



THE LISTER HILL NATIONAL CENTER FOR BIOMEDICAL COMMUNICATIONS

A Research Division of the U.S. National Library of Medicine

Making data understandable across systems and across times

Workshop on Long-Term Preservation and Management
of Electronic Health Records (NLM/VA/NARA/NIST)

April 5-6, 2011

National Library of Medicine, Bethesda, MD

Clement J. McDonald, M.D.

Director, Lister Hill National Center for Biomedical Communications



KEEPING CLINICAL DATA ALIVE AND USEFUL FOR 40 YEARS

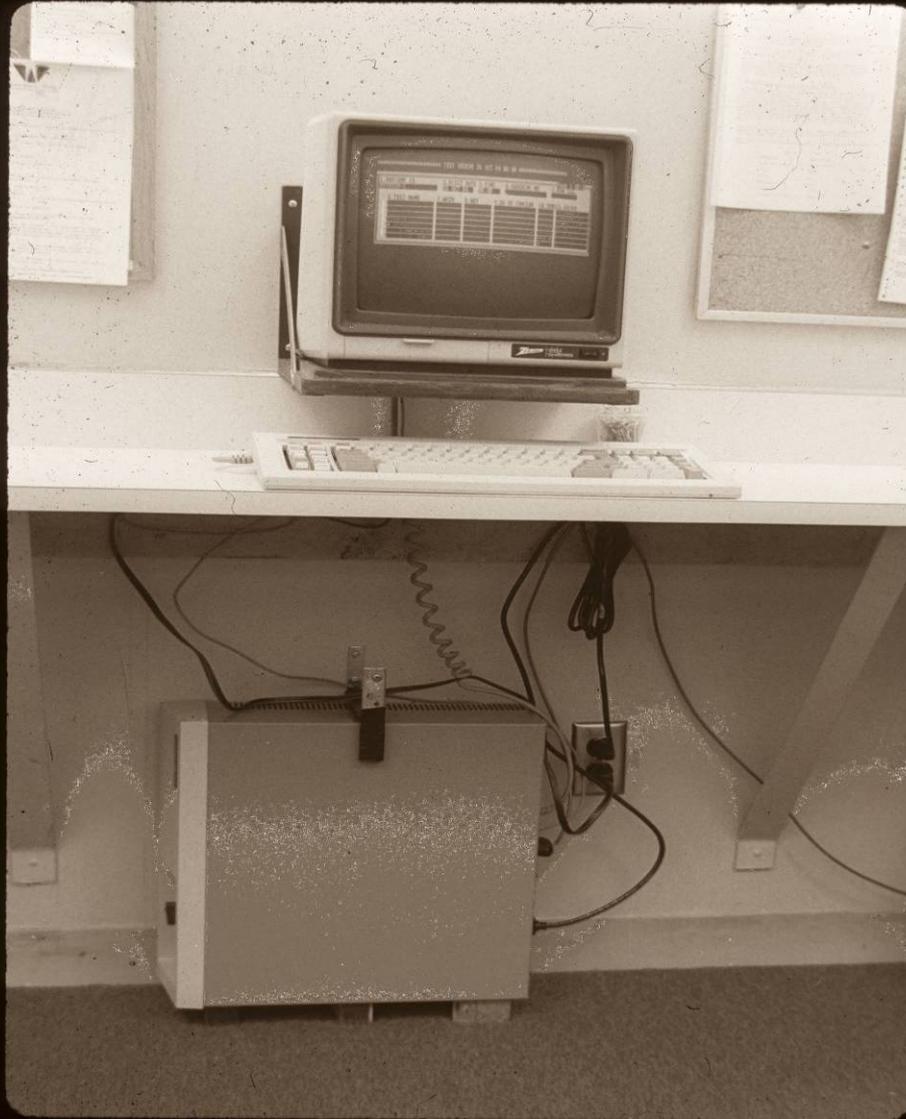
1973 Regenstrief Medical Record System (Start)

- ◆ 1972- 73 Started collection patient data for all (32) patients in diabetes clinic
- ◆ Also did back-loading of data in these early days so we have some data dating to late 1960's
- ◆ Covered all of the general medicine clinic by around 1977
- ◆ Grew to include whole hospital by about 1985

Regenstrief system – timeline 2

- ◆ Created ancillary service systems including Registration, Pharmacy and Laboratory systems – to feed the EMR
- ◆ These ran for decades
- ◆ 1986 – Installed physician order entry system in clinic – captured more data (Still running today)

To appreciate how long ago 1986 was –
(that is a monochrome monitor)



Early gopher order entry – This is a color photo

DISCHARGE.ORDERS 999999-6 TEST6,PATIENT H W Order# 39K, 8.77s 03:21PM
Page 2 of 3

8. Discharge Instructions

9. Occult Blood 10. PPD 11. Functional Class

12. Activities 13. Diet

DISCHARGE INSTRUCTIONS choices

When
1) Discharge {when}

Schedule clinic visit
2) Schedule to {Clinic} in {when} with {doctor.id} and obtain {tests} at t>

Other
3) Call family to inform of discharge

ESCape Info Same Help Choice TblDn TblUp Clear Flwsh Report Store Preview =>

Timeline 3

- ◆ 1990 – began to collect data from Indiana university hospital
- ◆ 1993 – National library of Medicine BAA grant to start the Indianapolis Network for Patient Care (INPC) with 3 Indianapolis hospitals that served the central city
- ◆ 1996 – National Library of Medicine support for further expansion of INPC to all 5 hospital systems, and homeless clinics

**WHAT IT LOOKED LIKE TO SOME
USERS**

- Chronologic Results
- Flowsheet**
- Clinical Synopsis
- REPORTS
 - ALL REPORTS
 - Discharge Summaries
 - Miscellaneous
 - Operative
 - Pathology
 - Radiology
 - Face Sheet
 - Orders
- ENCOUNTERS
 - Brief
 - Detailed
- PRESCRIPTIONS
 - Inpatient
 - Outpatient
- Advance Directive
- Surgery Log
- mrf_inq_tst_one
- echocardiogram

Flowsheet

BLD CELL PROFILE	20-Jul-99 11:18	24-Apr-97 11:45	12-Feb-91 10:33	16-Jan-91 00:34	13-Nov-90 06:00	08-Nov-90 06:00	27-Oct-90 06:00	26-Oct-90 06:00
<input type="checkbox"/> WBC #		3.5*L {a}	29.7*H {b}	13.5*H {b}	11.0 {b}	10.9 {b}	8.5 {b}	8.2 {b}
<input type="checkbox"/> WBC CORRECTED # BLD	1 {c}							
<input type="checkbox"/> RBC #		3.88*L {a}	2.7*L {b}	2.4*L {b}	3.3*L {b}	3.4*L {b}	2.7*L {b}	2.6*L {b}
<input type="checkbox"/> HGB		12.5*L {a}	7.6*L {b}	6.4**L {b}	9.1*L {b}	9.8*L {b}	7.6*L {b}	7.4*L {b}
<input type="checkbox"/> HCT BLD		37.3*L {a}	23*L {b}	19*L {b}	28*L {b}	29*L {b}	22*L {b}	22*L {b}
<input type="checkbox"/> MCHC		33.6 {a}	34 {b}	34 {b}	33 {b}	34 {b}	34 {b}	35 {b}
<input type="checkbox"/> MCH		32.2*H {a}	29 {b}	27 {b}	28 {b}	29 {b}	28 {b}	28 {b}
<input type="checkbox"/> MCV		95.9*H {a}	85 {b}	80 {b}	85 {b}	84 {b}	83 {b}	82 {b}
<input type="checkbox"/> RDW CV		15.5*H {a}						
<input type="checkbox"/> MPV		8.6 {a}						
<input type="checkbox"/> PLATELET #		82.0*L {a}					156 {b}	147*L {b}

{a} - From IUH Main Lab, 99999999-8 DEMO, JONATHAN DOE
{b} - From 99999999-8 DEMO, JONATHAN DOE
{c} - From Online Data Entry, 99999999-8 DEMO, JONATHAN DOE

(F) Age: 79 years [CLARIAN]

TUCKER

Select a patient | **Browse Patient Record** | Other

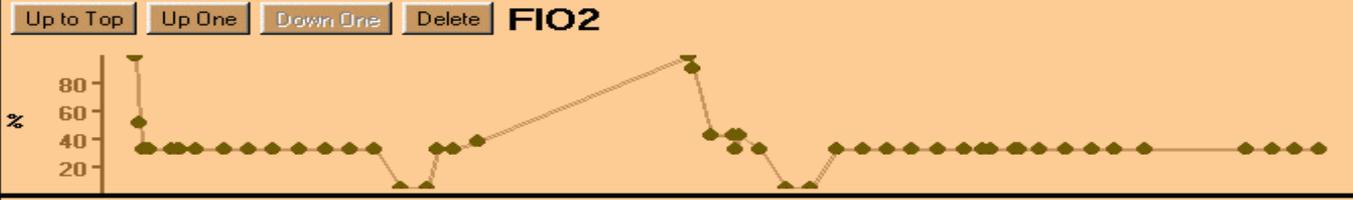
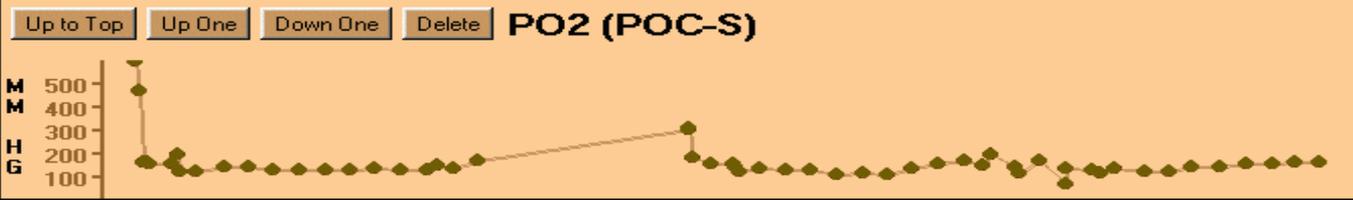
Browse Patient Record»Flowsheet

Logout | Help | Timing

- RESULTS**
- All Results
- Lab Results
- Choose Results
- Flowsheet**
- Clinical Synopsis
- REPORTS**
- ALL REPORTS
- Admission/Discharge
- Cardiology
- Operative
- Pathology
- Radiology
- Visit/Procedure Notes
- Face Sheet
- Orders
- ENCOUNTERS**
- Brief
- Detailed

Return to flowsheet

Zoom Out Fully | Zoom Out | Zoom In | Left | Right | Help



TIME ► **Sep/01**
 [OLDER] Aug 10, 2001 **Months and Days** Sep 28, 2001 [NEWER]

- Chronologic Results
- Flowsheet**
- Flowsheet (Advanced)
- Clinical Synopsis
- PORTS
- ALL REPORTS
- Discharge Summaries
- Miscellaneous
- Operative
- Pathology
- Radiology
- Case Sheet
- Orders
- COUNTERS
- Brief
- Detailed
- Master
- DESCRIPTIONS
- Inpatient
- Outpatient
- Advance Directive
- Surgery Log

Flowsheet

EKG MEASURES	30-Mar-98 15:18	29-Mar-98 06:34	28-Mar-98 11:06	27-Mar-98 10:40	26-Mar-98 17:47	25-Mar-98 06:49	23-Mar-98 15:18	08-Mar-98 06:34
<input type="checkbox"/> EKG	normal sinus rhythm, normal ECG	normal sinus rhythm, improper standard, normal ECG	sinus tachycardia, possible left atrial enlargement, QUESTION PRECORDIAL LEADS, poor quality tracing, borderline ECG	normal sinus rhythm, sinus arrhythmia, moderate left axis deviation, NONSPECIFIC ST-T, abnormal ECG	normal sinus rhythm, low QRS voltage in chest leads, CONSISTENT WITH PULMONARY DISEASE, abnormal ECG	normal sinus rhythm, low QRS voltage in chest leads, atypical ECG	normal sinus rhythm, normal ECG	normal sinus rhythm, improper standard, normal ECG
<input type="checkbox"/> P-Axis	48	52	37	5	43	38	48	52
<input type="checkbox"/> QRS-Axis	29**H	44**H	69**H	-24**H	30**H	26**H	29**H	44**H
<input type="checkbox"/> T-Wave Axis	52	11	2	104	16	6	52	11
<input type="checkbox"/> Pulse EKG	75	95	126	71	93	96	75	95
<input type="checkbox"/> PR Interval	180	184	160	128	164	172	180	184
<input type="checkbox"/> RR Interval	791	629	474	845	640	623	791	629
<input type="checkbox"/> QRS Interval	88	88	92	112	84	88	88	88
<input type="checkbox"/> QT Interval	364	348	336	448	340	344	364	348
<input type="checkbox"/> QT Corrected	393	401	411	470	391	397	393	401

Auto



Name: TEST1

PATIENT 1-94EK EKG STATION 1974

Loc : A227

Age: 43 normal ECG

MR #: 9-1

Tec: 14

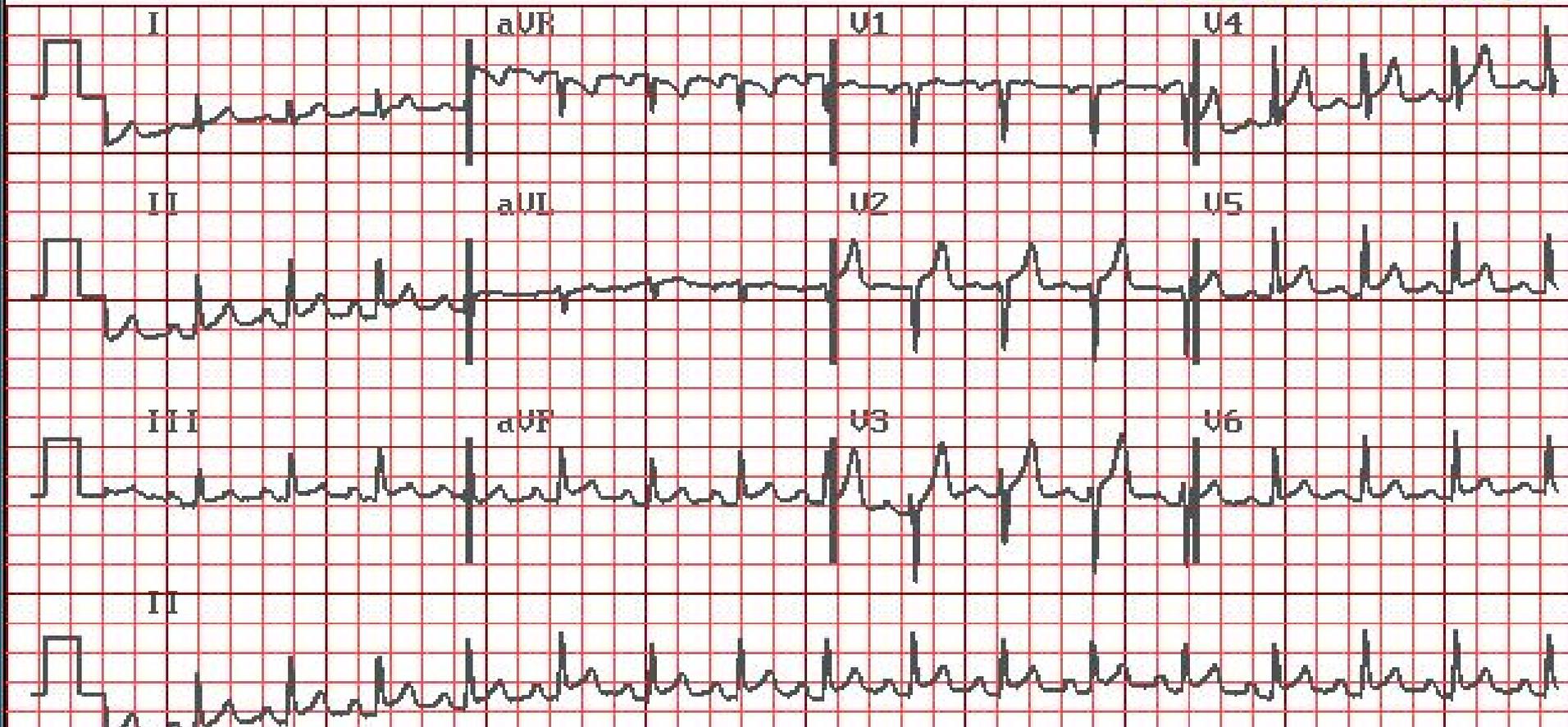
10:46 09/01/94

Intervals

Axes

HR	PR	QRS	QT/QTc	P	QRS	T
96	172	76	312/366	69	69	55

Press RETURN to exit



DEMO, JONATHAN DOE #99999999-8 @REGEN_DEVELOP M Age: 56 years

OVERHAGE, JOSEPH M

Browse Patient Record»Flowsheet

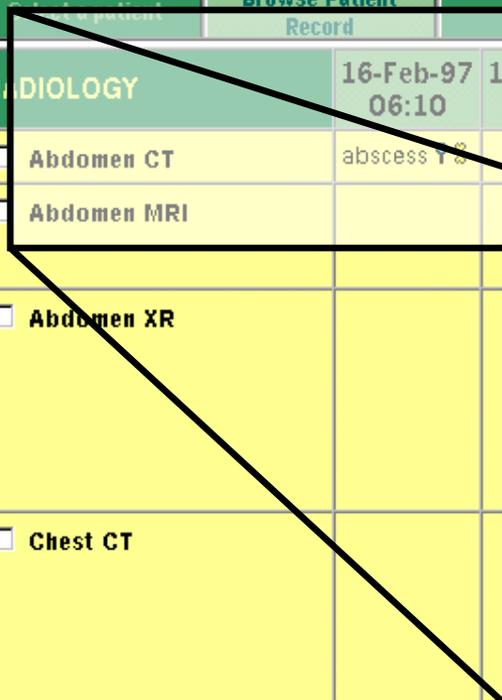
	16-Feb-97 06:10	14-May-96 16:10	09-Feb-96 06:10	11-Feb-91	10-Feb-91	24-Jan-91	16-Jan-91 01:20	16-Jan-91	03-Nov-90 09:21	25-Oct-90
RADIOLOGY										
<input type="checkbox"/> Abdomen CT	abscess ?									
<input type="checkbox"/> Abdomen MRI										
<input type="checkbox"/> Abdomen XR										
<input type="checkbox"/> Chest CT										
<input type="checkbox"/> Chest PA & Lat XR				HOSP right fluid NOS bilateral alveolar infiltrate interstitial mark		heart normal bilateral alveolar infiltrate lingula infiltrate same		WISHARD ER LUL infiltrate? overinflation	IMPRESSION: Interval decrease in left infiltrate.	WISHARD ER neg

RADIOLOGY

Abdomen CT

abscess ?

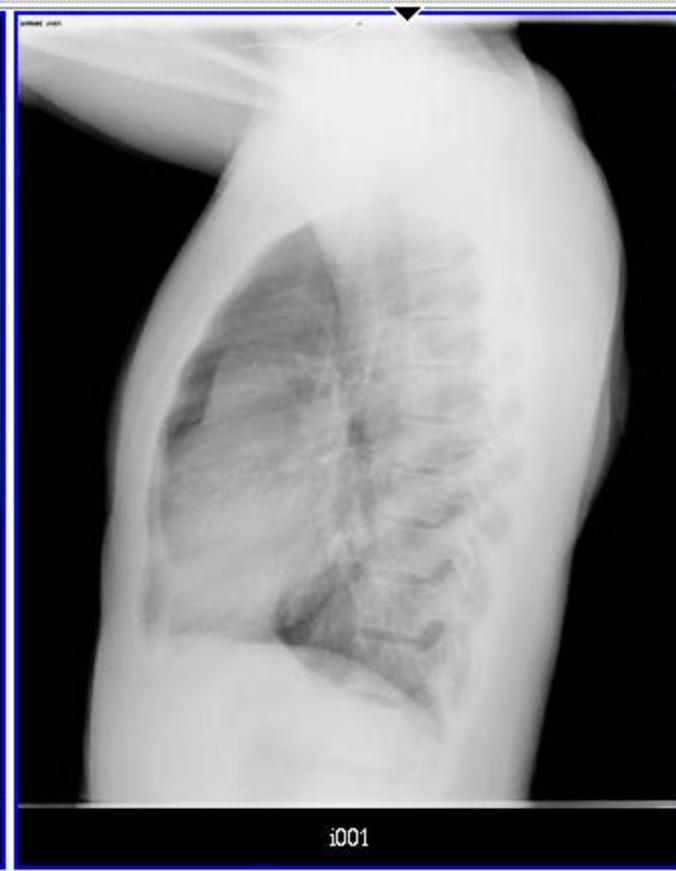
Abdomen MRI

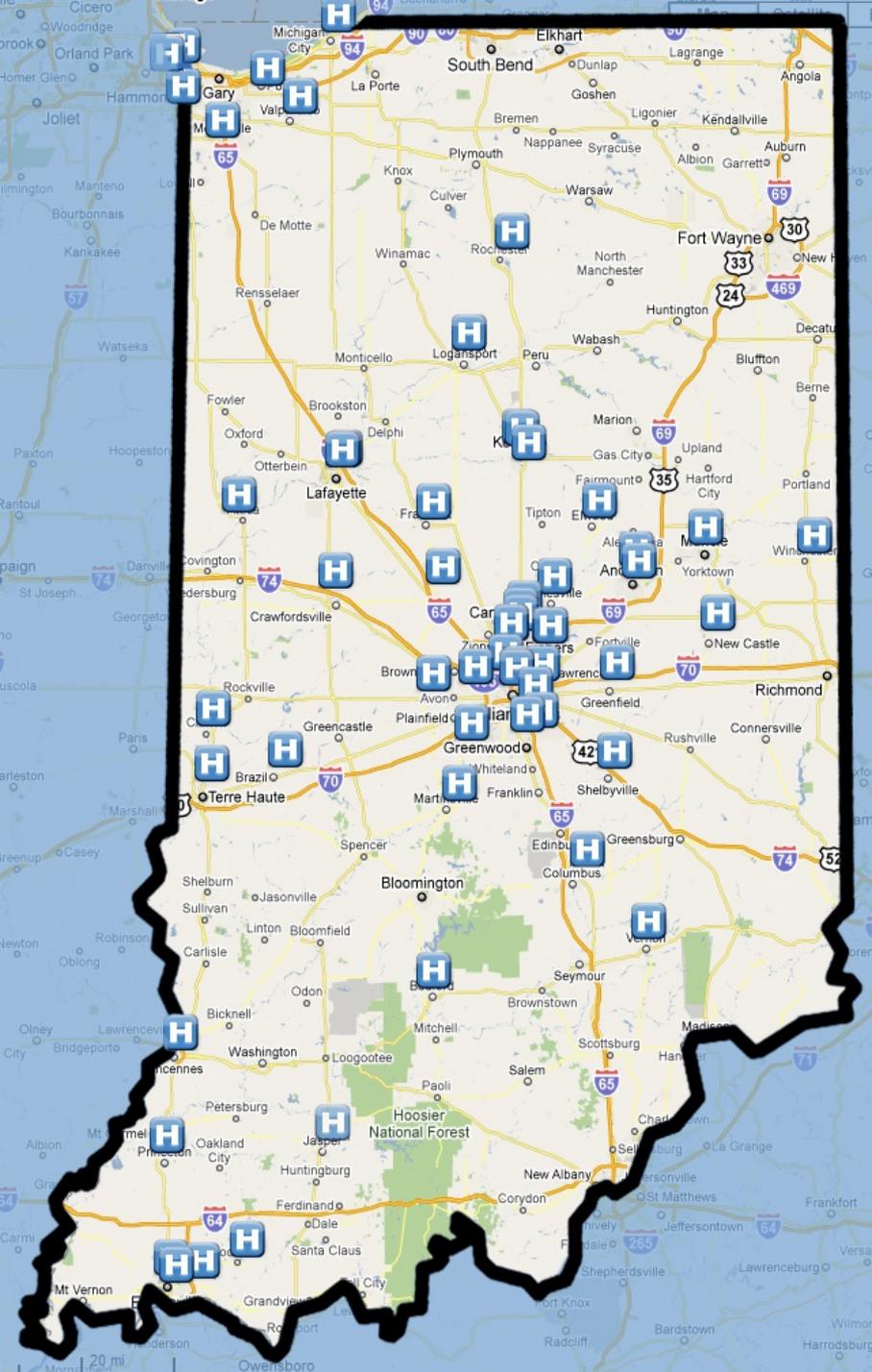


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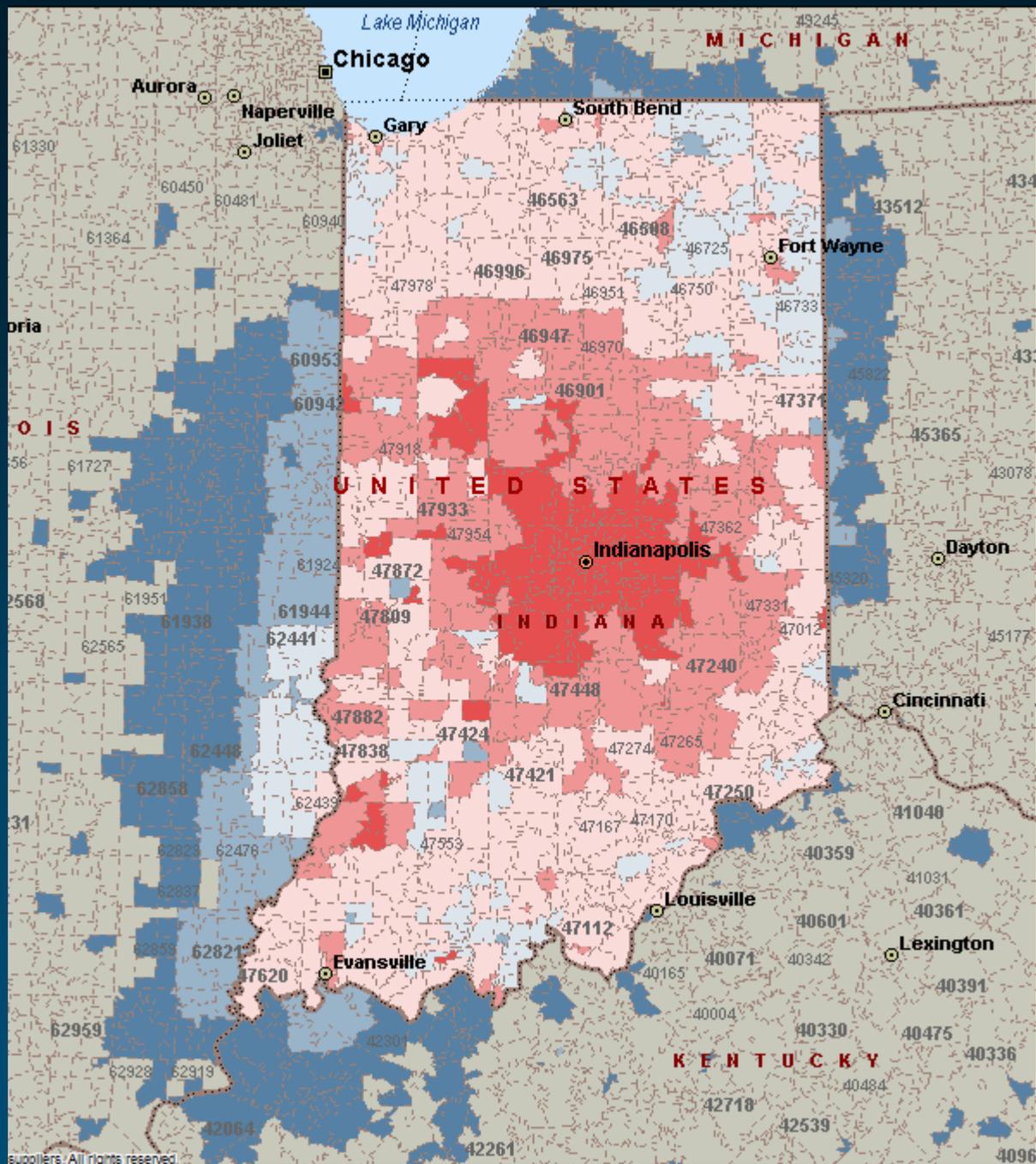
CHEST PA & LAT XR
CHEST, 2 VIEW

Click on a thumbnail image to see full image.
These are compressed images for clinical review.





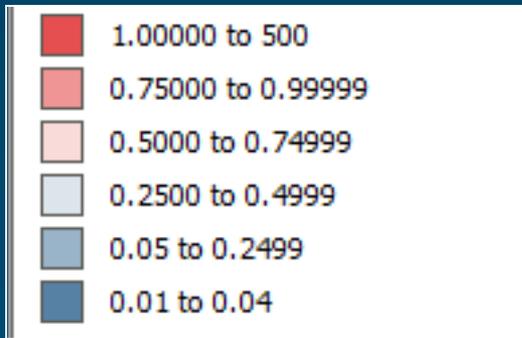
- ◆ 2011 INPC includes 4 billion results sent:
 - 24 different hospital systems – about 70 hospitals
 - 5 large medical groups and clinics
 - 5 payers
 - Several free-standing labs and imaging centers
 - Long-term and post-acute care facilities
 - State and local public health agencies



INPC Patients

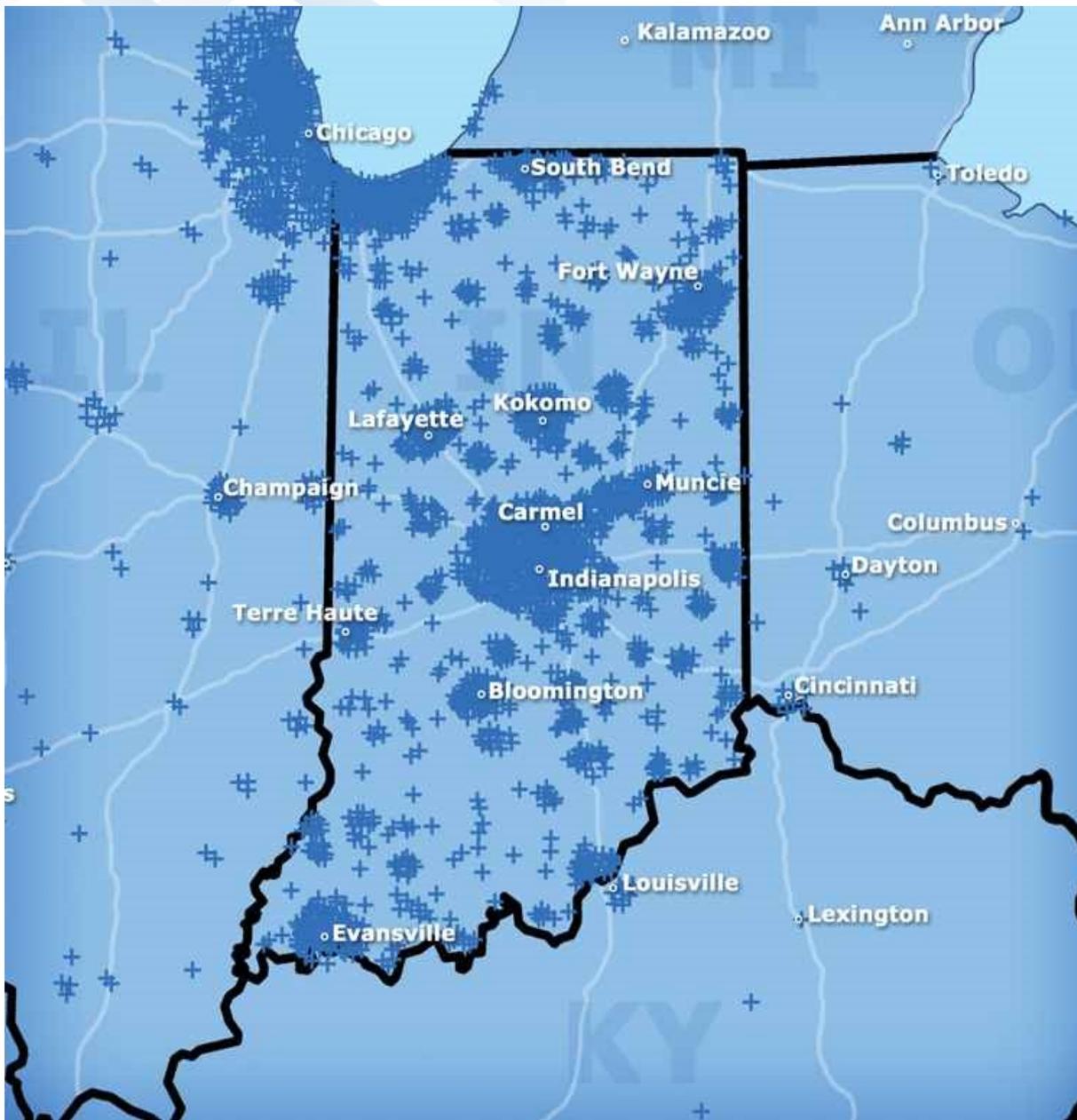
- Over 12 million unique patients
- Almost 4 billion structured results

Ratio of patients in INPC to population (2007 census)



Provider Reach

- Almost 20,000 physicians



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THE SECRETS

Rule 1: Keep the Data

- ◆ Never throw away data from the old system
- ◆ Keep it
- ◆ It is tempting to discard the data – but don't
- ◆ We changed to new data structures three times, and always copied the old data to the new structure
- ◆ Persistence was a major factor in our success

Rule 2: Use a stacked data structure for preservation and adaptability

- ◆ Use a data structure that will preserve existing data and adapt to the new data.

Flat versus Stacked Data Structure

- ◆ Flat files – the variable name is carried in the column header and the value is carried in a cell within that column . The variable name is a pre-defined part of the data structure.
- ◆ I will illustrate the principle with clinical observations – but the same principle applies to structures for drugs, or problem etc.

Flat structure – one field per observation

Patient ID	Name	Surgery date	Hemo-globin	Dias BP	# of BPU	Bypass Minutes	Choles-terol
1234-5	Doe Jane	12May95	13	95	3	80	180
9999-3	Jones T	1Aug95	12.5	88	2	90	230
8888-3	Doe Sam	4June95	16	78	0	80	205



Flat structure

- ◆ Don't use anything that has specific test, drug or problem name as a field name
- ◆ They are brittle and rigid – hard to add to it.
 - No way to add an attribute about the value.
- ◆ No natural place to put the definitions.
 - Field definitions never work . No room to write. Can't create additional attributes of your own.
 - So the definitions go into text documents, go out of date and disappear.

Stacked structure

Operational Data Base: One Record Per Observation

Pt ID	Relevant Date	Observation ID	Value	Units	Normal Rang	Place	Observer
Doe J	12-May-95	Hemoglobin	13	mg/dl	12.5-15	St Francis	Dr Smith
Doe J	12-May-95	Hemoglobin	11.5	mg/dl	12.5-15	St Francis	Dr Smith
Doe J	12-May-95	Dias BP	95	mm/H g	80-140	St Francis	Dr Smith
Doe J	12-May-95	Dias BP	110	mm/H g	80-140	St Francis	Dr Smith
Doe J	13-May-95	Bypass minutes	80	min		St Francis	Dr Sleepwell
Doe J	12-May-95	Cholesterol	180			St Francis	Dr Bloodbank

Stacked structure

- ◆ Store results for each discrete variable in a separate row (or record) of the database
- ◆ Lets you expand in width – add new attributes (fields) about the variable without killing the existing structure or data
- ◆ Lets you expand in height – At will, you can insert records that provide results for newly invented tests measures/questions
 - Picture a magician slipping a new playing card into a deck

Stacked structure – master files

- ◆ The Variable name (ID) in the stacked structure is really a link to another file – often called a master file – that tells all about that variable. You can store whatever descriptor makes sense in this master file.
- ◆ So the addition of new tests, or measurements, to you system, becomes a matter of adding a record to master file (easy) instead of revision of the database structure (hard).

Stacked structure is the structure to use

- ◆ The stacked structure is “roughly” the way all medical record systems, pharmacy systems, laboratory systems, inventory systems, etc are constructed
- ◆ Provides a row for storing information about one instance of each item.
- ◆ One (or more) links to a master dictionary that says what that item is.

Rule 3: Use Messages for Data Portability

- ◆ Use messages and think in terms of messages for portability
 - A message – something that sends data between a data source and the storage location, that you can review and save and reload into your system
 - It is the ability to reload that sets you (and your data) free
 - Push vendors for a function that exports its system contents into a standard message
 - Then you have a chance of rolling data from one system generation to the next
 - Things defined as databases always include obscure assumptions (e.g. about the representation of clock times) that bind you

The Messaging – more

◆ Pre-HL7 messaging

- We used many work intensive, unreliable and unsustainable methods to capture medical record data pre-HL7
 - Screen scraping.
 - Re-directed printer port outputs to input ports.
 - Hand entry.
- These were difficult, fragile and crazy
- So only crazy people built medical record systems back then

HL7 to the rescue

- ◆ HL7 was the enabler for the Indiana Health Information Exchange
- ◆ None of it would have happened without HL7
- ◆ Based on the Indiana HL7 result messages in Indianapolis, we estimate that 30 billion HL7 observation messages flow per year in the US.

Rule 4: Use standard coding systems

- ◆ To really make medical record information viable across time and space, we all need to be using standard code systems
- ◆ NLM and federal regulations support the use of:
 - LOINC – codes for the variable slot in the stacked data structure example
 - <http://loinc.org>
 - RxNorm- codes and names for medications
 - <http://www.nlm.nih.gov/research/umls/rxnorm/>
 - SNOMED-CT – codes and names for broad range of concepts (problems, organisms , body sites, etc)
 - http://www.nlm.nih.gov/research/umls/Snomed/snomed_main.html

Rule 5: Retain original codes and messages

- ◆ Retain the initial form of information when it gets transformed
 - When some one codes text, keep the text
 - Keep the source systems code for test along with the standard (LOINC) code system. Never know when you might need it.
 - Retain the HL7 message that you load (and modify) into your database – somewhere. (Doesn't have to be on fastest storage)
- ◆ All of that will let you re-transform and re-load if you need to.

An alternate and complementary approach

- ◆ Techniques exist for finding diagnoses, findings, drug names and other things in narrative, text using string matching, regular expressions and other techniques.
- ◆ So you can annotate narrative text with standard codes.
- ◆ This provides a way to get more computer-understandable content out of free text.
- ◆ You will hear more about this approach from Chris Chute tomorrow.

WHERE CODES FIT IN THE STACKED STRUCTURE

Blood count fully structured in HL7 yellow = test ID, orange = value

Patient level

PID|||0999999^6^M10||TEST^PATIENT^||1992022
5|F||B|4050 SW WAYWARD BLVD |

Order/report level t

 OBR|||H9759-0^REG_LAB|20725^Hemogram

Discrete Results

OBX|2|NM||789-8^RBC^LN||4.9|M/mm3|4.0-5.4|||F|

OBX|3|NM||718-7^HGB^LN||12.4|g/dL|12.0 5.0|||F|

OBX|4|NM||20570-8^HCT^LN||50|%|35-49|H|||F|

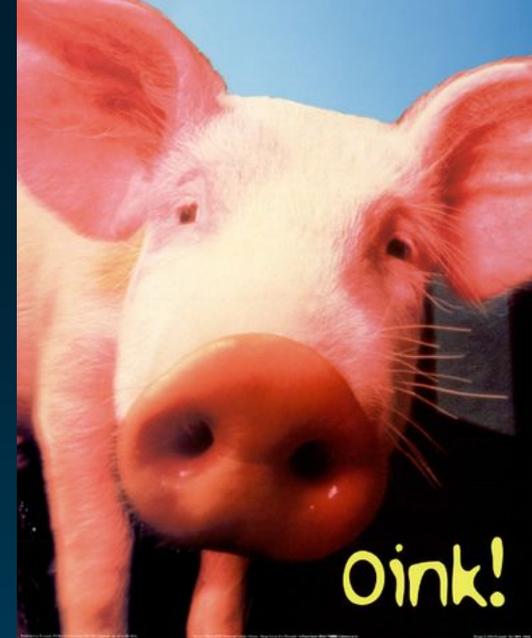
OBX|5|NM||30428-7^MCV^LN||81|fL|80-94|||F|b

When codes fit

- ◆ LOINC identifier is the variable (measured, question, etc)
- ◆ It fills in the 3rd field of the HL7 question

LOINC – What is it?

- ◆ Logical Observation Identifiers Names and Codes
- ◆ A set of more than 60,000 universal codes for ordering and identifying results of observations, including:
 - Laboratory and other measurements,
 - Survey questions,
 - Narrative reports, and
 - Defined collections of these things.
- ◆ Normal ranges, units, answer lists, text descriptions, panels for orders, survey instruments
- ◆ Supported by NLM and Regenstrief Institute; No cost in perpetuity





LOINC Coverage

◆ Not just laboratory:

- radiology tests procedures (4773)
- clinical documents (500)
- survey instrument terms (3600)
- General clinical measurements
- Dental/orthodontic measurements (300)
- Ocular/ ophthalmology measurements (500)
- Tumor registry (500)

LOINC supporting tools and documents

- ◆ LOINC web site – <http://loinc.org>
- ◆ RELMA browser/mapper now powered by Lucene and with an “auto” mapper
- ◆ Web browser (also powered by Lucene) -- <http://search.loinc.org>
- ◆ Panel downloads in three-layer spreadsheet

LOINC Web site – <http://loinc.org/> download everything



The screenshot shows the LOINC website homepage. At the top left is the LOINC logo, a stylized 'R' inside a circle, followed by the text 'LOINC®' and 'Logical Observation Identifiers Names and Codes'. To the right of the logo are links for 'site map', 'accessibility', and 'contact'. Below these is a search bar with a magnifying glass icon and the text 'search', and a dropdown menu showing 'all of loinc.org'. In the top right corner, there are links for 'log in' and 'join'. Below the header is a breadcrumb trail: 'you are here: home'. The main content area is divided into several sections. On the left is a 'Navigation' sidebar with a list of links: Home, Documentation, Downloads, RELMA, WebSearch, Submissions, International, Meetings, Discussion, Mailing Lists, Terms of Use, and Contact LOINC. Below the navigation is a 'Log in' button. The main content area has a title 'Logical Observation Identifiers Names and Codes (LOINC®)' with a printer icon. Below the title are four columns of links: 'Learn' (LOINC Background, FAQ, Users Guide, Online Training), 'Use LOINC' (Download LOINC, Search LOINC), 'Get Involved' (Forum, Meetings, Email List, Directory of Adopters), and 'Develop LOINC' (Submit Term Requests, What's Coming, Translate LOINC). Below these columns is a paragraph: 'A universal code system for identifying laboratory and clinical observations. Mapping local terms to LOINC makes it possible to exchange and pool data from many independent systems for clinical care, research, outcomes management, and lots of other purposes. [Regenstrief](#)'. To the right of the main content is a 'Current Versions' section with two entries: 'LOINC 2.34 Released: 2010-12-29' and 'RELMA 5.1 Released: 2011-02-17', each with a 'Download' link. Below that is a 'Recent Forum Posts' section with two entries: 'Chemistry | Re: Point of care testing (POCT)' and 'General Discussion | Re: Genetic Sequence Data Scale', each with a 'More posts...' link. At the bottom right is a 'LOINC LOINC' logo.

LOINC web browser <http://search.loinc.org>

Search LOINC

Options ▾ Help ▾



LOINC®
Logical Observation Identifiers Names and Codes

glucose test

1 / 4 [1 - 13 / 43]

LOINC	Component	Property	System	Timing	Scale	Method	Class
2340-8	Glucose	MCnc	Bld	Pt	Qn	Test strip auto	CHEM
2341-6	Glucose	MCnc	Bld	Pt	Qn	Test strip manual	CHEM
5914-7	Glucose	ACnc	Bld	Pt	Ord	Test strip	CHEM
5792-7	Glucose	MCnc	Urine	Pt	Qn	Test strip	UA
22705-8	Glucose	SCnc	Urine	Pt	Qn	Test strip	UA
25428-4	Glucose	ACnc	Urine	Pt	Ord	Test strip	UA
50555-2	Glucose	ACnc	Urine	Pt	Ord	Test strip, automated	UA
53328-1	Glucose	MCnc	Urine	Pt	Qn	Test strip, automated	UA
59156-0	Glucose	SCnc	Urine	Pt	Qn	Test strip, automated	UA
6761-1	Glucose^1.5H post 50 g lactose PO	ACnc	Urine	Pt	Ord	Test strip	CHAL
6763-7	Glucose^1.5H post 75 g glucose PO	ACnc	Urine	Pt	Ord	Test strip	CHAL
26553-8	Glucose^1.5H post dose glucose	ACnc	Urine	Pt	Ord	Test strip	CHAL
6747-0	Glucose^1H post 50 g lactose PO	ACnc	Urine	Pt	Ord	Test strip	CHAL

Search generated 43 hits in 0.013 secs. Copyright© 2010 Regenstrief Institute Inc.

Support for Lucene syntax in both places (RELMA and LOINC web browser search)

- ◆ Like Google: “+” must include “-” must not include
- ◆ Usual logical with “And”/ “Or”, with nesting
- ◆ Can restrict search to one field (e.g. search for **System:ser** would return only terms with serum in the system)
- ◆ Criteria can access most fields
- ◆ Wild cards, fuzzy matches, ranges



Required use of LOINC

- HITECH regulation for laboratory results in EHRs
- HEDIS quality assurance
- National Quality Forum (NQF)
- HL7 CDA documents including CCD
- CTSAs I2B2 database development
- Newborn screening
- FDA package inserts for drugs

Example Users

- Many insurance payers
- Many large care organizations
 - Kaiser, INPC, Partners of Boston, Lifespan
- Medical instruments/devices
 - Members of consortium of international instrument manufacturers are working to map all of their internal instrument codes to LOINC codes and create a database for their customers
- Most commercial laboratories
 - Increasingly can see on their web sites

Mayo's web site



Search Mayo Medical Laboratories

Search

Home

New User?

Sign In

PRINT PAGE

EMAIL PAGE

Test Catalog

Policies

Critical Values and
Semi-Urgent Results

Units of Measurement

LOINC Codes

Referred Tests List

Reflex Tests

NYS Informed Consent
Test List

Performing Locations

Catalogs by Discipline

Order Tests

Specimen Transport

Interpretive Handbook

Logical Observation Identifiers Names and Codes (LOINC®)

LOINC is clinical terminology important for laboratory test orders and results, and is one of a suite of designated standards for use in U.S. Federal Government systems for the electronic exchange of clinical health information.

RELATED

- Other Content:
 - Billing - Business Office

In 1999, [LOINC](#) was identified by the HL7 Standards Development Organization as a preferred code set for laboratory test names in transactions between health care facilities, laboratories, laboratory testing devices and public health authorities. In the future, LOINC is likely to become a HIPAA standard for certain segments of the Claims Attachment transaction.

Mayo Medical Laboratories has been systematically assigning LOINC codes to its assays, as provided in the following spreadsheet. See [Terms of Use and Legal Restrictions](#) for conditions.

[LOINC codes spreadsheet](#)

Updated: 9/29/2010

ARUP 's Web site



NATIONAL REFERENCE LABORATORY

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LABORATORY TEST DIRECTORY

A B C D E F G H I J K
L M N O P Q R S T U V
W X Y Z # ALLERGENS

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Testing Information

Laboratory Test Directory

Hot Lines—Quarterly

Hot Lines—Immediate Changes

ARUP Consult®
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Critical Values

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New Test Highlights

Consent & Patient History Forms

Quality & Compliance

Compliance Statement

HIPAA Compliance

Quality Assurance

Privacy Practices

Licensure & Accreditations

Testing Turnaround Time

CPT/LOINC Codes

Medicare Coverage

Studies

CPT & LOINC® CODES

CPT CODES

The American Medical Association Current Procedural Terminology (CPT) codes published in ARUP's Laboratory Test Directory are provided for informational purposes only. The codes reflect our interpretation of CPT coding requirements, based upon AMA's CPT codes published annually. CPT codes are provided only as guidance to assist clients with billing. ARUP strongly recommends that clients confirm CPT codes with their Medicare Administrative Contractor, as requirements may differ from one to another. CPT coding is the sole responsibility of the billing party. ARUP Laboratories assumes no responsibility for billing errors due to reliance on the CPT codes published.

LOINC CODES

The Logical Observation Identifier Names and Codes (LOINC) database provides a universal code system for reporting laboratory and other clinical observations. LOINC codes are used by large reference laboratories and federal agencies (e.g., the CDC and the Department of Veterans Affairs) and are part of the Health Insurance Portability and Accountability Act (HIPAA) attachment procedure. ARUP has been systematically assigning LOINC codes to its assays, as provided in the spreadsheet below.

Additional questions about LOINC may be routed through ARUP Client Services.

 [LOINC codes spreadsheet](#) (updated April 1, 2011)

Wide international usage

- ◆ Lab LOINC is national standard in Canada, Australia, Germany, France, and used widely in Brazil, Singapore, Italy, and China
- ◆ Translated into: French ,German, Italian, Korean, Simplified Chinese, Portuguese
- ◆ The Chinese translation includes radiology
- ◆ 10,000 registered users from 140 countries



How to say “glucose” in LOINC

(LP14635-4)

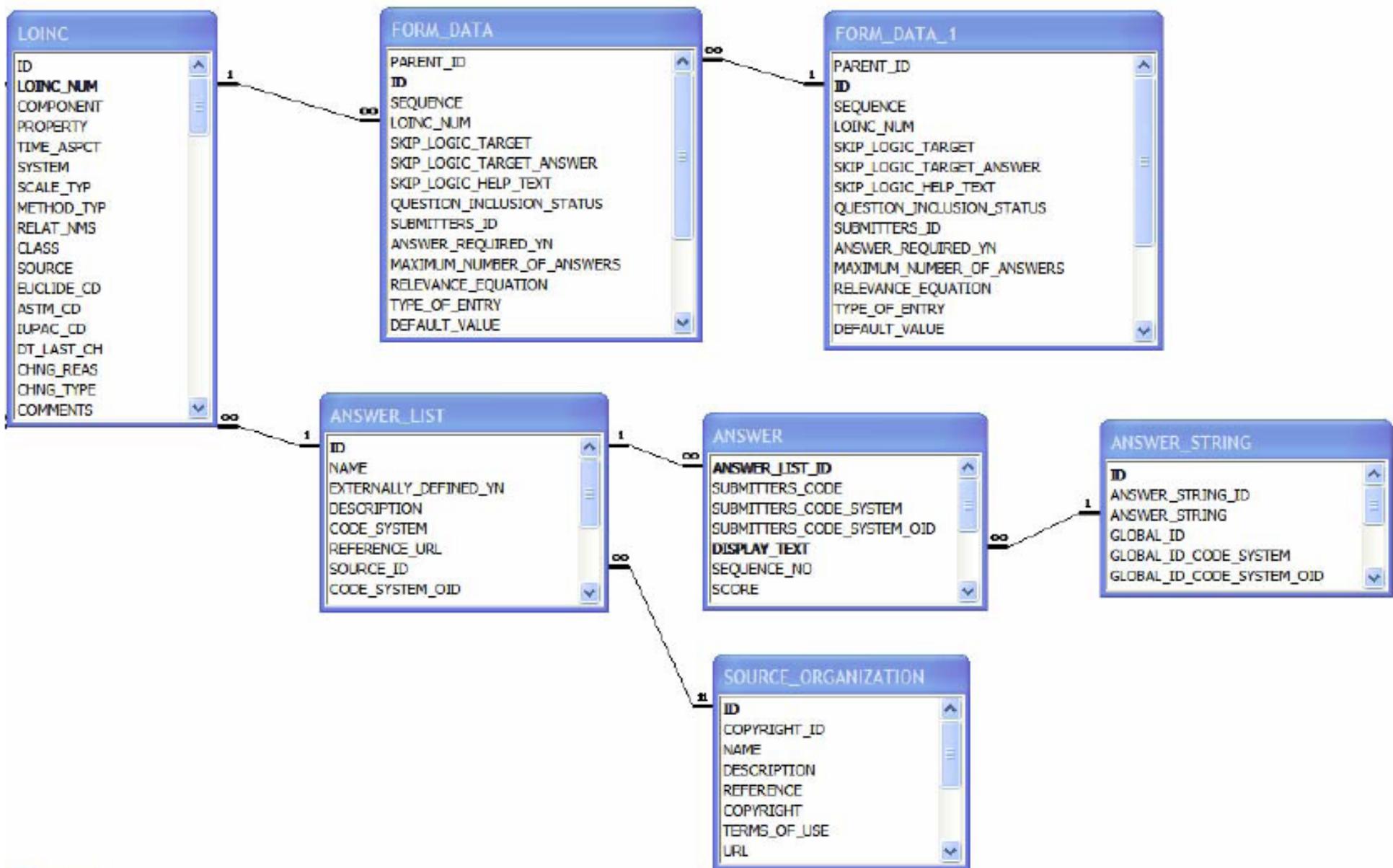
Language	Translations
English	Glucose
Estonian (Estonia)	Glükoos
French (3: Canada, France, Switzerland)	Glucose
German (2: Germany, Switzerland)	Glucose
Greek (Greece)	Γλυκόζη
Italian (2: Italy, Switzerland)	Glucosio
Korean (Republic of Korea)	포도당
Portuguese (Brazil)	Glicose
Simplified Chinese (China)	葡萄糖
Spanish (3: Argentina, Spain, Switzerland)	Glucosa

LOINC PANELS: SURVEY INSTRUMENTS AND DATA COLLECTION FORMS

Attributes of survey instruments in LOINC

- Terms for each question
- Association table that relates the questions in a hierarchy with:
- Statement of the question as it is addressed to patient
- Explicitly defined answer lists
- Skip logic (Human-readable)
- Help text – as needed to explain the question
- Copyright and terms of use for items taken from other sources

Approximate Data Model for instruments/panels



Example clinical instruments

- ◆ Apgar scores 1 min, 5 min, 10 min
- ◆ Glasgow coma score
- ◆ Braden Scale
- ◆ Morse fall scale

Part of RELMA details report for Apgar

Details for LOINC record # 48333-9

48333-9 5 minute Apgar panel

PANEL HIERARCHY

LOINC#	LOINC Name	R/O/C	Cardinality	Data Type	Ex. UCUM Units
48333-9	5 minute Apgar panel				
32411-1	5 minute Apgar Color				
32412-9	5 minute Apgar Heart rate				
32414-5	5 minute Apgar Reflex irritability				
32413-7	5 minute Apgar Muscle tone				
32415-2	5 minute Apgar Respiratory effort				
9274-2	5 minute Apgar Score				

Selected information about each LOINC that is part of this panel

32411-1 5 minute Apgar Color

NORMATIVE ANSWER LIST:

SEQ#	Answer	Code	Answer ID
1	The baby's whole body is completely bluish-gray or pale	0	LA6722-8
2	Good color in body with bluish hands or feet	1	LA6723-6
3	Good color all over	2	LA6724-4

32412-9 5 minute Apgar Heart rate

Custom Display Text Size - Larger Separated pages Previous 48333-9 Next Print Close

Type Ctrl-F to search the text of the details. 48333-9 1 of 1 LOINC HTML: 1.05 sec

Example government quality measure instruments

- ◆ CARE (CMS post acute care data collection form)
- ◆ OASIS – For home health care
 - 1 variant of version B & 5 variants of version C
 - 100 to 150 questions for each
- ◆ M.D.S (for nursing homes)
 - 6 variants of version 2 and 1 variant of version 3
- ◆ These representations are packed with information – it takes 70+ pages of LOINC detail to report out the basic information in one of the OASIS instruments (forms)

Why incorporate government forms into LOINC?

- ◆ Want to maximize re-use of terms across forms (not always easy)
- ◆ Encourage use of same term in clinical setting as in review processes to eliminate unnecessary data collection
- ◆ Have a computable content that can be delivered in a message
 - This information has substantial research value.
- ◆ Provide “everything” in one place and in a uniform format

NIH instruments

- ◆ Phenx-from NHGRI
 - Standard set of measurements/ questionnaires for measuring phenotypic characteristics for genome wide association studies
- ◆ Patient-Reported Outcomes Measurement System (PROMIS) supported by NIAMS
 - Patient recorded functional status measures



PhenX

- ◆ Twenty content domains – including demographics, body measurements, alcohol, tobacco and substance abuse, cardiovascular, etc.
- ◆ Measures very detailed, e.g. provide best alternative measure for people who can't stand (Floor to tibial plateau). The best of the published options
- ◆ Five of the 20 domains are in most recent LOINC release. All to follow.
- ◆ <https://www.phenx.org/>

PROMIS

- ◆ Well-validated instruments for measuring 13 dimensions of patient reported function. Includes an equivalent of SF12.
- ◆ 2 ways to report each dimensions
 - Using Computerized adaptive testing. (CAT)
 - Using standard short forms that can be completed by standard methods
- ◆ All 660 questions for 20 domains and 21 short forms (as panels) in latest LOINC release.
- ◆ <http://www.nihpromis.org/>



Value sets and guidance to facilitate the adoption of laboratory LOINC into source systems

- Mapper's guide to "Top 2000" laboratory test results/observations
- Top 300 laboratory test orders

**MORE CODES:
SNOMED CT AND RxNORM**

SNOMED CT

- ◆ Also recommended widely and internationally
- ◆ Provides a unified approach for most clinical answers (organisms, anatomic parts, specimens, diagnoses and symptoms). It does also provide codes for some observations.
- ◆ More than 300,000 codes and hierarchical relations
- ◆ Has an elegant formalism

CORE Problem List Subset of SNOMED CT

- ◆ Based on datasets from 7 institutions
- ◆ Designed to facilitate the use of SNOMED CT as the primary coding terminology for problem lists or other summary level clinical documentation
- ◆ Contains the list of controlled terms and their actual frequency of usage in clinical databases
- ◆ http://www.nlm.nih.gov/research/umls/Snomed/core_subset.html

RxNorm

- ◆ US recommendation for drug ordering, medication profile, etc.
- ◆ Provides codes for drugs at the clinical drug and ingredient level. FDA provides related codes.
- ◆ Clinical level includes the strength and dosage form
 - E.g. Ampicillin 500mg oral capsules
- ◆ Includes brand names and generic

RxTerms

- ◆ A subset of RxNorm
- ◆ Developed by NLM
- ◆ Tailored to ease prescription ordering (CMS)
 - <http://wwwcf.nlm.nih.gov/umllicense/rxtermApp/rxTerm.cfm>