Laboratory Computing Models for Resource-Limited Countries

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What is a resource-limited country?

1. A function of national income per capita
2. For health assessment, can also look at physicians per 1000 population

Old names:
“Third world”
“Developing world”
“Resource poor countries”
Acknowledgements

Many individuals associated with the following organizations: WorldVista, HardHats, CompProMed, Schuylerhouse, Antek, University of Washington, University of Iowa, University of Miami, WorldWide Lab Improvement, Pathologists Overseas, Association of Public Health Labs, Baobab Health, and many others...
Countries with the lowest per capita income (World Bank)

Burundi
Congo Dem
Liberia
Eritrea
Malawi
Afghanistan
Ethiopia
Sierra Leone
Zimbabwe
Niger
Guinea
Mozambique
Madagascar
Countries with the fewest physicians per 1000 population

Malawi
Tanzania
Burundi
Ethiopia
Liberia
Mozambique
Sierra Leone
Niger
Somalia
Chad
Eritrea
Lesotho
Low staffing levels

World map distorted by number of doctors
Various approaches

Install an LIS previously developed and proven elsewhere

Design and build LIS specifically for the resource-limited setting
Terminology is important

LIMS vs LIS
EMR/HIS vs LIS
Lab reporting system vs. an LIS
PACS vs PACCS
Open source
“Installed” systems
“support” of an installed system
Impediments and mistakes

Confusing LIMS with LIS

Assuming that major cost is in software license fee

Being overly defensive (not sharing insights or experiences with colleagues)

Being ignorant of local conditions - “you should love our $1 million system!”

Arrogance

Declining offers of assistance from colleagues
Disturbing realities

Corruption
In certain countries, leader's relatives control granting of contracts – with strings

Customs impediments
  - Salary level

Political instability
Developed-world vendors “who seem to regard abandonment as an integral part of technical support.”
Success stories

There is not one magic formula

Vendor-developed and open source

Widely deployed is a better bet than a few sites

A necessary prerequisite – many (?)300 cycles of prototyping/agile development
VA-Vista
Developed beginning in 1977
Several hundred sites in US
The primary basis for “no better care anywhere”
Open source
Uses medically-oriented database paradigm (sparse-array) rather than accounting model (relational)
With all these advantages, why not everywhere?
VA-Vista: implementation more difficult that it would seem

Complex, interwoven set of code, tailored to the VA environment

However, it has been successfully implemented in Indian Health Service (Davies Award winner), several other US sites

Many US-specific specializations (primary key: social security number)

For lab, have to implement more than just lab – core functions (admitting, etc.)
Active development to industry leadership in 1988

Then 20 years of funding neglect

Central office, rather than trying to catch up on all that deferred maintenance, chose to instead contract for a commercial LIS

Chose one with good salesmen, less-capable database, but fancy features

After about 3 years, getting the first sites activated
“but what about us?”

Many other users of VA-Vista – such as Indian Health Service, and international sites, don't have the option of spending millions on a lab module.

An effort is underway, through hardhats.org, worldvista, and others, to build the next-generation VAV-LIS.
VA-Vista in Resource-limited settings

India
Samoa
Jordan
Nigeria
Uganda (blood bank)
Egypt
Kenya
Pakistan
http://www.hardhats.org/adopters/vista_adopters.html
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CompProMed

Installing LIS's since the early 1980's
Very stable peer-based platform
Largest number of RLC labs in Ethiopia (a few dozen), only LIS in Bhutan (over 40)
Resilient database design – not damaged by kicking a plug of one of servers out of the wall
Practical – not fashionable
Schuyler House

Installing GUI-centric LIS's since the early 1990's

Recent release – SchuyLab Basic – single user, no license fee – available in most parts of the world

Sites in Ghana, Dominican Republic, Guyana, Suriname, total 20 countries
Antek LabDaq

Thousands of sites in US labs
RLC: Malawi, Uganda, Tanzania
Other US-based and multinational vendors

Meditech
StarLIMS
LabWare
Lack of data from other countries

Unfortunately, we have not so far found a regular tabulation of companies based in or doing business in other countries, to parallel the survey of US-operating countries we publish each November in CAP Today.

I would very much appreciate pointers to data sources on companies in other countries.
Technidata

French-based
Installations in 25 countries
Distributors/subsidiaries in 28 countries
Countries listed include Zambia, Vietnam, Indonesia, Philippines
Client machines can continue running even if connection to server is lost
LIS vendors based in other countries

Custom Software, Ireland – small company, but well regarded. Netaquire LIS

- 16 labs in Ireland,
- Mozambique – 4
- Tanzania – 4

Www.customsoftware.ie

Laboratory System Technologies (Pty) Ltd, South Africa (DISAlab)

Several labs in S. Africa, some other countries
Software on which I have found less data

Prelink, South Africa

Bika Open Source LIMS – wine, water quality, geology, etc

BLIS (CDC, USA).
Focused/research LIS's

TB LIS for Peru – Blaya, 2007
World Wide Lab Improvement

Founded in early 1990's
Focuses on equipment and supplies for mission labs
In 2010, served 50+ countries and over 100 organizations

In 2006, began building an LIS – which morphed into a mini-HIS, in Kabul, Afghanistan
System has now been rebuilt using different tools, planned for deployment in 2012
Deals with both LIS and hospital-wide needs

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World Wide Lab Improvement – histopathology and telepathology

Bill Walker, MD – International Pathology Services – receives about 1200 specimens via FedEx per year, reports via eMail.

Have configured static telepathology with several labs
Entire configuration, including microscope and camera, less than $2000
Capture images into PC, attach to eMail, send
Dr. Walker and other volunteers read images, send back their impression via eMail
Pathologists Overseas

Founded 1991
Concentrate on surgical pathology in several RLCs
Facilitated LIS implementation (Bhutan)
Telepathology
15+ articles on their general work
Association for Public Health Labs

Published 5 guidance documents 2005
(The first update is expected by early 2012)
Sponsored development of OpenELIS
Facilitated CDC PEPFAR project to assist RLC in selecting LIS: including Mozambique, Botswana, Kenya, Swaziland, Tanzania, Lesotho, Ethiopia, and other locations
OpenELIS
Funded by APHL, CDC, PH labs, UW, HRSA, others beginning in about 2005
Originally envisioned as a LIS for US Public Health labs
Iowa, Minnesota, (Kansas) began development
Recently, Minnesota is working on one version, Iowa on another
U Washington/iTech adopted 2007 for use in Haiti
Now 4 variants

OE 1 – development by Minnesota, partly operational in Missouri

OE Vietnam – installed in 7 Vietnamese labs,
  – Has been evolved by local software developer
  – recent APHL grant to UW to converge with OE iTech
OpenELIS continued

OE 2 – development by Iowa, expected to be operating in a few months

OE iTech – Extensively adapted for use in Haiti and Ivory Coast –

3 labs operating in Haiti, one HIV lab in IC

Recent innovations

- Use of agile development (2 week cycles)
- Instrument interfacing tool
- Interface with iSante EMR
For any systems – vendor or custom-developed ....

We face some challenges...
Impediments to implementation - expected

Financial
Internet infrastructure
Logistics – transportation
Vendor organization
Availability/familiarity with local vendors/products
Impediments 2

Getting the first lab in....

Beware of big ideas and marginal honesty whose “deal” is all at your expense and their profit

IT people who want you to install the LIS on Windows95, or on the instrument computer
Impediments 3

Staff willing to travel aboard
time differences in supporting remotely
safety concerns when traveling aboard
communication between implementation
staff and end users
contract processes.
Internet access

Variable from one country, or region, to another

If reliable, you can consider options such as remote hosting, or rely on internet delivery of results

If not available or reliable, then pursue a technology that doesn't require communication with the outside world.
Suitable offerings 1

Configurable – not programming
Minimize need for IT support
Architectures than can run even when not connected to server or each other
(or) Use of thin clients
Track record of deployment in many labs
“we really do work”
Single server – or no server
Fraser and Blaya

“One successful system beats 10 almost ready”
Suitable offerings 2

Ease of use

Language-independent – icons?

Flexibility

Reliability

Large library of instrument interfaces – rapidly configurable instrument subsystem – less than one day
The role of instrument interfacing

No interfaces = 0\textsuperscript{th} generation LIS

In a very small lab, may not be worthwhile

Configure so it is not a frequent point of failure

Some projects, deferred instruments

Need a fast, reliable, and cost-free methodology
How are LISs funded?

Country government (e.g., Bhutan)
Non-governmental organizations
Universities, via governmental grants
EU or US aid (espec for HIV programs)
Private labs – e.g., Ethiopia, Caribbean
Neighbors come – ask govt, international
Instrument vendors bundle LIS
Lessons we haven't yet learned

1. We need to learn from our mistakes – there have been a number of failed LIS installations – but these are swept under the rug. Long ago in medicine we learned that errors were expected – but failure to learn from them was not acceptable.

2. We forget how complex even a small lab is – even a lab with 3 techs has 10 departments – therefore, we underestimate the difficulty of development from scratch.
Questions

• Thoughts? Comments? Objections?

• If you think of something later, please eMail - raller@usc.edu