

personal digital assistants (PDAs) for development



use of handheld mobile and
complementary technologies in low
resource settings

Holly Ladd
SATELLIFE

research questions

- ❑ Is handheld computing a viable cost effective option for health information management and provider education in low resource areas?
- ❑ What are the barriers to adoption of this technology?
- ❑ Can it impact provider practices or decision making to improve health outcomes?

research settings

- ❑ Field data collection - surveys
- ❑ Routine program performance monitoring
- ❑ pharmaceutical inspection at PoE
- ❑ Routine registration of blood donors
- ❑ Service area mapping
- ❑ Routine health information management
- ❑ Clinical level distance education
- ❑ Voter registration list management

technology - handheld

❑ Low end Palm OS handheld	\$105
❑ Secure Digital (SD) expansion card	18
❑ SD back up card	34
❑ Travel power charger	16
❑ Solar charger	65
❑ Car adaptor/charger	15
❑ GPS device	99
❑ GPS cable	65

software applications

- ❑ Forms / data collection
- ❑ Browser /html text reader
- ❑ PDF reader
- ❑ Word file reader
- ❑ “Up-loader”
- ❑ Other free / shareware programs
- ❑ Commercial e-book application

field level data collection

- Nepal
- Kenya
- Ghana

Kenya Measles Survey*

Do you have a domestic worker not

Do members of your household work

What is your usual source of water?
▼ Select one...

What type of sanitation do you have?
▼ Select one...

What type flooring do you have in
▼ Select one...

Mother Survey

राष्ट्रिय भिटामिन "ए" कार्यक्रम
भिटामिन "ए" कय
वितरणका मूल्याङ्कन

आमा सम्झका
लागि पश्नावल

GPS CODE

अक्षांश देशान्तर
(Latitude) (Longitude)

डि.मी (न.) (न.)

मिनेट: (न.) (न.)

routine site performance monitoring

- Nepal
- Bangladesh
- Bolivia
- Kenya

Field 2 of 11

How many Health Units have functional Health Unit Management Committees (HUMC)?

+ -	7	8	9
Del	4	5	6
	1	2	3
		0	.

Enter a number

End



A: 108

Is there a written guideline or protocol for a routine pre- and post-test counseling for HIV testing? (VCT and CT guidelines)

IF YES, ask to see the document.

Lookup...

End

Previous

Next

B: 206

Clinic/Unit in This Facility

Rapid test onsite in clinic

Client sent to VCT clinic

Client sent to PMTCT clinic

Blood drawn in this clinic and sent to lab

Client sent to lab

End

Previous

Next

pharmaceutical inspection at point of entry

□ Tanzania

Field 32 of 51

Do the products in the consignment fall under the physical examination testing program?

PortOfEntry

POE Name: ↓

Control Type: ↓

Control Number:

Is the consignee re

Name of unregiste

Name of registere

Documentation: Ins

Does consignee ha

Are specified produ

Is the consignment

Product Category: ↓

End [Navigation icons]

Yes
No
NA

End

Record View

Field 42 of 51

Do unit samples collected from each batch have tamper-proof seals?

Yes No

End

Record View

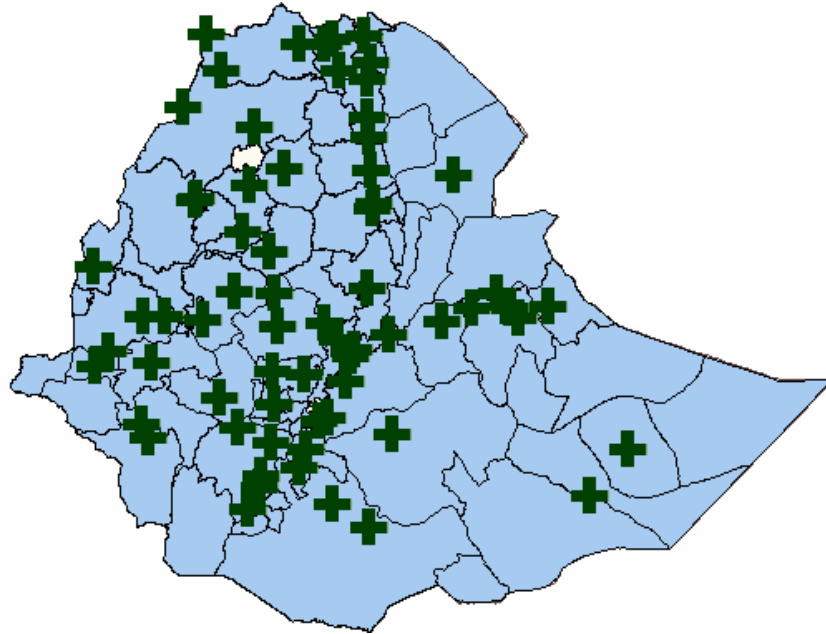
registration of blood donors

□ Uganda

The screenshot shows a 'Form Designer' window with a blue title bar. The main area is divided into two panes. The left pane, titled 'Donor Registration', contains a list of form fields: 'Last Name', 'First Name', 'Registration Number', 'Unit Number', 'Place of Donation' (with a 'Lookup...' button), and 'LC1' (with a 'Lookup...' button). Below the fields are navigation buttons: 'End', 'Previous', and 'Next'. The right pane shows the 'Question: 1' configuration for the selected 'Last Name' field. It includes tabs for 'Field', 'Data', 'Visual', 'Sizing', and 'Script'. The 'Field Name' is set to 'Last Name'. The 'Position' is set to '1', indicated by a vertical slider and a '1' next to the field name.

service area mapping

- WHO SAM
 - Ethiopia
 - Nigeria
 - Uganda
 - Tanzania
 - WHO Afro
 - WHO SEAsia



routine health information management

- Uganda HIN
 - Rakai
 - Mbale
 - Manafawa

Field 19 of 40

01 Acute Flaccid Paralysis
0-4 years

+-	7	8	9
Del	4	5	6
	1	2	3
		0	.

Enter a number

End Record View ◀ ▶

67703

Referrals from uni

Outpatient Diag

01 Acute Flaccid Pa

01 Acute Flaccid Pa

02 Cholera

02 Cholera

03 Diarrhoea -Dys

03 Diarrhoea -Dys

04 Guinea Worm

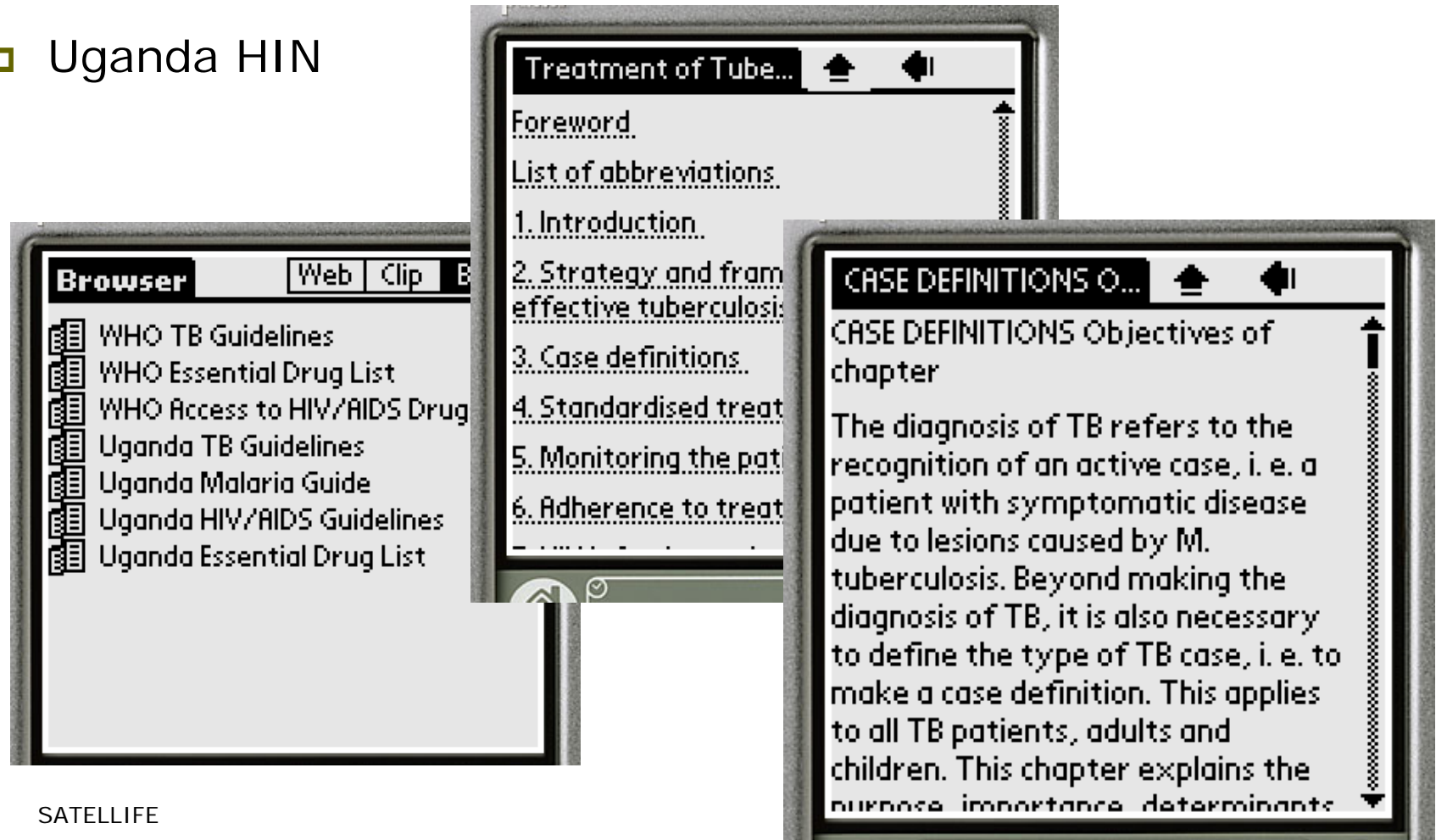
04 Guinea Worm

05 Measles

End ◀ ▶ ▶▶

health center level provider education

□ Uganda HIN



provider education

Diarrhea

If patient has diarrhea, ask:

Lasted > 14 days? ▼ No

Blood in stool? ▼ N/A

Look:

Sensorium? **Lethargic**

Sunken eyes? Restless

Drinking? Normal

Feel:

Skin pinch? ▼ N/A

Diarrhea

If patient has diarrhea, ask:

Diagnosis

Shigella Dysentery with Severe Dehydration

RECOMMENDED ACTION:

Antibiotics plus Treatment Plan C

provider education

HIV

If HIV infection is suspected, ask:

Lost > 10% weight?	▼ No
Diarrhea > 1 month?	▼ Yes
Fever > 1 month?	▼ Yes
Cough > 1 month?	▼ Yes
Itchy rashes?	▼ Yes
Recurrent herpes zoster?	▼ No
Oral candida?	▼ No
Chronic herpes simplex?	▼ Yes

Done Diagnose

Diagnosis

Possible HIV infection

RECOMMENDED ACTION:

Refer to clinic, provide prophylaxis of PCP with Bactrin. Recommend TB screen due to prolonged coughing

OK

community health – patient tracking

Satellife Register

Name	Sex	Age	Status
Lalit	M	11	
Mala	F	45	
Palomi			
Piyush			
Prabha			
Rishi			
Tapi			
Virat	M	7	

Demographics
Immunizations
Drugs
Maternity

New **Back**

DemographicsForm

Name Palomi
ID# 103
Sex ▼ Female
DoB Feb 6, 1996
Marital ▼ N/A
R to H ▼ N/A
Occup.
Literacy

Done

Immunizations

	Dose	Last	Given?
BCG	0	--	<input type="checkbox"/>
DPT	0	--	<input type="checkbox"/>
DPTB	0	--	<input type="checkbox"/>
DT	0	--	<input type="checkbox"/>
OPV	0	--	<input type="checkbox"/>
OPVB	0	--	<input type="checkbox"/>
Measles	0	--	<input type="checkbox"/>
Vit A	0	--	<input type="checkbox"/>
Foli	0	--	<input type="checkbox"/>

Done

voter registration list management

□ Rwanda



NEC Voter Card

No. Y'ikimuranga
Num P Identite
ID Card Number

+-	7	8	9
Del	4	5	6
00	1	2	3
	000	0	.

End

Previous

Next

Signature

Umukono/Igikumwe cya
Nyirayo

Signature du Proprietaire

PLEASE PRESS LIGHTLY
AND SIGN SLOWLY

Clear...

John Doe

OK

Cancel

data transfer options

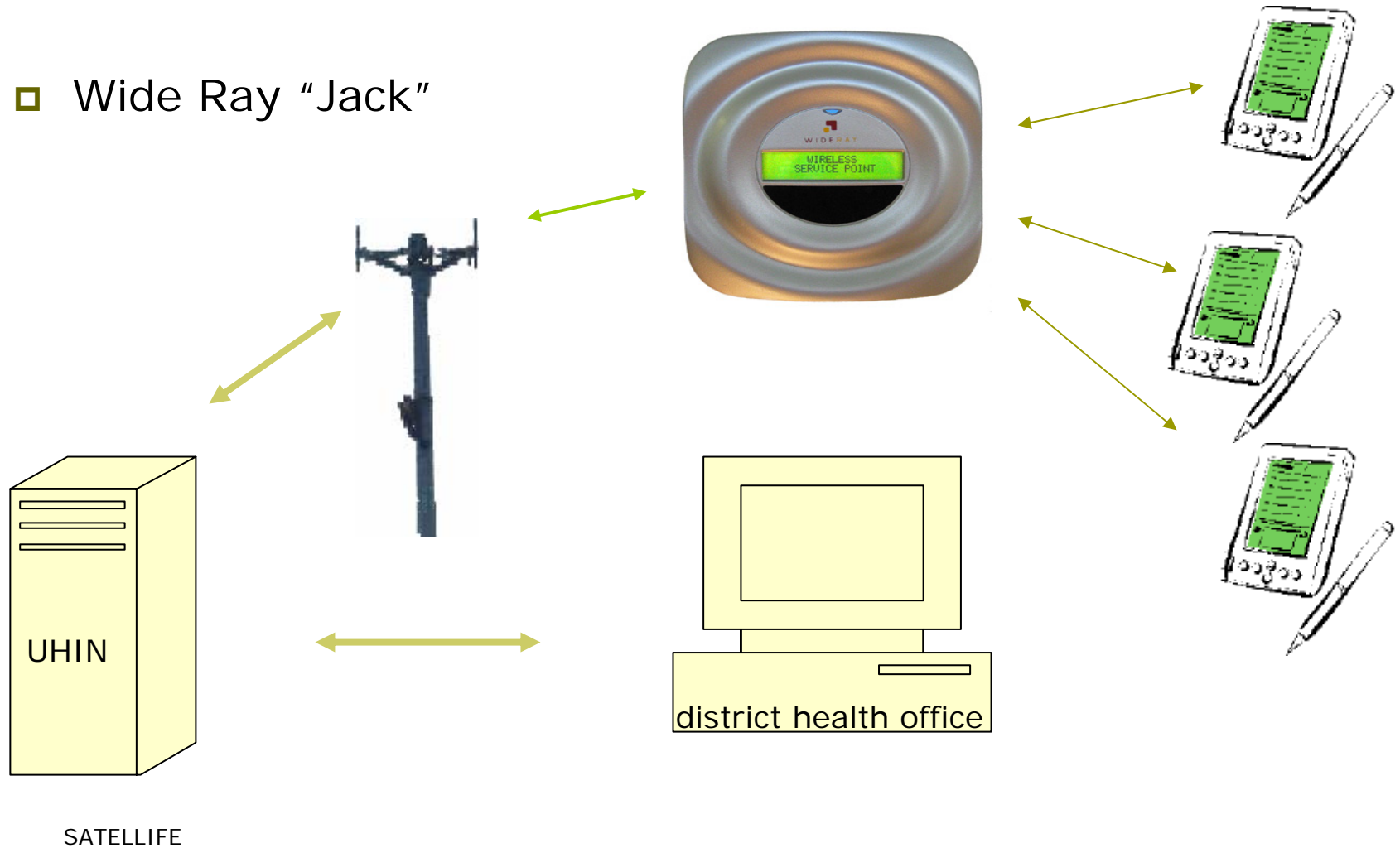
- by hand
 - turn over PDA
 - turn over SD card
- unit to unit
 - “beam” data between units
- unit to local host
 - field “hot sync”
- unit to remote host
 - dial up hot sync or data transfer
 - wifi or other wireless data transfer

program design specifications for routine electronic data transfer

- ❑ use existing infrastructure where possible
- ❑ stand alone appliance
- ❑ little or no user maintenance
- ❑ little or no skill to operate
- ❑ remote management
- ❑ power smart - solar battery
- ❑ support multiple users
- ❑ low operating cost
- ❑ secure

current technology

Wide Ray "Jack"



“jack” specs

□ Hardware

- Size and Weight: 6.5" x 5.5" x 2", 23 oz.
- IR Transmission Range: Up to 15 feet
- IR Transmission Rate: Up to 115,200 bps
- Number of Simultaneous Users: Up to 1,000
- Wireless Network: GPRS and GSM Worldwide Wireless Network
- Storage Capacity: 32 MB

□ Software

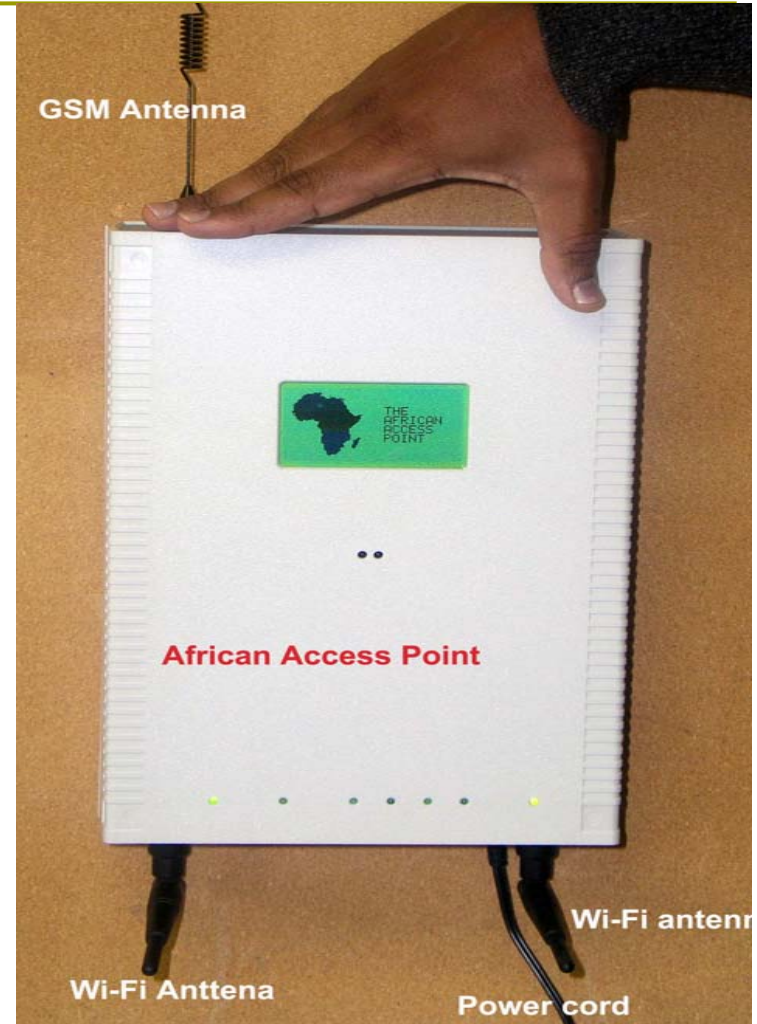
- Operating System: Linux (ARM)

“jack” -- secure, but available for all - Rakai district health office



new technology

- "Africa Access Point"



AAP specs

□ Hardware:

- **Power Supply:** 15V AC-DC power converter is its main power supply. Feeding into the Regulator/Charging circuit, 12V is used to power the AAP while a higher voltage is needed to charge the backup battery.
- **Real Time Clock (RTC):** Using the GPIO lines a RTC is placed on a Custom Interface board and uses a lithium battery to ensure it is kept operational at all times.
- **Secure Digital (SD) Card Reader:** To give the AAP the ability to expand its memory capacity a SD card reader will be placed on the GPIO lines. This will allow for SD cards to be added to the AAP as required.
- **LCD Module:** LCD module is attached to the GPIO lines via interface circuitry.

AAP specs (continued)

- **GSM Module:** The GSM module, attached to one of the two available serial interfaces, provides cellular capabilities of the AAP. A SIM card socket allows the addition of SIM cards which provide the identification of the AAP for cellular communications.
- **Analogue Modem Module:** Placed on the same serial interface as the GSM module and accessible via electronic switch circuitry the modem provides an alternate communications medium to the GSM module.
- **Bluetooth Module:** The Bluetooth module provides wireless connections to Bluetooth compatible devices. It is placed on the other available serial interface.
- **Infra-red Module:** Attached to the same serial interface as the Bluetooth module and also using electronic switch circuitry the Infra-red module provides Infra-red connections to compatible devices.

APP specs (continued)

- **Wi-Fi and Ethernet:** Wi-Fi and Ethernet connectivity are provided as the default communication mediums of Linksys WRT54GS.

- Software
 - Operating System: OpenWRT GNU/Linux
 - Web Server: LightTPD
 - Mail Server: Mini-Sendmail (SMTP) & popa3d (POP3)
 - FTP Server: Atftpd
 - Scripting Language: PHP
 - Programming Language: C

data transfer technology compared

Jack

- ❑ \$2400 retail per unit (our price \$1800)
- ❑ requires proprietary backend
- ❑ additional price for wifi or bluetooth

AAP

- ❑ \$580 per unit expected price
- ❑ open source
- ❑ larger cache
- ❑ email option
- ❑ includes wifi & ethernet
- ❑ gsm & analogue phone
- ❑ expandable memory

research findings to date

- Is handheld computing a viable, cost effective option for health information management and provider education in low resource areas?
 - reduces cost of data collection and data entry
 - easy to use by all levels of health professional
 - increased accuracy, timeliness and completeness of data collection
 - improvements sustained over time
 - user demand for additional, practical educational content
 - not good for lengthy text entry

research findings to date (continued)

- What are the barriers to adoption of this technology? – what we expected:
 - Fear of new technologies
 - Unwillingness to learn new skill not related to reward
 - Continuing user support required from program
 - Continuing user training required from program
 - Unit Loss, breakage
 - Language difficulty
 - Power needs deter use
 - Lack of understanding sufficient to solve user problems
 - Security of “Jacks”

research findings to date (continued)

□ What we found:

- Near 100% use over year
- Improved timeliness and completeness of reports
- Requests for additional programs/applications and email
- Requests for additional practical CME material
- Sharing device with community
- Loss or breakage equal to US
- Jacks 99% un-tampered with
- Regular Use of solar chargers
- Request for programs in Luganda
- Local take over of training and user support functions
- ***NEED MORE JACKS***

research findings to date (continued)

- ▣ Can it impact provider practices or decision making to improve health outcomes?

Preliminary outcomes of study due March 28 – 29th UHIN Stakeholders Meeting – Kampala Uganda.

next steps?

- patient management – electronic medical record
- scale-up (Uganda CPD)
- back-end database design and management
- additional “appliances”

references

- ❑ www.bridges.org/satellife
- ❑ www.healthnet.org/pdaprojects.php
- ❑ PDA toolkit – *coming soon*

- ❑ *Technical reports and user surveys from Uganda project available upon request*

Contact Information:

Holly Ladd

Executive Director

SATELLIFE

617-926-9400

hladd@healthnet.org