### ICT4Health in Multi-Institutional Disease Research, Control and Prevention

:: Lessons Learned from Nicaragua

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# About SSI

Since 1988 (in various forms) SSI and partners work to build scientific capacity in developing countries to research, diagnose, and work to control priority infectious diseases.

- increase access to training, funding, information, equipment, and supplies
  - target low-cost methodologies and locally appropriate technologies
    - facilitate knowledge exchange networks

#### Nicaragua (15+ years)

- dengue, leishmaniasis and influenza research
- biomedical scientist training
- laboratory support
- · bioinformatics training
- ICT support\*

#### Ecuador (8+ years)

- dengue surveillance
- Immunology research
- virology and scientific writing capacity building
- · biomedical scientist training



# PDVI: Managua, Nicaragua

#### **Center of Excellence and Training (2004-present)**

A multi-institutional pediatric cohort study of dengue transmission (~3,700 children ages 2-12) was established in 2004 in Managua, Nicaragua to:

- Characterize the natural history of dengue transmission and the clinical manifestations of the various forms of the disease (non-symptomatic, DF, DHF, DSS)
- Collect biological samples (serum, virus) to aid in research directed towards vaccine safety
- Prepare a Phase II/III vaccine trial site for a pediatric dengue vaccine including capacity building and training efforts in
  - 1) Good Clinical Practice
  - 2) Good Laboratory Practice
  - 3) Standard Operating Procedures
  - 4) Quality Control measures
  - 5) Integration of information and communication technologies (ICT)

#### **Partners and Collaborators**

#### International

- Pediatric Dengue Vaccine Initiative project (PDVI Gates Foundation / IVI)
- Division of Infectious Diseases, University of California, Berkeley

National

- Epidemiology and Surveillance Branch, National Ministry of Health (MoH)
- National Diagnostic and Reference Center, MoH

Provincial

• Managua Public Health Department, SILAIS - MoH

Local/District

- Children's Hospital Manuel de Jesús Rivera, MoH
- District II Health Center Sócrates Flores Vivas, MoH, (and 2 satellite clinics)



## Barcodes and Fingerprint ID Systems

Barcodes and Fingerprint Scanning for:

- Patient identification
- Medical chart localization and processing
- Confirming informed consent
- Specimens from suspected dengue cases
- Aliquoting specimens (cases, annual sampling)

Time required to locate medical chart using barcode versus traditional paper method









## Laboratory Information Mgmt System: v1

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bry Information Databases

nple reception, separation, age and tracking

**Protocol generated by** 

scanning barcodes labels on the vials

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0.394

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Media CN:

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- SA
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## **PDA** Applications

### Health Center

- New patient's medical history is entered in PDA format Laboratory
- Registration of freezer/fridge/incubator temperatures
- Quality of samples

### Home visits

- Interview forms on PDA for immediate data entry at time of interview
- Field-team access to data collected during that field visit
- Documentation of sample temperature during collection/transport
- Consent Forms





Use of GIS for high efficiency and low-cost field visit strategies:

- Maps with geographic localization of the vast majority (>97%) of cohort participants
- Directed field visit strategies; analysis of progress during annual sampling
- Geographic localization of children suspected of / confirmed with dengue
- Spatio-temporal analysis -- tracking an outbreak









## Beyond Disease-specific Research Studies...

### **Enhanced Immunization Program "SIPAI"**

- facilitates data entry, analysis and report generation
- used by decision makers about how and where to target limited resources for increasing population-level immunization coverage



### Vaccine Inventory Control System "Kardex"

- inventory control system
- imbedded in the SIPAI database
- tracks vaccines and medications for maintenance and QC
- piloted within the CSSFV
- scaled to SILAIS-Managua clinic system in next few years

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## Beyond Disease-specific Research Studies...

### Individualized Vaccine Registry "RII"

- individualized vaccine registry system
- designed in 2006 to track Rotavirus vaccination coverage of children
- now includes **complete vaccine history** (according to recommended WHO schedule)
- dosage timing
- eventually will be integrated with GIS and hand-held PDA data collection devices to facilitate real-time information flow to/from from field vaccination teams during annual house-tohouse vaccine campaigns



### Healthy Pregnancy Information System "SIMS"

- individualized prenatal health monitoring system
- developed in coordination with the SILAIS-Managua
- piloted in the CSSFV since November of 2007
- incorporates the major health indicator data used by the WHO/PAHO
- includes appointment scheduling information, facilitating data access for health service providers to increase the capacity and efficiency of following individual high-risk pregnancies



## Beyond Disease-specific Research Studies...



MINISTERIO DE SALUD Cobertura Inmunización

Reporte del: 23/04/2007 al: 00/05/2007

SILAIS: Managua

Municipio: Managua

Unidad: Sócrates Flores

Ватіо	Pob #1s	Realizado BCG	Cob 800	Realizado Antipolio	Cob Arépoiro	Realizado Farta	Cob Perts	Realizado Rotavirus	Cob Rotavinus	Pob 1a	Resizedo MER	Cob MIN	Reskcado DPT	Cdb DP1
Cristo del Rosario	77		1.30	1	9.09	7	9.09	5	6.49	74	9	12.16	15	20.2
Cuba	161		0.62	11	6.83	11	6.83	5	3.11	156	16	10.26		15.3
Javler Custra	70	1	1.43	37	52.86	37	52.66	0	11.43	60	25	36.76	30	44.1
Monserior Lezoano	82	4	4.88	8	9.76	8	9.76	4	4.88	78	7	8.97	19	24.3
Santa Ane Note	144	1	0.69	14	9.72	14	9.72	5	3.47	143	13	9.09	12	8.3
Santa Ana Sur	130	2	1.54	11	8.45	11	8.46	7	5.38	126	17	13.49	23	18.2
Bier	134	0	0.00	16	11.94	16	11.94	6	4.48	130	20	15.38	29	22.3
El Camen y Retorna	21	0	0.00	0	0.00	0	0.00	0	0.00	20	1	5.00	2	10.0
Fuers de Sector	0	0	0.00	5	0.00	5	0.00	3	0.00	0	0	0.00	2	0.0
Julio Bultrago	107	0	0.00	13	12.15	13	12.15	7	6.54	103	12	11.65	.27	26.2
La Cruz	64	0	0.00	7	10.94	7	10.94	2	3.13	62	1	14.52	20	32.2
Los Polmos	30	0	0.00	1	5.00	1	\$.00	1	5.00	19	1	10.53	3	15.7
Manuel Olivares	69	0	0.00	2	2.90	2	2.90	0	0.00	67	7	10.45	11	16.4
Martha Quezada	45	0	0.00	1	2.22	- 21	2.22	2 3	2.22	- 43	1	2.33	2	4.6
San Artonio	25	0	0.00	3	11.54	3	11.54	0	0.00	- 25	4	16.00	8	32.0
San José	94	0	0.00	4	4.26	4	4.26	1	1.06	90	8	8.89		8.8
San Sabastián	110	0	0.00	25	21.19	25	21.19	9	7.63	116	30	20.45	42	36.2
Villion Disz	20	0	0.00	4	17.39	4	17.39	3	13.04	22	1	4.55	5	22.7
Total	1385	10	0.72	169	12.20	169	12.20	67	4.84	1342	585	13.79	282	21.0

Reporting functions generation of data in a variety of formats allows decision makers to plan for deployment and use of limited resources to meet vaccine coverage goals.

## **New Directions**



<u>...other eHEALTH pipeline areas...</u> Disease Surveillance Systems Pharmacy Information Systems Telemedicine Outreach/Patient Education Software & Tools Interoperability Solutions

#### Lab Information Management System (LIMS)

- National Reference and Diagnostics Lab (+ regional offices) onto a web-based LIMS
- link with other Nicaraguan ministries for geospatial data sharing for Epi/Surveillance system (track disease incidence, outbreaks)
- Sharing with the PDVI 12+ sites (2008) and SSI Cairo (early 2009)

### Electronic Medical Record Systems (EMR)

- modifying/implementing/evaluating a webbased registration and electronic medical record system (openMRS) in the Centro de Salud Socrates Flores Vivas and the children's hospital
- determining the feasibility and scalability of this system for use in other clinics at the regional and national levels
- deveoping a reporting structure to match <u>but</u> <u>possibly replace</u> - existing report reqs.

### **Mobile Applications**

- phones? PDAs? Tablet PCs?
- EMR interoperability on a mobile platform
- logistical coordination and facilitation tools to increase field-team effciency (and efficacy)

## **New Directions**



- Start small but be mindful of scalability and adaptability -- careful of the pilot-syndrome!
- Make the leap onto more user-friendly and scalable systems options (open source and web-based in our case) when appropriate.
- Engage stakeholders and tools/system user groups for feedback and input at multiple implementation steps -- it's an iterative process. Build capacity for locally-based support (ICT, analysis, evaluation) from the beginning.
- Avoid imagined needs ... focus on targeted information outputs for health impact.
   Publication AND Public Action are both necessary!
- Don't underestimate politics "public" health actors must be engaged early and often.
- Keep in mind infrastructure, hardware, human resource, and language (!) limitations and plan appropriately to address all.
- Avoid the "silo" affect actively seek out South-South networks and keep in mind the continuum of "developing" vs. "developed" in different regions.
- Document, publish, present, engage, share so that duplication of effort and use of limited resources are minimized.



SSI Nicaragua's ICT Team

- doctors, researchers, health center/hospital/lab staff, computer engineers, data entry staff, data managers, graphic desiners, network managers, and people coordinators!

### Sustainable Sciences Institute

Dr. Josefina Coloma Dr. Oscar Ortega Elsa Videa Nicole Fitzpatrick Mirtha Monterrey

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Dr. Julio Caldera

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