ICT4Health in Multi-Institutional Disease Research, Control and Prevention

:: Lessons Learned from Nicaragua

UC Berkeley iSchool
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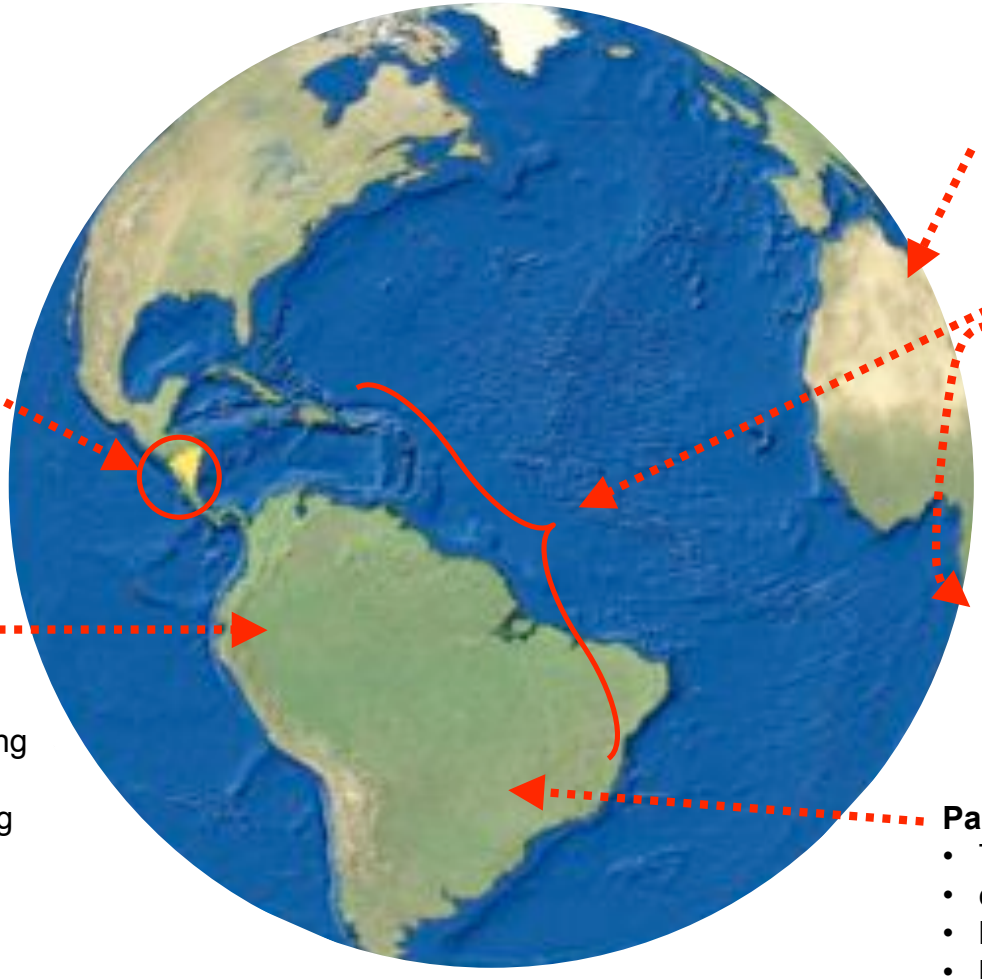
About SSI

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**



Egypt (8+years)
- Hepatitis C virus research
- biomedical scientist training
- laboratory support

Nicaragua (15+ years)
- dengue, leishmaniasis and influenza research
- biomedical scientist training
- laboratory support
- bioinformatics training
- ICT support*

Guatemala
El Salvador
Panama
Colombia
Venezuela
Brazil
Peru
Bolivia
Namibia (15+ years)
- biomedical scientist training

Ecuador (8+ years)
- dengue surveillance
- Immunology research
- virology and scientific writing capacity building
- biomedical scientist training

Paraguay (8+ years)
- TB and dengue control
- epidemiological research
- biomedical scientist training
- laboratory support

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

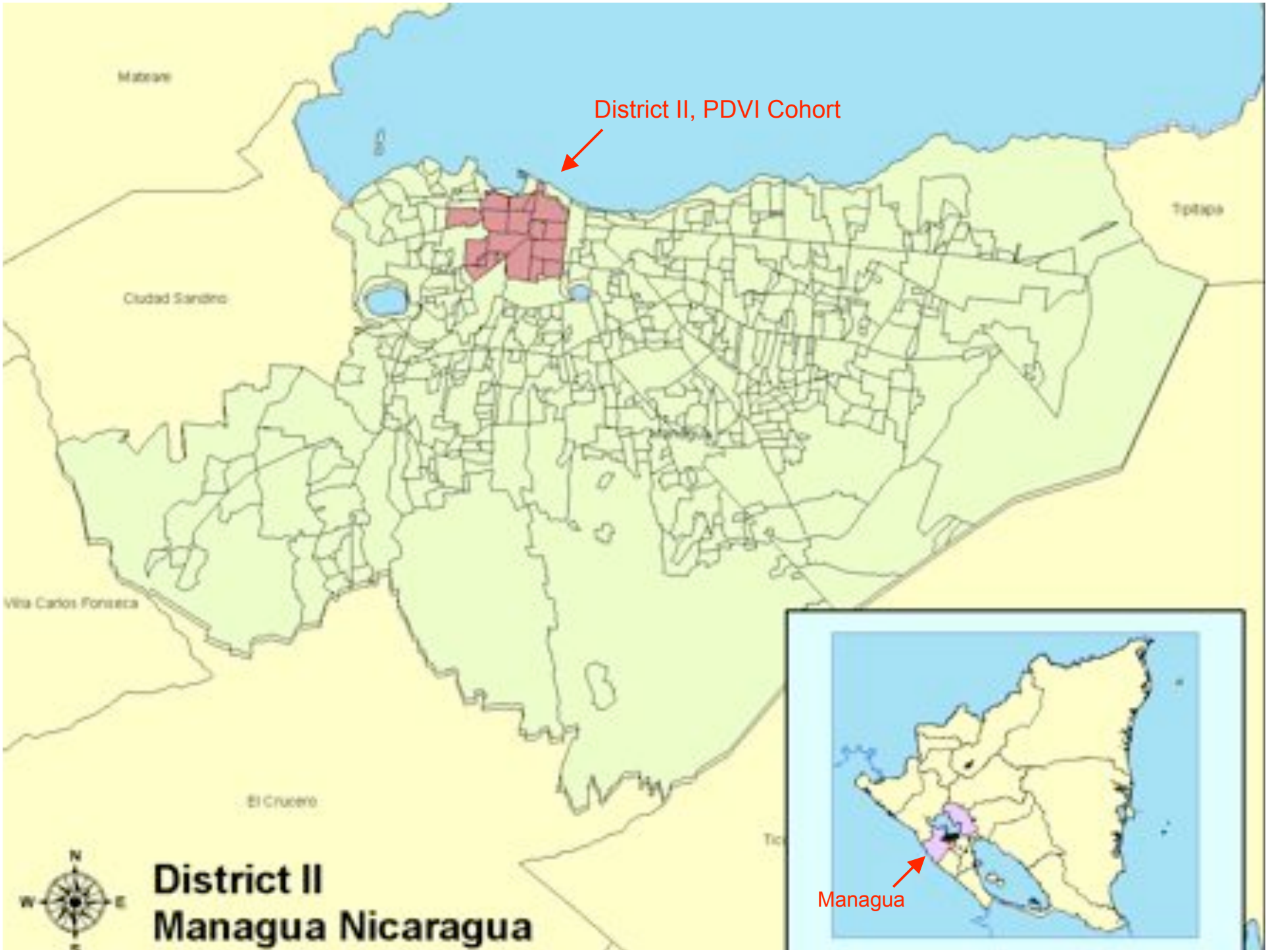
- Epidemiology and Surveillance Branch, National Ministry of Health (MoH)
- National Diagnostic and Reference Center, MoH

Provincial

- Managua Public Health Department, SILAIS - MoH

Local/District

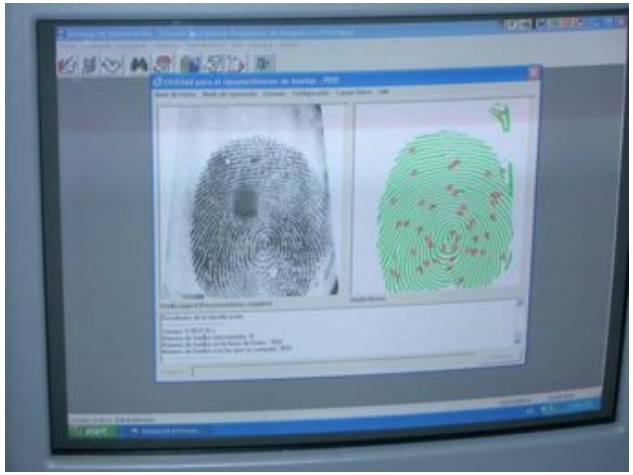
- Children's Hospital Manuel de Jesús Rivera, MoH
- District II Health Center Sócrates Flores Vivas, MoH, (and 2 satellite clinics)

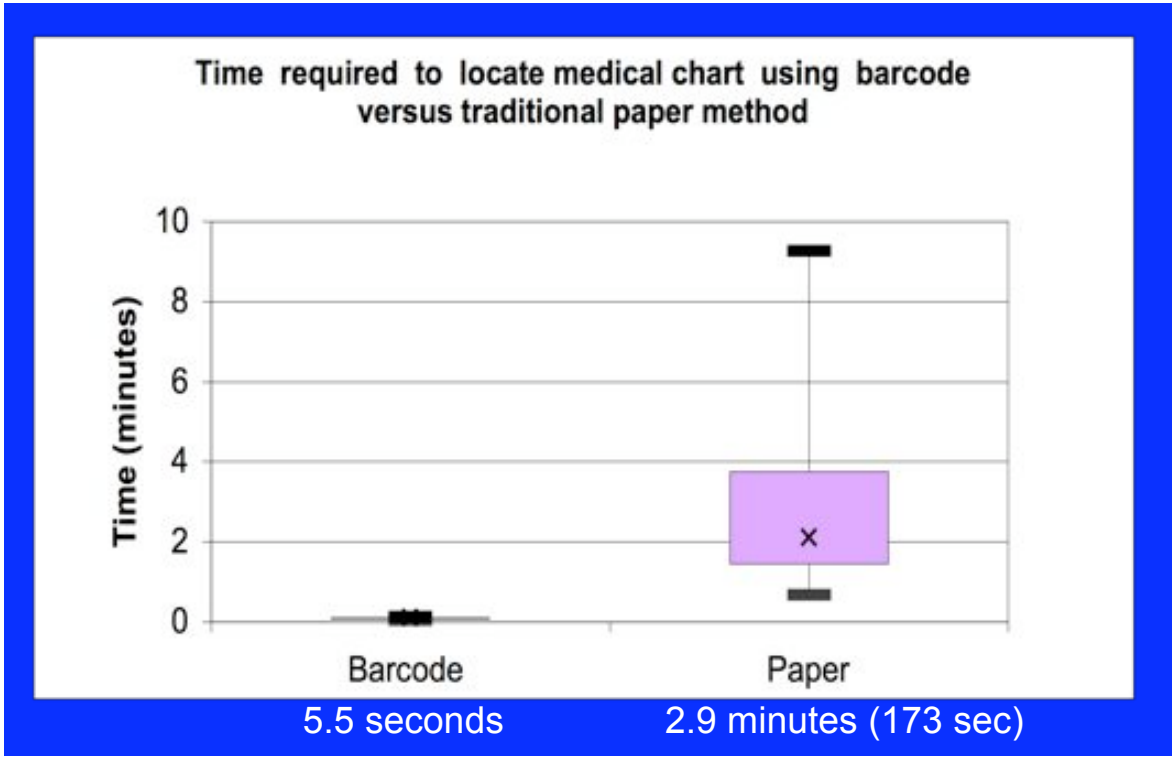

District II, PDVI Cohort
Managua
District II
Managua Nicaragua

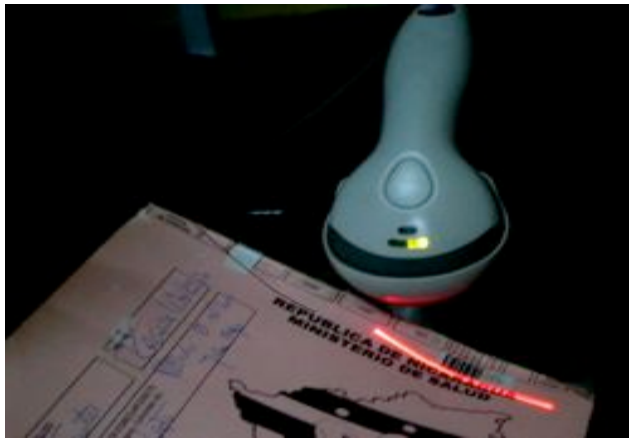
Barcodes and Fingerprint ID Systems

Barcodes and Fingerprint Scanning for:

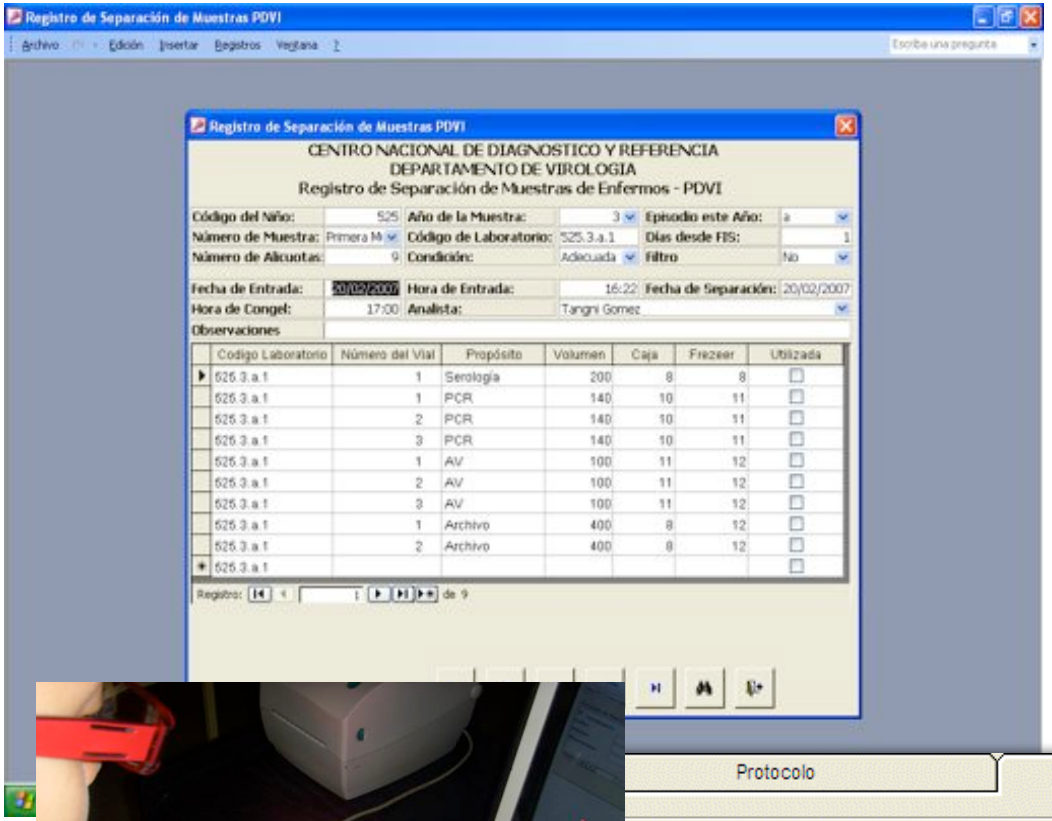
- Patient identification
- Medical chart localization and processing
- Confirming informed consent
- Specimens from suspected dengue cases
- Aliquoting specimens (cases, annual sampling)

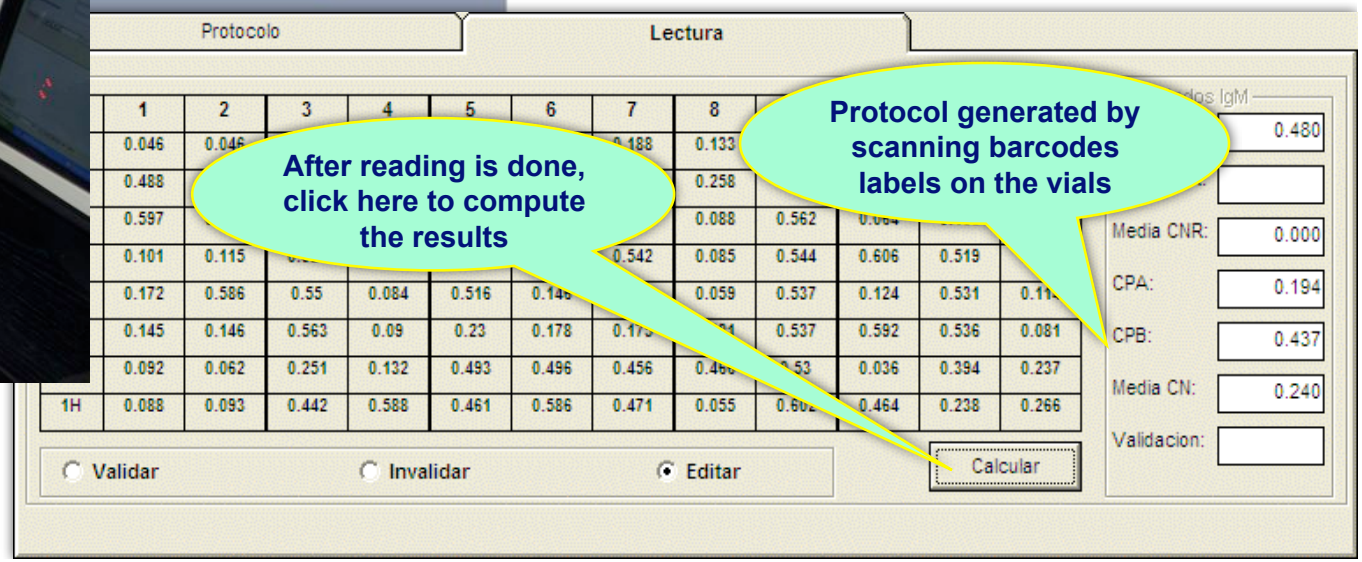






Laboratory Information Mgmt System: v1





Laboratory Information Databases

- Sample reception,separation, storage and tracking
- PCR
- Viral Isolation
- ELISA
- Reagent Control
- Inventory Control
- Quality Control

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

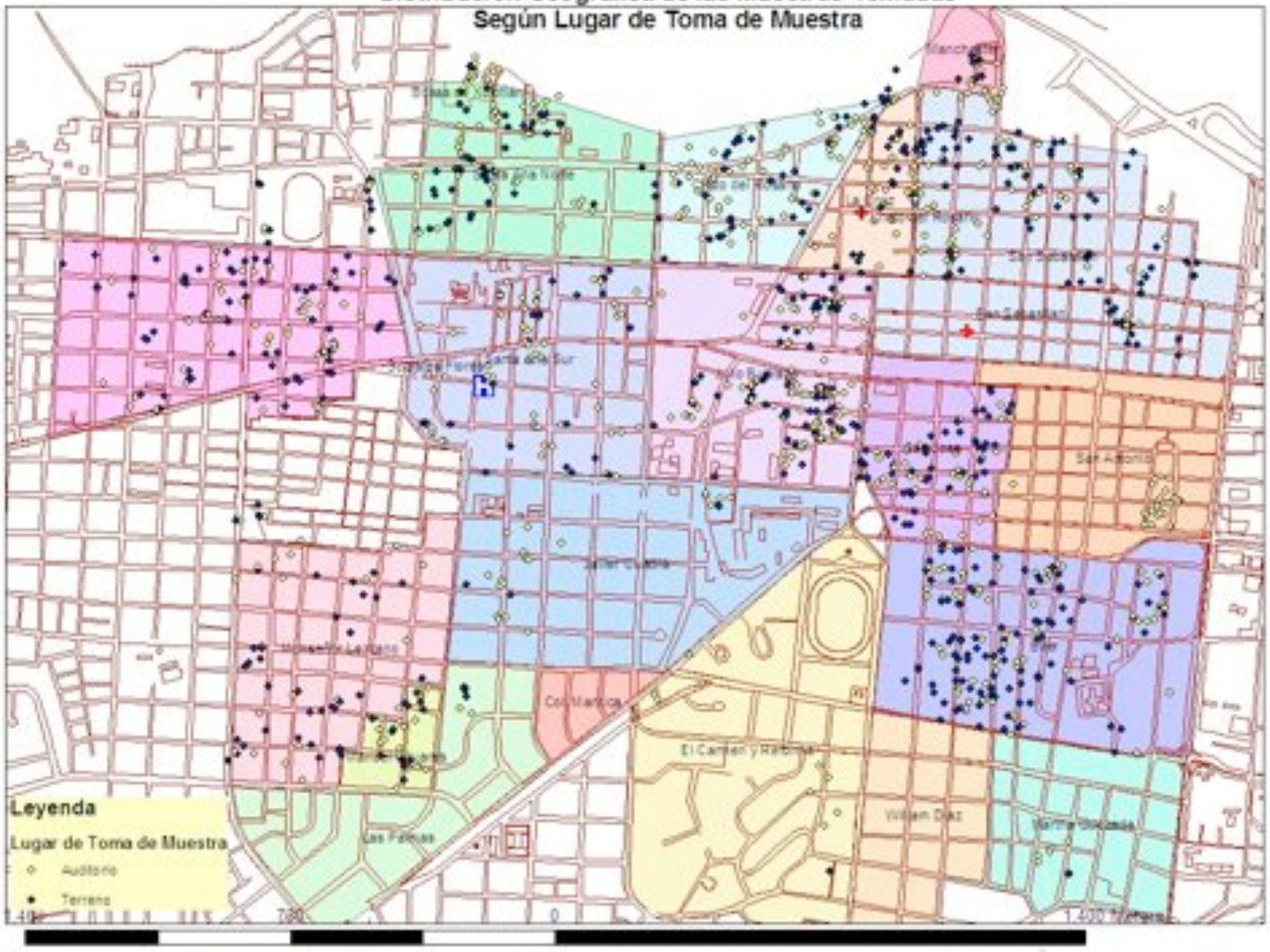
- Interview forms on PDA for immediate data entry at time of interview
- Field-team access to data collected during that field visit
- Documentation of sample temperature during collection/transport
- Consent Forms

GPS/GIS Applications

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

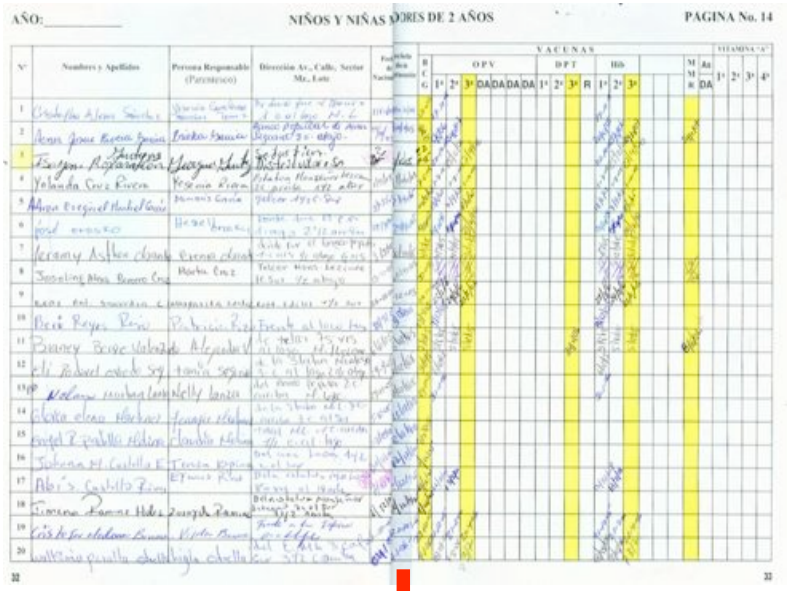
Proyecto de Dengue
Distribución Geográfica de las Muestras Tomadas
Según Lugar de Toma de Muestra



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

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-to-house vaccine campaigns

Beyond Disease-specific Research Studies…

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…

Gobierno de Reconciliación y Unidad Nacional

MINISTERIO DE SALUD

Cobertura Inmunización

Reporte del: 23/04/2007 **al:** 09/05/2007

SILAIS: Managua
Municipio: Managua
Unidad: Sócrates Flores

Barrio	Pob <1a	Realizado BCG	Cob BCG	Realizado Antipolio	Cob Antipolio	Realizado Penta	Cob Penta	Realizado Rotavirus	Cob Rotavirus	Pob 1a	Realizado MMR	Cob MMR	Realizado DPT	Cob DPT
Cristo del Rosario	77	1	1.30	7	9.09	7	9.09	5	6.49	74	9	12.16	15	20.27
Cuba	161	1	0.62	11	6.83	11	6.83	5	3.11	156	16	10.26	24	15.38
Javier Cuadra	70	1	1.43	37	52.86	37	52.86	8	11.43	68	25	36.76	30	44.12
Monseñor Lezcano	82	4	4.88	8	9.76	8	9.76	4	4.88	78	7	8.97	19	24.36
Santa Ana Norte	144	1	0.69	14	9.72	14	9.72	5	3.47	143	13	9.09	12	8.39
Santa Ana Sur	130	2	1.54	11	8.46	11	8.46	7	5.38	126	17	13.49	23	18.25
Böer	134	0	0.00	16	11.94	16	11.94	6	4.48	130	20	15.38	29	22.31
El Carmen y Reforma	21	0	0.00	0	0.00	0	0.00	0	0.00	20	1	5.00	2	10.00
Fuera de Sector	0	0	0.00	5	0.00	5	0.00	3	0.00	0	0	0.00	2	0.00
Julio Buitrago	107	0	0.00	13	12.15	13	12.15	7	6.54	103	12	11.65	27	26.21
La Cruz	64	0	0.00	7	10.94	7	10.94	2	3.13	62	9	14.52	20	32.26
Las Palmas	20	0	0.00	1	5.00	1	5.00	1	5.00	19	2	10.53	3	15.79
Manuel Olivares	69	0	0.00	2	2.90	2	2.90	0	0.00	67	7	10.45	11	16.42
Martha Guezada	45	0	0.00	1	2.22	1	2.22	1	2.22	43	1	2.33	2	4.65
San Antonio	25	0	0.00	3	11.54	3	11.54	0	0.00	25	4	16.00	8	32.00
San José	94	0	0.00	4	4.26	4	4.26	1	1.06	90	8	8.89	8	8.89
San Sebastián	118	0	0.00	25	21.19	25	21.19	9	7.63	116	33	28.45	42	36.21
William Díaz	23	0	0.00	4	17.39	4	17.39	3	13.04	22	1	4.55	5	22.73
Total	1385	10	0.72	169	12.20	169	12.20	67	4.84	1342	185	13.79	282	21.01

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

Solution Lab

…other eHEALTH pipeline areas…

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)

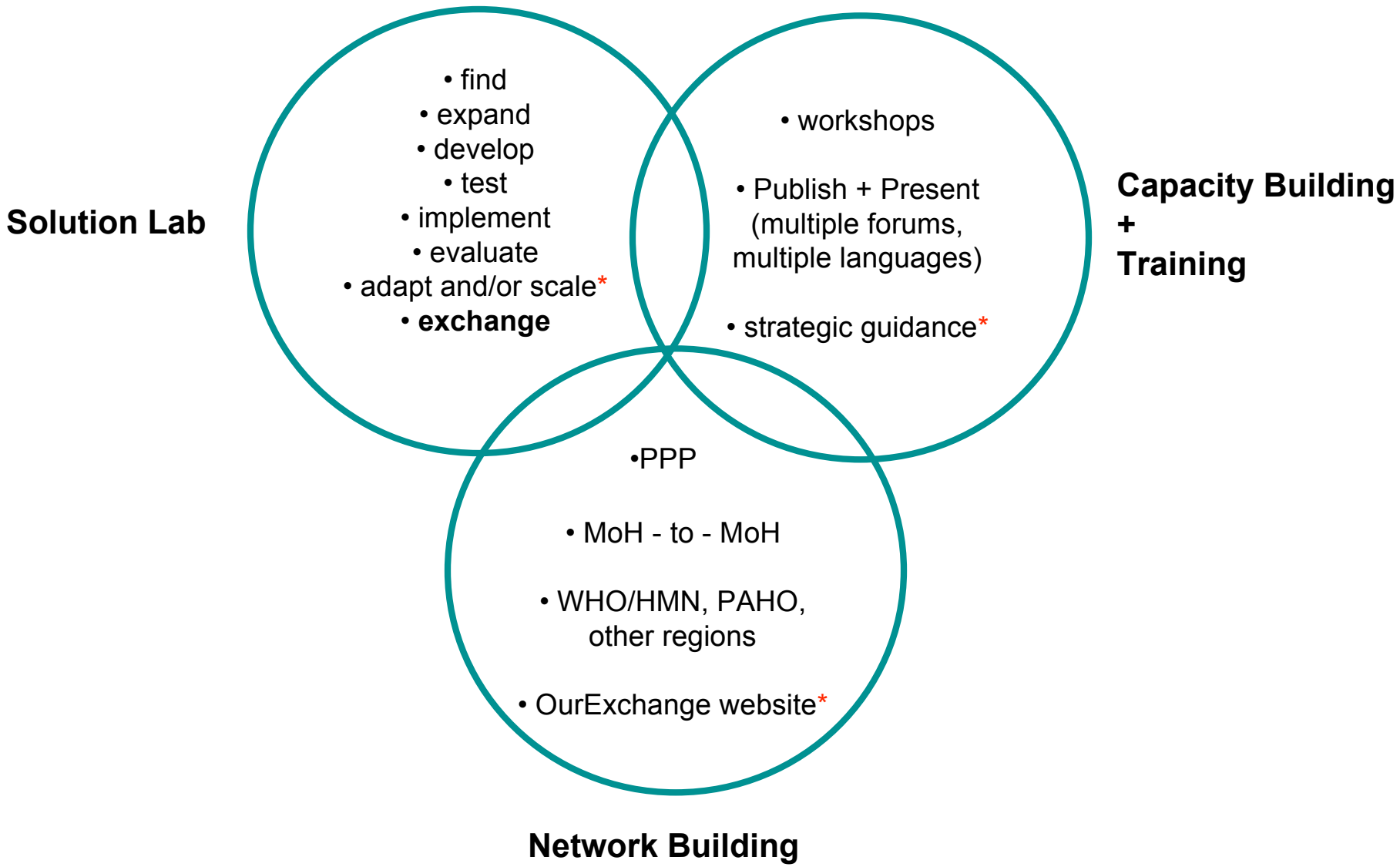
Electronic Medical Record Systems (EMR)

- modifying/implementing/evaluating a web-based 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 - but possibly replace - 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



Challenges and Opportunities

- 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!

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