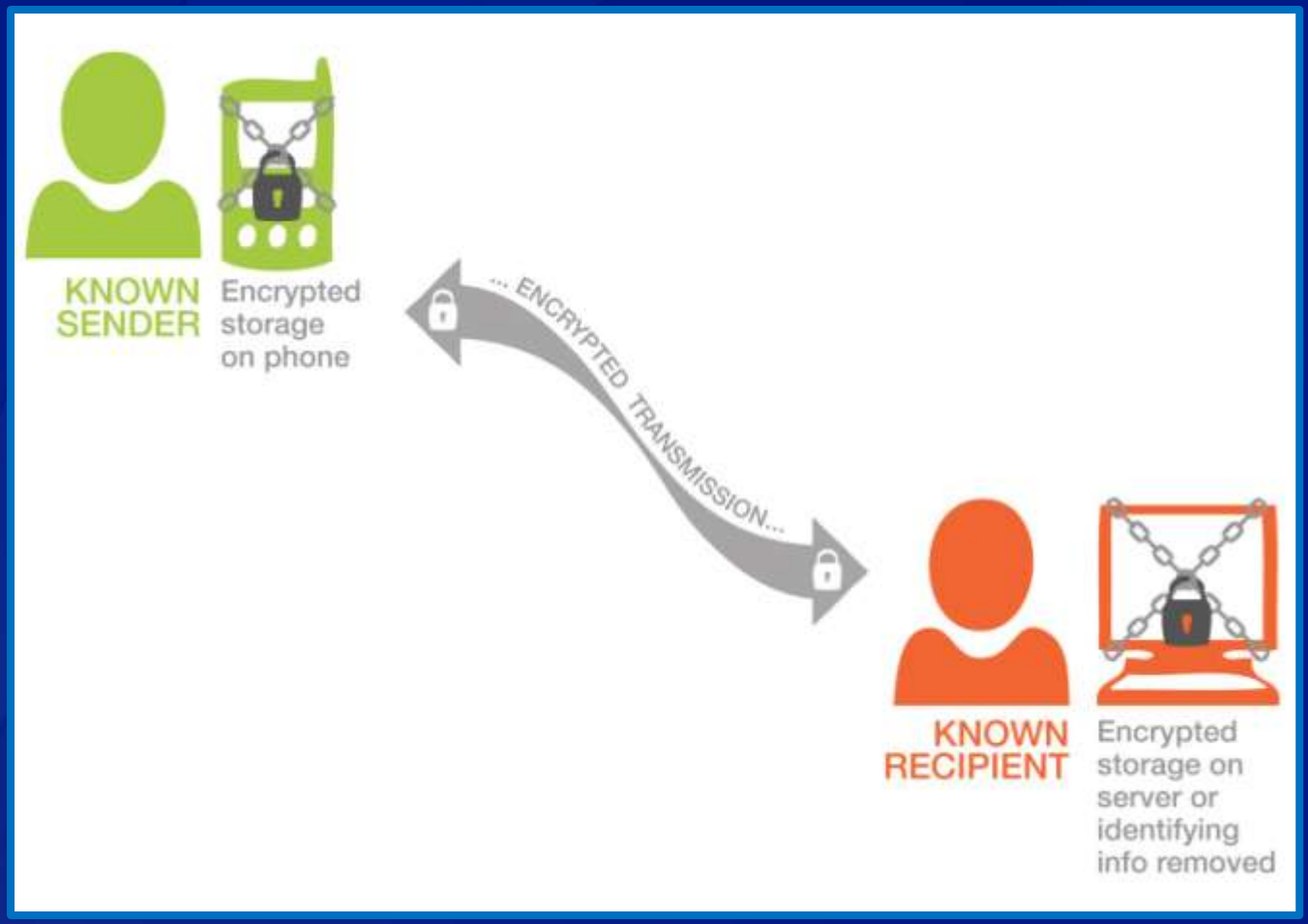
Operation: Data Transmission

- Must be *encrypted*
- Depends on platform, but most likely:
  - GPRS
  - Wi-Fi
  - Computer connection
- Frequency
  - Need to store data until connection available OR
  - Data collectors return to central point (with server)

Operation: Analysis, Back Up & Storage

- **Analysis:**
  - **Local level: feedback for health planning**
  - **National level: national summaries**
- **Back-up:**
  - **Paper forms**
  - **Remote location (additional servers, external storage)**
- **Storage: need *encryption***
  - **Local server at district level (6 in county; 140 in Kenya)**
  - **SQL server at national level**
  - **Cloud server?**

Operation: Security



www.safermobile.org

Encryption Features of Various Tools

Platform	Encrypted Data Transmission	Verified Receiver	Encrypted Storage on Phone	Server Security
Frontline SMS Forms	SMS sent in condensed form, not encrypt.	Yes, by phone #	No	No explicit security features; database in particular is not secured.
RapidSMS	No	Yes, by phone #	No	Database server can be secured.
JavaRosa	Yes (https)	Yes (https)	No	Depends on server; generally DB server can be secured.
OpenXData	Yes (https)	Yes (https)	No	Yes (although you need to set it up); access permissions on server also available.
Open Data Kit (ODK)	Yes (https)	Yes (https)	No (yes in future release)	Hosted solution; various server options if you can host and secure your own server.

https://safermobile.org/resource/secure-mobile-data-collection/

Operation: Other Considerations

- Power source / battery life
  - Solar
  - Extra battery supply if removeable battery
  - Recharge at central location
- User
  - User preference / previous experiences
  - Education level
  - Paid employee
- Training: *ESSENTIAL!*

COST

Cost

	Fixed One Time Costs	Ongoing/Variable Costs
Device & Functional Requirements	Equipment: Device Server Connectivity Software (open source)	Replacement Maintenance
Useage	-	GPRS < SMS over long run
Personnel	Software configuration Technical support Training	Data management Technical support
TRAINING	Thorough up front	Ongoing training

EFFECTIVENESS

Effectiveness

- Monitoring / audit trail
  - Flags for completeness
  - GPS – interviewer location
  - Time stamping
- Accuracy of data entry
  - Logic / range checks
- Speed of data entry (depends on device)
  - Collection & entry combined
  - Skip patterns / data flow
- Operational risk: accidental deleting

Summary of Advantages of Mobile Data Collection

- Potentially improves timeliness of data production
- Enhanced data quality
- Monitoring interviewer
- Additional features (e.g. GPS, camera, voice recording)

Thank you!

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The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Comparison of Mobile Data Collection Tools

- ODK
  - Requires Android phones
- JavaRosa
  - Java enabled phones
- Open X Data

- Similarities (licensing- open source, language, data type, network, cost (free software), tools for configuration, software completely customizable, support)

- Differences (device/cost, data storage, connectivity not required for data collection, operating systems