

A faint, light-colored map of the state of Florida is positioned in the background, centered behind the main title text.

**AHRQ Pilot Project:
Adding Clinical Data Elements
to Administrative Data**

Christopher B. Sullivan, Ph.D.

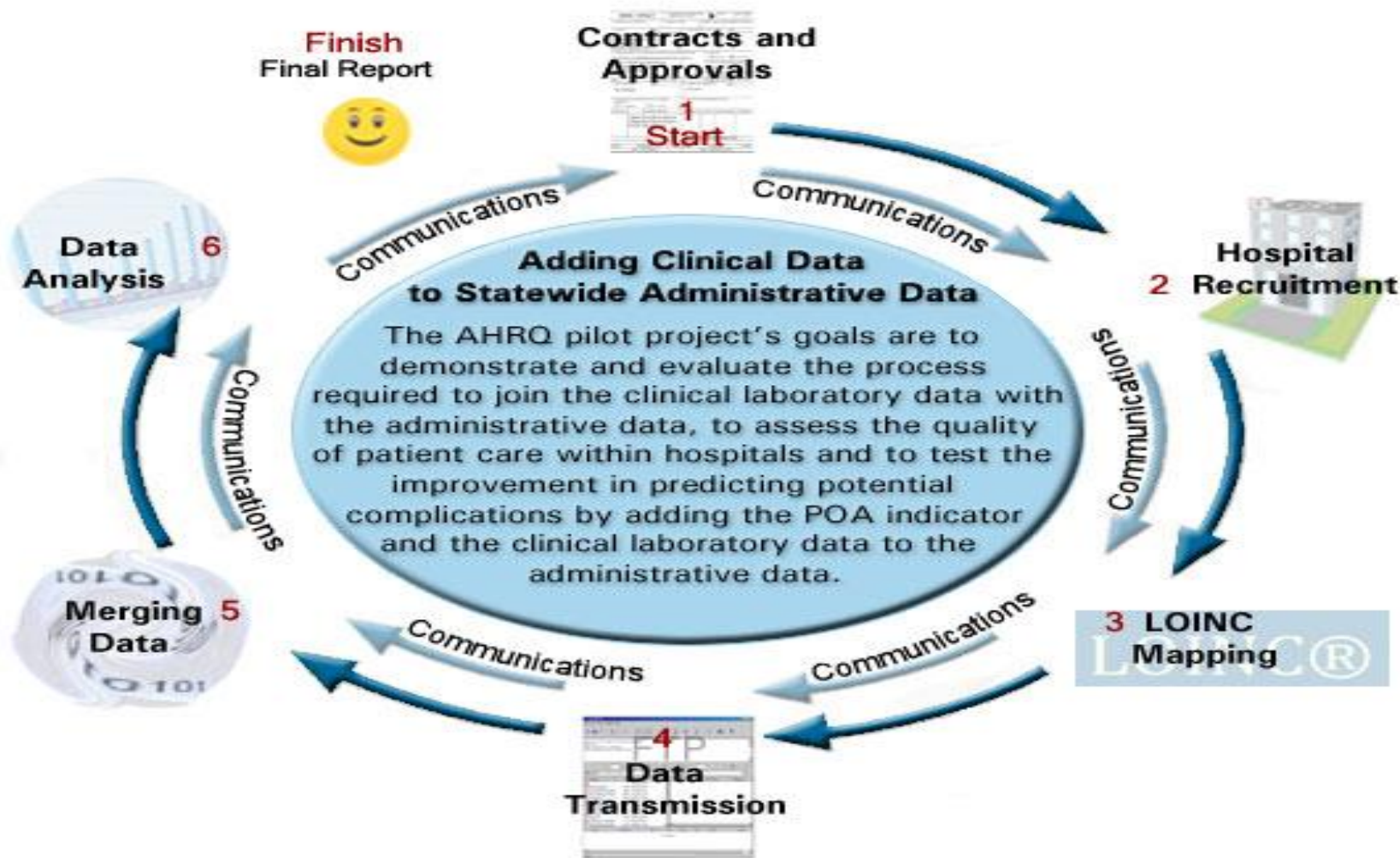
Bahia Diefenbach, Ph.D.

Florida Agency for Health Care Administration

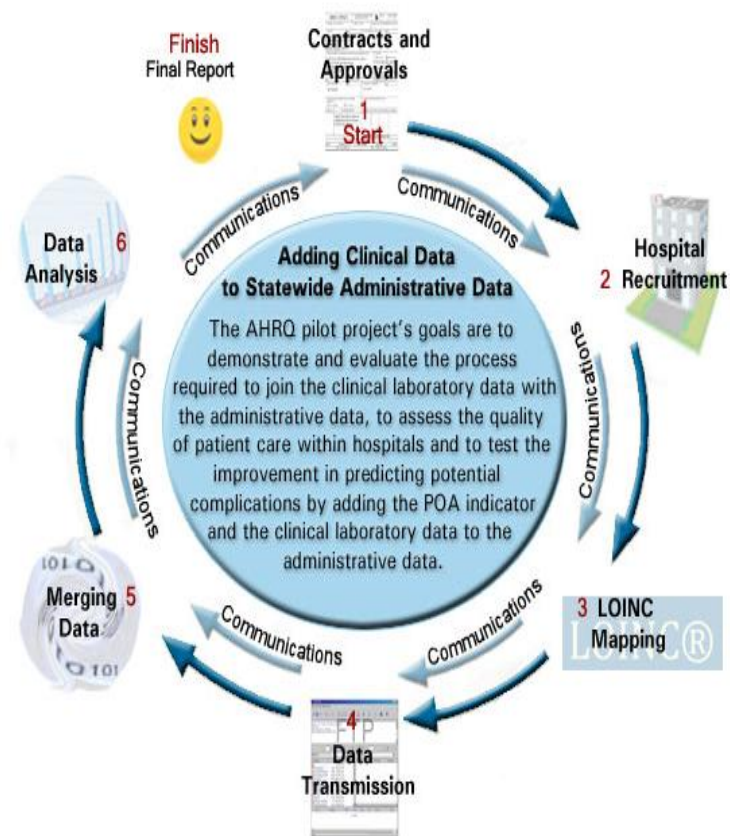
Adding Clinical Data Elements to Administrative Data

- Brief Description of Project Stages
- LOINC Mapping
- Data Challenges in Joining Clinical Laboratory Data to Administrative Inpatient Data
- Data Analysis
- Evaluation Survey
- Lessons Learned and Conclusions

Project Stages



Contracts and Approvals

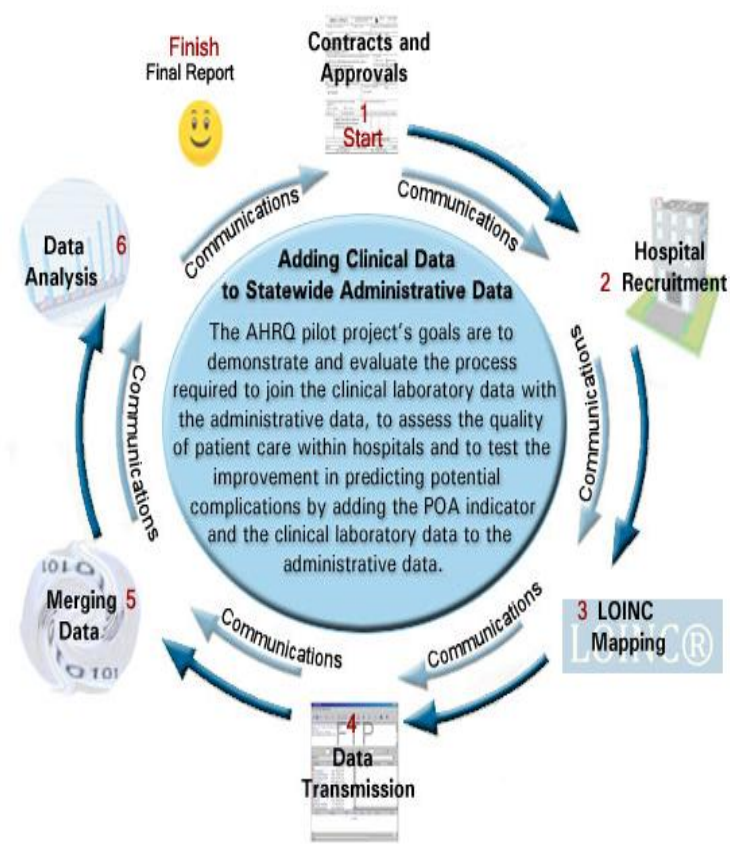


- Budget amendment approved by the Legislative Budget Committee before the Agency could receive any funds from AHRQ.
- Project coordinator contract
- 3M contract
- Participating hospitals' Data Sharing Agreement
- Project started a year late

Hospital Recruitment

A total of 22 hospitals participated in the pilot project:

- Broward Health System (5)
- Memorial Healthcare System (6)
- BayCare Health System (9)
- All Children's Hospital
- Miami Children's Hospital

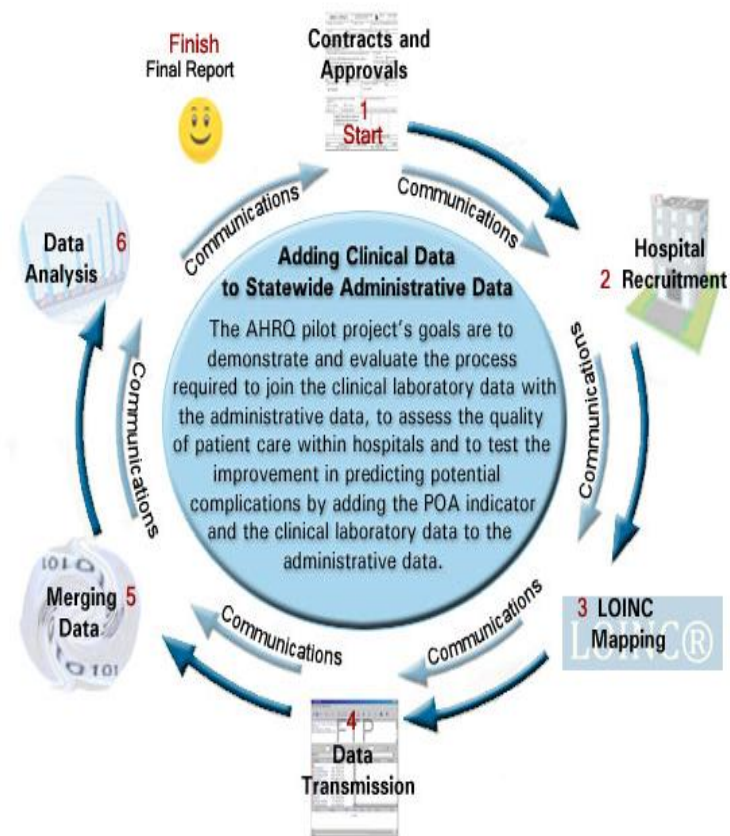




Hospitals in the AHRQ Project

Pediatric Hospitals	Broward Health
All Children's Hospital (216 Beds)	Broward General Medical Center (716 Beds)
Miami Children's Hospital (268 Beds)	Coral Springs Medical Center (200 Beds)
BayCare Health System	Imperial Point Medical Center (204 Beds)
Mease Countryside Hospital (300 Beds)	North Broward Medical Center (409 Beds)
Mease Dunedin Hospital (143 Beds)	Chris Evert Children's Hospital (141 Beds)
Morton Plant Hospital (687 Beds)	Memorial Healthcare System
St. Joseph's Women's Hospital (192 Beds)	Memorial Hospital Miramar (100 Beds)
Morton Plant North Bay Hospital (122 Beds)	Memorial Hospital Pembroke (301 Beds)
St. Joseph's Children's Hospital (164 Beds)	Memorial Hospital West (236 Beds)
South Florida Baptist Hospital (147 Beds)	Memorial Regional Hospital (690 Beds)
St. Anthony's Hospital (365 Beds)	Memorial Regional Hospital South (100 Beds)
St. Joseph's Hospital (527 Beds)	Joe DiMaggio Children's Hospital (100 Beds)

LOINC Mapping



- The AHRQ project required standardizing 28 laboratory data elements into a common nomenclature based on the Logical Indicators, Observations, Indicators, Names and Codes (LOINC) standard.

Clinical Laboratory Data Elements

Albumin	Glucose	SGOT
Alkaline phosphatase	Hematocrit	SGPT
Base Excess	Mean cell Hemoglobin	Sodium
Bicarbonate	Mean Cell volume	Total bilirubin fractions
Blood urea nitrogen	Partial thromboplastin time	Total Hemoglobin
Blood/Lymph Culture-Positive	pCO ₂	Troponin I
Calcium (ionized)	pH	White blood cell count
Calcium (total)	Phosphorous	<u>Additional Data Elements</u>
Chloride	Platelets	Date of specimen Run
CPK MB	PO ₂ .sat	Time of Specimen Run
Creatinine	Potassium	Type of test performed
Gamma glutamyl transferase	Prothrombin time	Reference range of test



Lab Result Interface Code Comparisons

Lab Test Name	All Children's	Miami Children's	BayCare Health	Broward Healthcare	Memorial Healthcare
SGPT	ALT	ALT (SGPT)	ALT	55548699	ALT
Albumin	ALB	Albumin	Albumin	55548695	ALB
Alkaline phosphatase	AP	Alkaline Phos	Alk Phos	55548696	ALKP
SGOT	AST	AST (SGOT)	AST	55548697	AST
Blood/Lymph Culture-Positive	BCECMO	Blood Culture	C Blood	C BLD	CXBLD
Glucose	GLU	Glucose	Glucose	55548690	GLUC
Hematocrit	HCT1	HCT	HCT	55542287	HCT
Total Hemoglobin	HGB1	HGB	HGB	55542285	HGB
Potassium	K1	Potassium	Potassium	55548685	K
Sodium	NA	Sodium	Sodium	55548683	NA

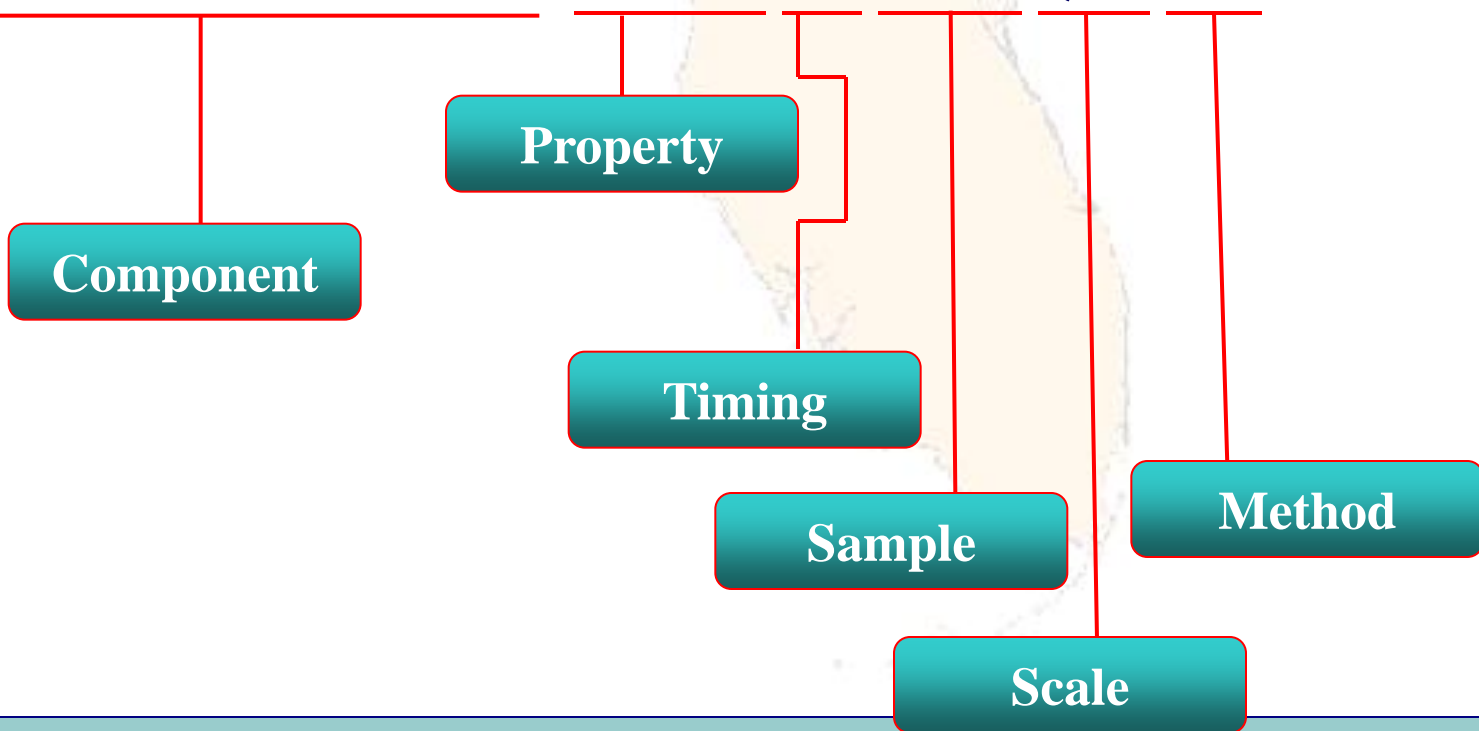
Anatomy of a LOINC Term

Component : Property : Timing : Sample : Scale : Method

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LOINC Code; sequential number plus check digit

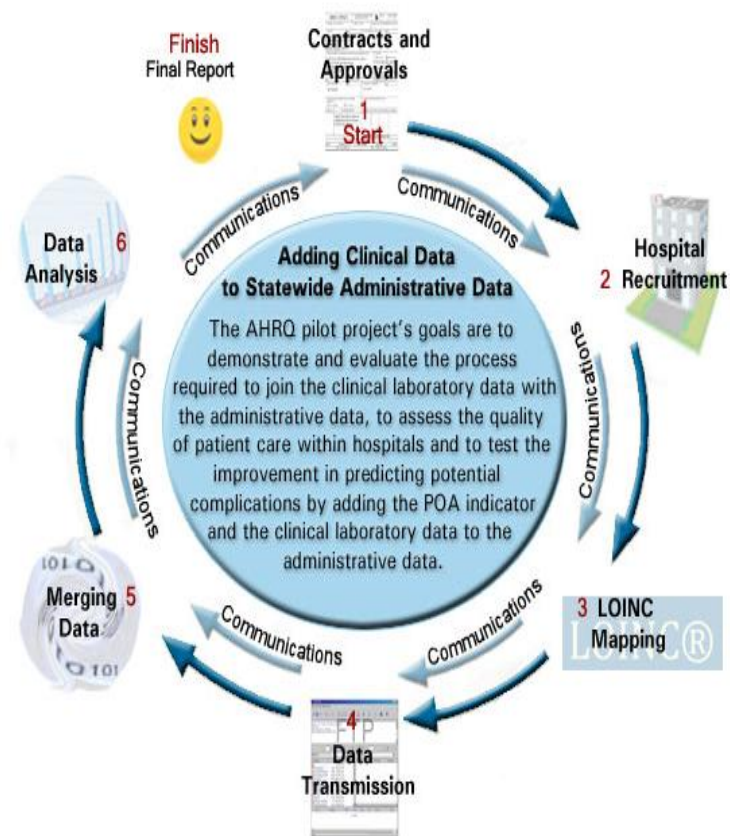
HEPATITIS B SURFACE AB:ACNC:PT:SER:QN:EIA



Lab Result Interface Code Comparisons

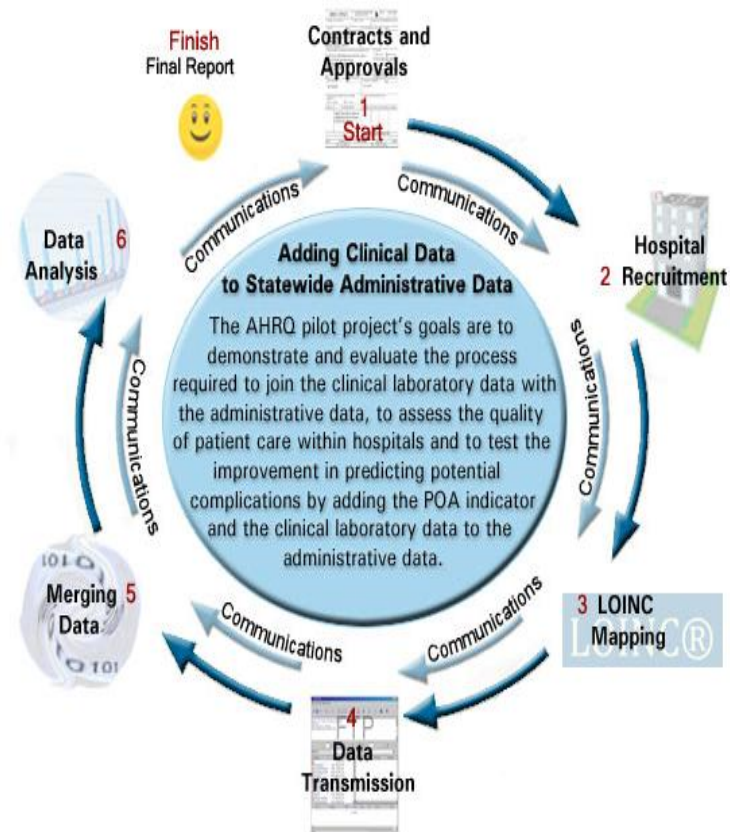
Lab Test Name	LOINC Name
SGPT	Alanine aminotransferase:CCnc:Pt:Ser/Plas:Qn:
Albumin	Albumin:MCnc:Pt:Ser/Plas:Qn:
Alkaline phosphatase	Alkaline phosphatase:CCnc:Pt:Ser/Plas:Qn:
SGOT	Aspartate aminotransferase:CCnc:Pt:Ser/Plas:Qn:
Blood/Lymph Culture-Positive	Bacteria identified:Prid:Pt:Bld:Nom:Culture
Glucose	Glucose:MCnc:Pt:Ser/Plas:Qn:
Hematocrit	Hematocrit:VFr:Pt:Bld:Qn:Automated count
Total Hemoglobin	Hemoglobin:MCnc:Pt:Bld:Qn:
Potassium	Potassium:SCnc:Pt:Ser/Plas:Qn:
Sodium:	Sodium:SCnc:Pt:Ser/Plas:Qn:

LOINC Mapping Process



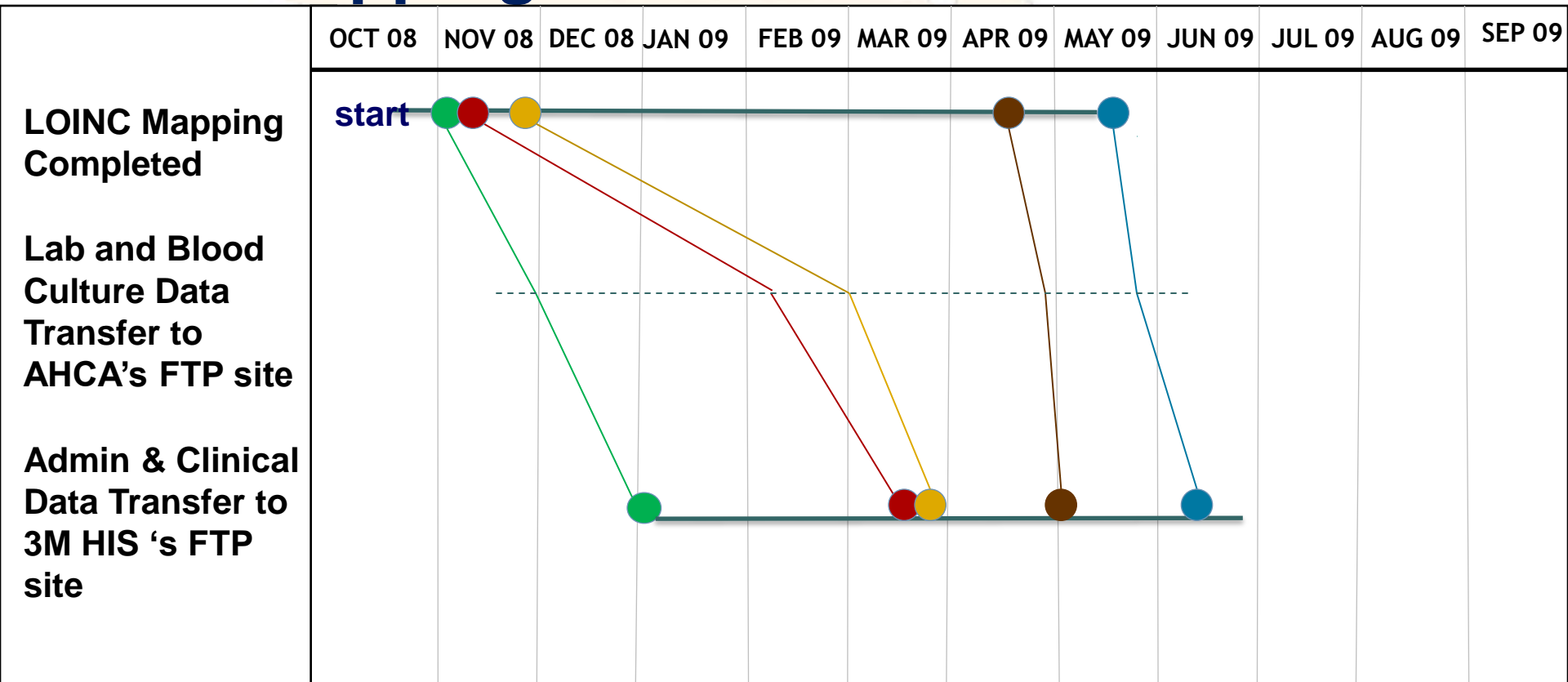
- 3M Terminology Consulting Services (TCS) worked with each hospital to standardize its laboratory data terminology and to verify accuracy of the final normalized map of laboratory values to LOINC.
- We initially estimated about eight weeks to complete the LOINC mapping.

Data Transmission



- Hospitals extracted laboratory and blood culture data from inpatient admissions between April 1, 2007 and December 31, 2007.
- All inpatients records and all laboratory tests were included in the dataset.
- Hospitals uploaded the LOINC standardized laboratory datasets, in a Tab Separated Value format to the secure AHCA FTP site.

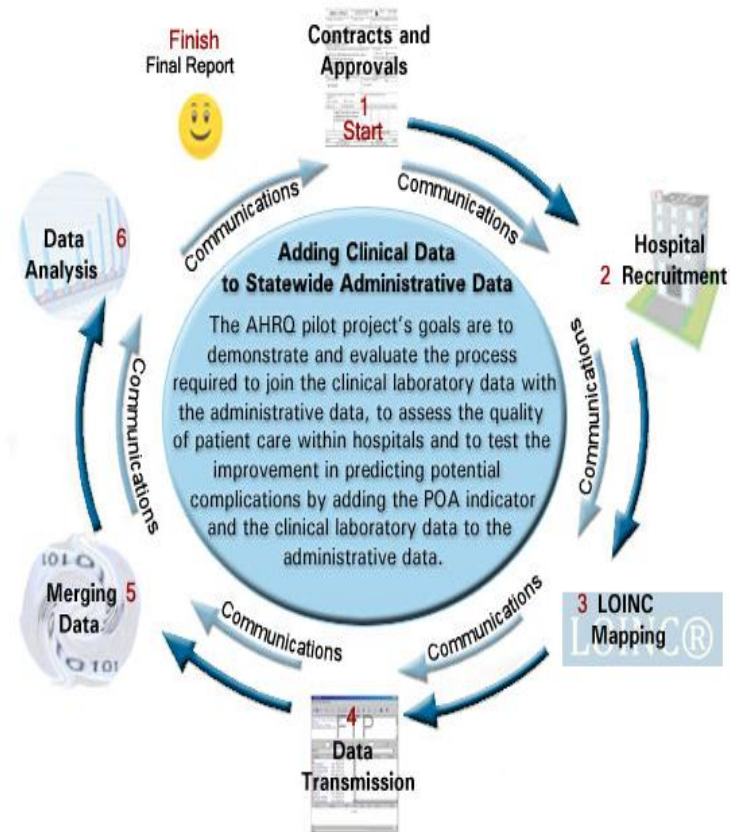
LOINC Mapping & Data Transmission Timeline



All Children's Hospital
Memorial Healthcare System
Broward Health System

Miami Children Hospital
BayCare Health System

Merging Datasets



- Florida inpatient administrative datasets with Present on Admission coding.
- Data collected from hospitals in the AHRQ project included:
 - 188,555 inpatient administrative claims and
 - 6,506,941 laboratory test results.
- Many challenges in joining the datasets.

Laboratory Dataset Submitted by Hospitals

LOINC Name	LOINC Code	Reference Code	Reference Name	Value	Unit	Value Range	Date	Time
Alanine aminotransferase: CCnc:Pt:Ser/Plas: Qn:	1742-6	41243	ALT	25	units/L	7-56	2007-04-14	07:05
Aspartate aminotransferase: CCnc:Pt:Ser/Plas: Qn:	1920-8	41242	AST	41	units/L	5-40	2007-04-14	07:05
Albumin:MCnc:Pt:Ser/Plas:Qn:	1751-7	41239	Albumin Lvl	3.6	gm/dL	3.9-5.0	2007-04-14	07:05
Alkaline phosphatase:CCnc:Pt:Ser/Plas:Qn:	6768-6	41241	Alk Phos	220	units/L	38-126	2007-04-14	07:05
Urea nitrogen:MCnc:Pt:Ser/Plas:Qn:	3094-0	41220	BUN	7	mg/dL	7-18	2007-04-14	07:05

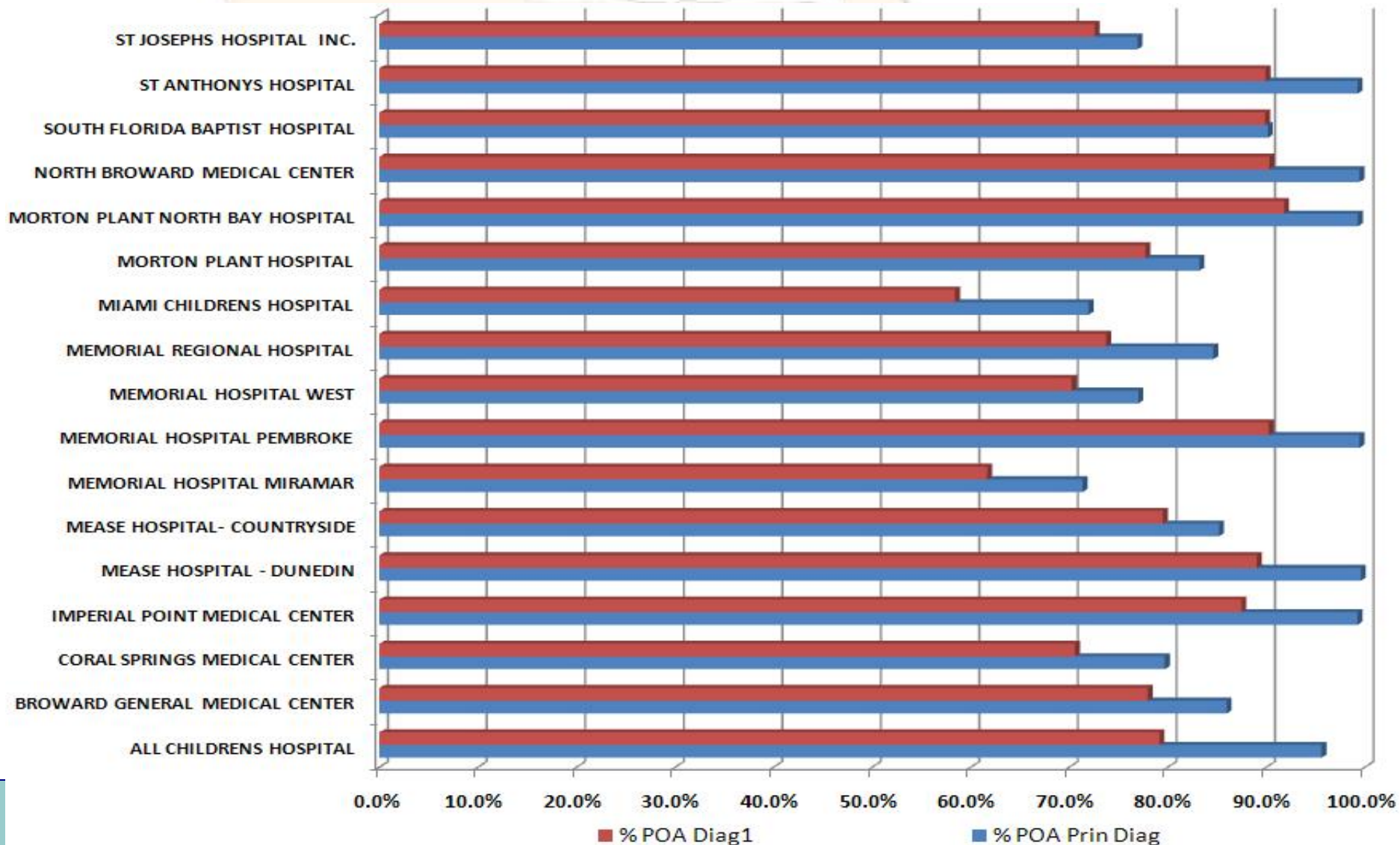
Blood Culture Laboratory Data

LOINC Name	LOINC Code	Test ID	Isolate Number	Organism Name	Date	Time	Free text
Blood/Lymph Culture-Positive	600-7	CXBLD	2	Klebsiella pneumoniae	4/4/2007	11:15	!PIMIC RVTK1;04/08/07;08:56;
Blood/Lymph Culture-Positive	600-7	CXBLD	1	Strep. pneumoniae	4/4/2007	12:10	!DIFF1-:53; ^48-@Preliminary ID: Alpha hemolytic Streptococcus. ;
Blood/Lymph Culture-Positive	600-7	CXBLD	1	Corynebacterium, not jeikeium	4/4/2007	16:40	No further work-up.
Blood/Lymph Culture-Positive	600-7	CXBLD	1	Staphylococcus aureus	4/4/2007	17:50	!SDRT EAD;04/06/07;09:38;Dox=R ~&MRSA;
Blood/Lymph Culture-Positive	600-7	CXBLD	1	Klebsiella oxytoca	4/4/2007	11:19	@Preliminary ID: Gram negative bacilli
Blood/Lymph Culture-Positive	600-7	CXBLD	2	Klebsiella pneumoniae	4/4/2007	11:19	!PIMIC RVTK1;04/08/07;08:56;!PIMIC1 RVTK1;04/08/07;08:56;
Blood/Lymph Culture-Positive	600-7	CXBLD	1	Klebsiella oxytoca	4/4/2007	11:15	@Preliminary ID: Gram negative bacilli
Blood/Lymph Culture-Positive	600-7	CXBLD	1	Staphylococcus aureus	4/4/2007	17:50	NOTICE! This is a Methicillin Resistant Staph Aureus (MRSA).

Lab Matches from 3M HIS

Adm	Counts	not in Lab	not in blood
BayCare\Final 2deit Mease Dunedin admin del 2006	4,793	191	4,793
BayCare\Final 2deit Morton Plant North Bay admin del 2006	4,838	1,359	4,838
BayCare\Final 2deit Morton Plant admin data del 2006	23,662	23,662	23,662
BayCare\Final 2deit St Anthony admin del 2006	8,158	392	8,158
BayCare\Final 2deit St Joseph admin del 2006	37,214	4,914	37,214
BayCare\Final 2deit mease countryside admin del 2006	12,929	1,286	12,929
BrowardHealth\Final deit Broward General Medical Center Admi	21,896	1,863	21,896
BrowardHealth\Final deit Coral Springs Medical Center Admin	9,876	1,314	9,876
BrowardHealth\Final deit Imperial point admin 2006	5,318	272	5,318
BrowardHealth\July 09 final deit revised admin broward North	10,120	182	10,120
Memorial\Final deit Memorial Pembroke admin del 2006 Tab	5,185	1,344	5,109
Memorial\Final deit Memorial West admin del 2006 Tab	20,405	7,680	20,206
Memorial\Final deit Miramar admin del 2006 Tab	8,142	3,530	8,094
Memorial\Final deit Regional del 2006 Tab	28,401	12,605	28,139
MiamiChildren\July 09 Final deit Miami admin 2008	12,060	10,815	9,047
allchildrens\Final july09 deit revised admin all children de	5,947	1,086	5,702
TOTAL	218,944		

Hospital POA for Principle Diagnoses



Pediatric Blood Cultures in First 24 Hours

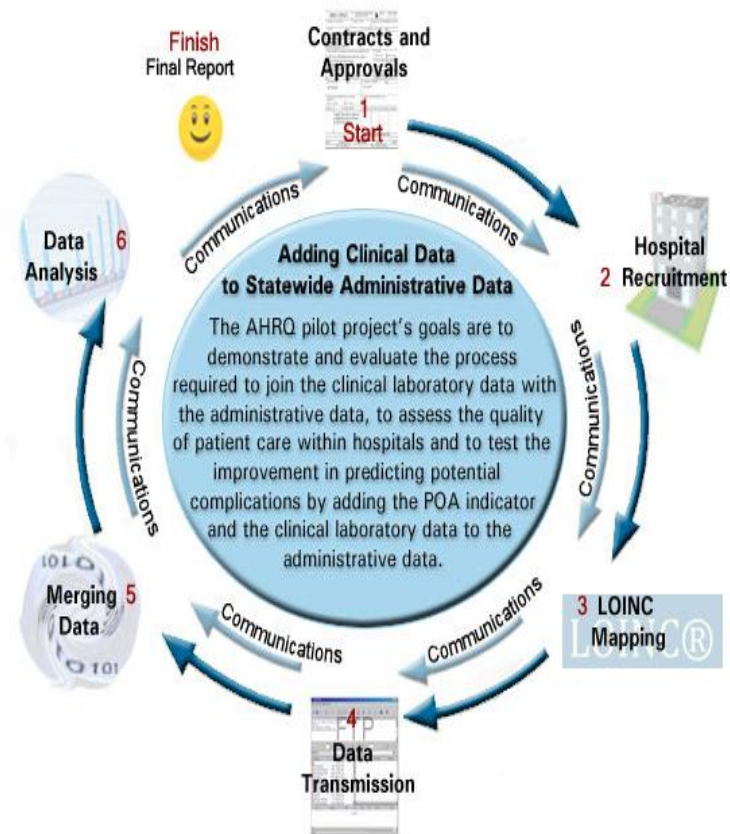
Principle Diagnosis = 771.81 – Septicemia of Newborn

Tests	Not Present on Principal Diagnosis	Tests	Present on Principal Diagnosis
1	Calcium:ionized:SCnc:Pt:Bld:Qn:	2	Bilirubin:MCnc:Pt:Ser/Plas:Qn:
1	Calcium:MCnc:Pt:Ser/Plas:Qn:	2	Calcium:MCnc:Pt:Ser/Plas:Qn:
1	Chloride:SCnc:Pt:Ser/Plas:Qn:	2	Chloride:SCnc:Pt:Ser/Plas:Qn:
1	Creatinine:MCnc:Pt:Ser/Plas:Qn:	2	Creatinine:MCnc:Pt:Ser/Plas:Qn:
1	Erythrocyte mean corpuscular hemoglobin:EntMass:Pt:RBC:Qn:Automated count	2	Erythrocyte mean corpuscular hemoglobin:EntMass:Pt:RBC:Qn:Automated count
1	Glucose:MCnc:Pt:Ser/Plas:Qn:	2	Glucose:MCnc:Pt:Ser/Plas:Qn:
1	Hematocrit:VFr:Pt:Bld:Qn:Automated count	2	Hematocrit:VFr:Pt:Bld:Qn:Automated count
1	Leukocytes:NCnc:Pt:Bld:Qn:Automated count	2	Leukocytes:NCnc:Pt:Bld:Qn:Automated count
1	Mean corpuscular volume:EntVol:Pt:RBC:Qn:Automated count	2	Mean corpuscular volume:EntVol:Pt:RBC:Qn:Automated count
1	Platelets:NCnc:Pt:Bld:Qn:Automated count	2	Platelets:NCnc:Pt:Bld:Qn:Automated count
1	Potassium:SCnc:Pt:Ser/Plas:Qn:	2	Potassium:SCnc:Pt:Ser/Plas:Qn:
1	Sodium:SCnc:Pt:Ser/Plas:Qn:	2	Sodium:SCnc:Pt:Ser/Plas:Qn:
1	Urea nitrogen:MCnc:Pt:Ser/Plas:Qn:	2	Urea nitrogen:MCnc:Pt:Ser/Plas:Qn:

Patient to Lab Ratios

Hospital	Patient Admissions	Labs	Labs per Patient	Length of Stay - Days
BayCare Health System	91,594	3,636,370	39.7	4.2
Broward Health	47,210	4,677,511	99.1	4.1
Memorial Healthcare	62,130	3,631,655	58.5	3.5
Miami Children's	12,060	10,397	0.9	5.1
All Children's	5,947	316,479	53.2	6.3

3M HIS Data Analysis Approach



- Since the analysis is based on risk adjustment at the time of admission, the first recorded laboratory results were used in the analysis when multiple results were recorded for the same clinical laboratory data element.
- Clinically determined erroneous laboratory test results were excluded from the analysis file.

3M HIS Data Analysis Process

- Step 1: Assign Admission APR DRG and Risk of Mortality Subclass.
- Step 2: Develop Standardized Ranges for the Clinical Laboratory Data Elements.
- Step 3: Screening Mechanism for Determining Where There is a Significant Relationship Between a Specific Laboratory Test Result and the Risk of Mortality for a Specific APR DRG.
- Step 4: Determine the Effect of each Laboratory Data Element on Risk of Mortality at the Overall Patient Level.
- Step 5: Evaluate the Impact of Adding Laboratory Data to Administrative Data on the Discriminatory Power of the Admission APR DRG and Risk of Mortality.

All Patient Refined Diagnosis Related Group

- Each admission is assigned to one of 314 admission APR DRG
 - APR DRG uses the diagnosis, procedures, age, sex, and discharge status fields on the standard claim form.
 - Admission APR DRG also requires the POA indicator for each diagnosis and the date each procedure is performed.
- The assignment of the admission base APR DRG, risk of mortality subclass, is accomplished through a seven-step process that eliminates certain diagnoses and procedures from consideration in the assignment of the APR DRG.

Effect of Each Laboratory Data Element on Risk of Mortality at the Overall Patient Level

- Each clinical laboratory model abnormal test result range category was evaluated to determine its effect on the likelihood of dying and to determine if it should be used to alter the risk of mortality subclass assignment.
- In order to make this determination, the mortality rate for each subset of cases is compared to the expected mortality rate, or the expected value for cases in that subset, using indirect rate standardization calculations.

3M HIS Preliminary Findings

- There is considerable effort and cost associated with a mandate to report laboratory test results.
- To justify such costs the operational value of the availability of the laboratory test results must be demonstrated.
- This study demonstrates the value of eleven selected laboratory results for the purpose of predicting patient mortality.
- This study identifies key LOINC laboratory tests that are relevant for an APR DRG risk of mortality prediction, which should minimally be included in any subsequently mandated collection of selected laboratory test results.
- The analysis found a 4.52% increase in R^2 for predicting patient mortality at the time of admission.

LOINC Mapping Evaluation Survey

An evaluation survey was developed by the Agency's team and sent to participating hospitals to gather their feedback related to:

- Hospital description,
- Resources needed,
- LOINC mapping,
- Data transmission,
- Communication tools,
- Barriers encountered, resolutions, and the lessons learned.

Personnel Involved in this Project

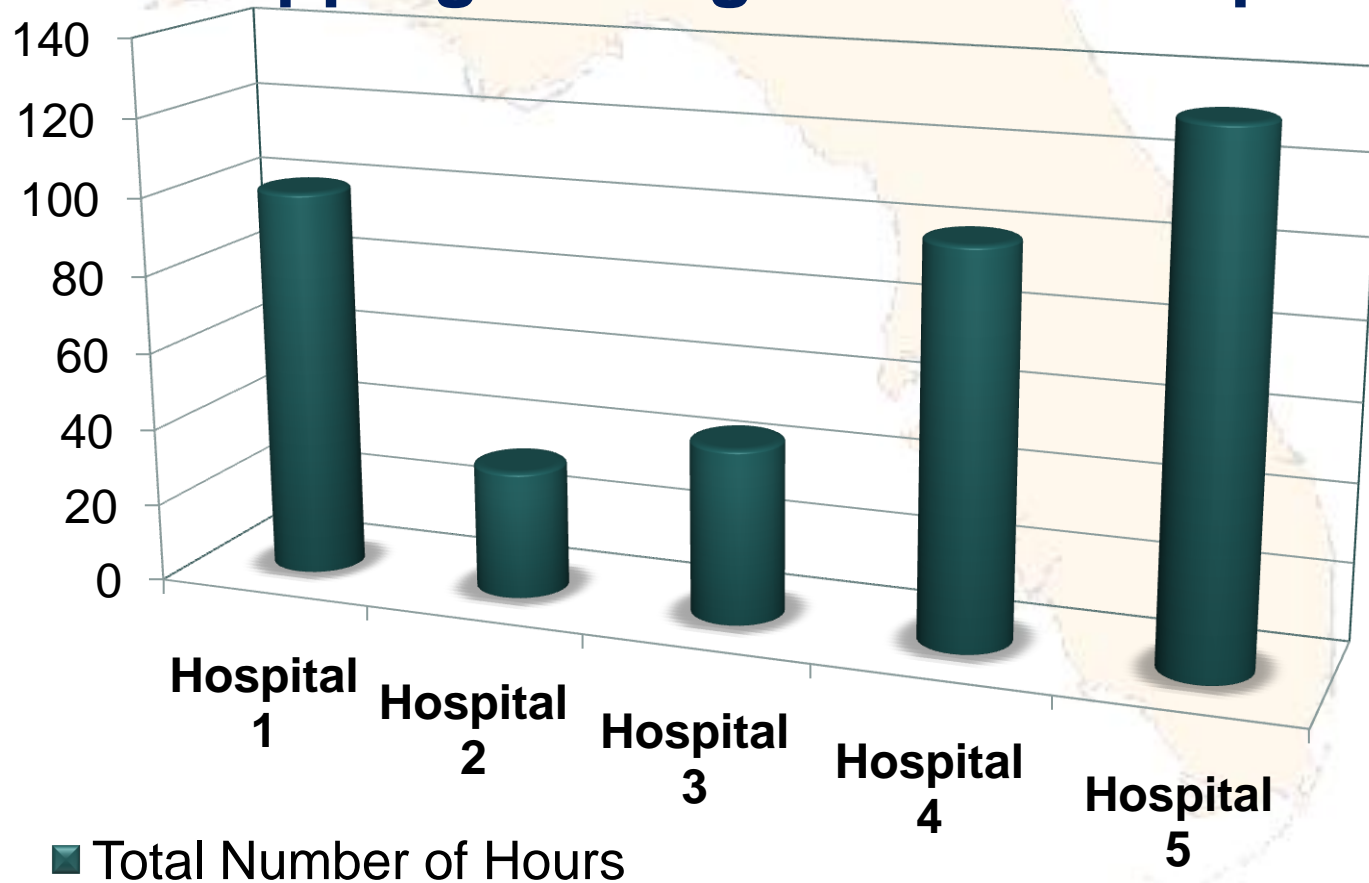
- All hospitals participated in the Agency/3M kick-off meeting.
- From that date on, hospitals worked independently and at their own pace from submitting their data catalog to 3M to uploading their data on the FTP site.
- The number of hours each participating hospital's personnel spent on this pilot project varied from 33 hours to 132 hours.
- In general most of the time spent was by the IT or systems analyst team members.



Agency for Health Care Administration

	Personnel Title	Task performed	Number of Hours
Hospital One	VP of Information Technology	Project Manager	30
	VP of Medical Affairs	Executive Sponsor	30
	I/T Sr. Systems Analyst	Program download	40
Hospital Two	Consulting systems analyst	Procedure mapping; create the data catalog, and data extraction	21
	Administrative Support	Attended Conference calls and meetings	12
Hospital Three	Mgr LIS	Sample Data extract and LOINC mapping, point person for questions from other teams	20
	CCL team	Modified and ran scripts to extract data and create the data catalog	16
	Database	Security and FTP	5
	Security team	Opened ports for FTP	1
	Cerner Corporate Support	Helped with some database issues	3
Hospital Four	Manager, IT Clinical Systems	Data extract	100
Hospital Five	Manager, Revenue Cycle Applications.	FTP files	2
	Lab System support analyst	Data extraction	10
	Outcomes Research Manager	Project Coordination	120

Total Number of Hours Spent on LOINC Mapping Among the Pilot Hospitals



Staff Issues Encountered by Hospitals

Barriers	How was issue resolved?
Time: Every team is under time constraints right now	A couple of other projects were put on the back burner
Time availability, staffing shortage	Staff worked in off hours
Coordination of multiple staff members and departments. Project approval by multiple departments	Cross Dept Coordination, working groups and increased collaboration. Interdepartmental coordination and cross collaboration used to secure project approval
This project occurred during our phase 2 scheduled build period of our EMR project so resources were extremely tight	Resources were pulled from build to complete the report

Technology Issues Encountered by Hospitals

Barriers	How was issue resolved?
Date range requested covered a different system than one in current use	Look up historical data catalog
Concurrent system upgrade project and move of servers off site	Extended time taken to complete
<ol style="list-style-type: none"> 1. Amount of data put a significant increase on system resources 2. We had the scripts error out twice after running for 20 hours due to the amount of data being returned 	Scripts were broken up into smaller time frames and the scripts were run during off hours when system resources aren't as high.
Database structure on lab system	Multiple extracts with links was required
Patient Data unavailable for year requested, 2007 without significant increase in data extraction efforts	Patient data extraction for 2008
Definitions of data fields were changed during the course of the project.	Additional programming time was required to accommodate the change in data

Lessons Learned

- Coordinate early and often and remain flexible in order to achieve your goals.
- Up-front training on LOINC is essential for success and help with the LOINC mapping is vital.
- Hospitals with similar Lab Information Systems (e.g., Cerner Millennium) can reuse the same LOINC mapping.
- Always appreciate the database work that has gone on before you and remember to ask for help
- Working with good people gets you further than expected.

Conclusions

- The AHRQ “Adding Clinical Data to Administrative Data” opened up new avenues to data collection and data analysis in Florida that will carry over into other areas, such as health information exchange.
- Conducting the LOINC mapping and translation and collecting the laboratory data was the easy part – joining the clinical and laboratory datasets has proven to be the true challenge in working with the data.
- The potential for new analytic approaches in working with administrative and laboratory data creates many opportunities for future research and discovery.



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