Hawaii Health Information Corporation

Enhancing Hawaii Hospital Information Content (eHHIC)

Deliverable 2:

Data Acquisition

HAWAII HEALTH INFORMATION CORPORATION
Hawaii's source of healthcare data

TABLE OF CONTENTS

I. OBJECTIVE……3
a. IMPLEMENTATION GUIDE……4
i. Data Specifications……4
ii. Data Elements……4
b. DATA TRANSFORMATION……5
i. Data Transformation Tools……5
ii. HL7 Interface Engine……5
c. HISTORICAL DATA FILES……6
d. METHODS OF TRANSMISSION……7
e. TEST FILES……7
II. CONCLUSION……8
III. SIGNATURES……9
APPENDIX A: DATA SPECIFICATIONS FOR HL7……9
APPENDIX B: DATA SPECIFICATIONS FOR ASCII……10
APPENDIX C: DATA ELEMENTS……13
APPENDIX D: HL7 INTERFACE ENGINE EVALUATION CRITERIA……16
APPENDIX E: HL7 INTEGRATION ENGINE EVALUATION……17

I. Objective

To receive lab data for 32 requested lab tests from 19 participating hospitals in the State of Hawaii from CY2008-CY2011 to enhance the clinical content of an all-payer, hospital-based, encounter-level database. This was achieved through:

A. Preparation and use of an implementation guide by providing data specifications
B. Procurement of data transformation tools
C. Receipt of historical data for CY 2008- 09/2011
D. Receipt of test files

II. Method

A. *Implementation Guide*

1. *Data Specifications*

Data specifications were provided to all participating hospitals to allow for receipt of high-quality lab data standardized across facilities. HHIC initially requested all participating providers transmit data via Health Language Seven (HL7); which is the standard method for exchanging, managing, and integrating healthcare information from one system to another. All facilities however were not programmatically capable of transmitting data via HL7 and/or preferred to transmit data in American Standard Code for Information (ASCII) format. To accommodate the facilities, separate data specifications were created to allow for transfer of data via HL7 or ASCII (see Appendix A and B).

These specifications outlined the data elements that were to be transmitted, including the requested 32 lab tests, the file layout and the data submission schedule. Data specifications were also used to validate the test files.

2. *Data Elements*

Appendix C highlights the data elements that were requested to be transmitted in the laboratory record. These data elements also included specific demographic variables for linking lab data to HHIC discharge data.

Many facilities however were unable or unwilling to provide all of the variables. One of the laboratories, which supplies data for two of the facilities, does not collect SSN (a key linking variable) and was therefore unable to supply the info. Due to policy changes, another facility refused to provide the patient's SSN in the laboratory record despite the fact that this data element is provided by this same facility in the discharge data that is submitted to HHIC[1].

The facilities were also unable to provide the ordering physician information (name and identifier) in a standard format. Some facilities provided only the physicians last name or a physician identifier that was not consistent with the physician identifier transmitted by the hospitals in HHIC's discharge data. As

[1] See Deliverable 7 for details on linking

a result, a business rule was established to use the attending physician listed on the existing discharge record as the ordering physician.

Providing the Logical Observation Identifiers Names and Codes (LOINC) to identify the hospital test across all facilities was also challenging as all facilities were not aware of this standard method for identifying medical laboratory observations. Data standardization methods and crosswalks were established to address this issue.[2]

B. *Data Transformation*

1. Data Transformation Tools

In accordance with industry standards, HHIC requested laboratory data submitted via HL7 v2.5.1. As we met with the facilities, it was determined that not all facilities could send data via HL7. Of the facilities that were capable of transmitting data via HL7, none were able to transmit in the most current and requested HL7 version, 2.5.1[3]. These facilities were only able to transmit lab data according to HL7 version 2.3.

We began to investigate data transformation tools to allow for the transfer of large data files in numerous file formats (American Standard Code for Information Interchange (ASCII), HL7) and multiple HL7 versions (v.2.3, v.2.5.1) to be accepted and translated to one centralized method.

a. HL7 Interface Engine

An HL7 interface engine is an integration engine built specifically for the healthcare industry. It allows for different systems to communicate with each other by using a standard messaging protocol.

Based on recommendations within the healthcare community and KLAS[4] ratings, we evaluated five industry leading HL7 Interface Engines.

[2] See Deliverable 3 for more detail regarding LOINC assignment
[3] See Deliverable 3, Appendix B – "Data Transmission Format by Facility" for additional details.
[4] KLAS' is a company whose mission is to improve healthcare technology delivery by measuring vendor performance and providing impartial ratings to help providers make informed decisions.

Criteria, such as scalability, filtering functionality and product support were established to assist with the assessment of the HL7 tools. Appendix D displays the criteria utilized in the evaluation process.

As shown in Appendix E, our selection was narrowed to two HL7 Integration Engines, Corepoint and Orion Health's Rhapsody. Our assessment showed both products supported numerous message formats that allowed it to map and translate data reliably and accurately. Although Corepoint's weighted score was slightly higher than Rhapsody's (due to customer support response time), Orion Health's willingness to provide flexible pricing to stay within our budget affected our final decision.

We selected Orion Health's HL7 Integration Engine (Rhapsody) to assist us in receiving and transforming the laboratory data. Rhapsody allowed for seamless transfer of data both internally (to HHIC databases) and externally (from the providers to HHIC).

Understanding HL7 and Rhapsody was not without challenges. The appropriate environments to install the software and store the data at HHIC needed to be developed. Staff also attended training to become proficient in the software as well as 'experts' in regards to HL7 laboratory data.

The benefits of investing in an HL7 interface allowed HHIC to receive data in any format preferred by the provider. It also allowed us to easily make changes without depending on significant provider resources.

C. Historical Data Files

The laboratories initially proposed that HHIC provide the facility id, account number, medical record number and admit date for each inpatient discharge record to assist in creating their historical data extract from CY 2008 through September 2011[5].

Creating the historical lab extracts based on the information provided by HHIC resulted in additional issues and concerns. Data provided to the laboratories was not necessarily in the same format as the data that resided in the laboratories repository due to variances in each organizations data specifications. For example, the account number submitted in HHIC's hospitalization discharge record is left padded with 0's if the length of the variable is not 15 characters; while the account number submitted by the hospital providers to the laboratories does not contain the leading 0's. This

[5] An HL7 interface was established in October 2011 at which time the transmission of 'live' laboratory data was implemented by facility.

resulted in the laboratories not being able to initially match the lab result to the discharge information supplied by HHIC. Customization by the laboratories and HHIC to format the data by removing the leading 0's for linking purposes helped to overcome this challenge.

In addition to formatting issues, not all variables provided by HHIC were present in the laboratory data for all hospitals. The agreed upon solution was for HHIC to provide a revised list of data variables that included the facility id, account number, medical record number, admit date and **discharge date.** This allowed the laboratories to view a range of dates to determine which lab results met the project criteria (Ex: 32 requested lab tests, the lab result's observation date was within the patient stay).

D. Methods of Transmission

To cover the timeframe of the study (CY 2008-2011), it was necessary for facilities to submit both historical and 'live' (current) lab data. Electronic data transmissions were received via Virtual Private Networks (VPN) or via Secure File Transfer Protocols (SFTP). Both methods ensured data encryption and security. Each participating facility chose the method that best suited their business infrastructure and the type of laboratory data that was being submitted.

Due to the way the historical lab data was stored, all facilities with the exception of two[6] transmitted their lab data via SFTP. 'Live' (current) data was transmitted by all participating facilities through VPN with the exception of one hospital which transmitted their 'live' data via SFTP[7].

E. Test Files

Each facility submitted test files for both historical and 'live' lab data to HHIC for review. The files were evaluated to ensure all data elements were present and met the requirements of the data specifications. If modifications were needed, corrected files were required and resubmitted by the hospital. The entire process was repeated until all specifications were met according to HHIC's implementation guide. Data standardization requirements as well as data quality review is described in Deliverable 3: *High-Level Analysis of Transmitted Laboratory Data.*

[6] Data from these two facilities were sent from one of the two centralized laboratories
[7] Hospital approval for VPN transmission was not granted.

II. Conclusion

Providing detailed data specifications to guide the facilities minimized the effort required to create a successful extract. The data specifications provided the requirements to ensure that expectations were met.

Investing in current technology is critical to acquiring “big” data. This allowed us to be flexible in accommodating our providers as well as managing large sets of data (volume), combined from disparate sources (variety), supplied in a rapidly increasing flow of information (velocity).

III. Signatures

Prepared by: _____

Position Title: _____

Date: _____

Approvals:

Project Manager: _____

Date: _____

Co-Principal Investigator: _____

Date: _____

Appendix A: Data Specifications for HL7

HHIC LABORATORY INFORMATION AHRQ PROJECT

INTRODUCTION

This document serves as a functional specification and technical requirements for integrating key lab results with Hawaii Health Information Corporation's (HHIC) inpatient database via Health Level 7 (HL7).We request a library of 32 laboratory tests and their respective LOINC codes be transmitted from each of our prospective ELR (Electronic Laboratory Reporting) providers.

HHIC uses these results of the key lab tests to enhance the content of their existing statewide, all-payer hospital discharge database by adding key hospitalization-related laboratory results. The enhanced data set will be used to improve the predicative methodology use to measure key patient outcomes, such as inpatient mortality.[8]

[8]This effort is supported by CER funding received from The Agency for Healthcare Research and Quality (AHRQ). Todd Seto, MD, from The Queen's Medical Center is the Primary Investigator and will direct the comparative effectiveness research component of the research. Jill Miyamura, PhD, HHIC, is Co-Principal Investigator. HHIC's role is to demonstrate the feasibility of enhancing inpatient all-payer data with clinical (laboratory) data to support the purpose of comparative effectiveness research. More information on the grant, its aims and methodology can be found at http://www.hcup-us.ahrq.gov/datainnovations.jsp.[8]

CONTENTS

HHIC Laboratory Information AHRQ Project 10
Introduction 10
General Specifications 12
Lab Data Set 14
Table1. Summary of Laboratory Tests and LOINC 18
Appendix A.1: The Health Level Seven (HL7) Standard 19
Appendix A.2: Message Segments: Field Specifications and Usage 21
Appendix A.3: MSH Segment 22
Appendix A.4: PID Segment 24
Appendix A.5: PV1 Segment 25
Appendix A.6: Common Order (ORC) Segment 26
Appendix A.7: OBR Segment 26
Appendix A.8: OBX Segment 28
Appendix A.9: NTE Segment 32
Appendix A.10: References 33
Appendix A.11: Selected HL7 Data Types and Segment Sequencing 34
Appendix A.12: Optionality of Segments: Designation and Meaning 35
Appendix A.13: Sample ORU Messages 36
Appendix A.14: HHIC Use Only - Edits Applied After Receipt 39

GENERAL SPECIFICATIONS

The instructions and specification contained in the *Implementation Guide- HL7 Specifications for Laboratory Observation Reporting (ORU Messages)* are applicable to participating HHIC institutions submitting data to HHIC, effective with discharges of January, 2008.

Hospitalization-related **(Inpatient)** laboratory results should be obtained from laboratory hospital's clinical laboratory system/laboratory information system. Observed test results (e.g., finger stick) and other test results from glucometers, chemsticks, etc. should not be submitted. Submit test results specific to that laboratory test only. As an example, for the test of hemoglobin, do not submit a hemoglobin value that was reported as part of an arterial blood gas test result.

Units of Measure

Each laboratory test has a unique test code that represents both the laboratory test and the unit of measure. For example, the laboratory test lists Glucose with mg/dL as the unit of measurement. The laboratory test codes were designed to accept the submission of the units of measure used specified in the LOINC system. Please consult with the clinical laboratory system/laboratory information system personnel at your facility if you have questions regarding the laboratory units of measures outlined on page 10, Table 1.

Corrected Values

When two results are available for the same date and time the laboratory specimen was collected and one is labeled "corrected,"submit the final corrected test result.

Data Submission Schedule

Lab will be submitted to HHIC as follows:

Data Due at HHIC	File
July 1, 2011	50 test messages per hospital
September 1, 2011	1st Quarter 2008
October - December, 2011	2nd, 3rd, 4th Quarter 2008 data (HHIC will provide a detailed schedule by October, 2011)
2012 schedule	To be established by November, 2011

Data File Description

The file will be submitted in batch on a quarterly basis (at the beginning—and will move to a more frequent schedule as defined at a later time).

Each submission should include a summary document with the following information: hospital name/ID, time frame of messages submitted, number of messages sent in the batch.

Separate batch files should be submitted for each hospital.

Transmission Options

Data will be transmitted to HHIC in one of the following ways:

1. Secure File Transfer Protocol (SFTP)
2. VPN

HHIC will collaborate with each provider to determine the best method.

LAB DATA SET

The lab data set includes the specified laboratory data of all inpatient admissions for the specified time period. Generally, data elements specified in the Implementation Manual follow HL7 standards.

The ORU message segments that HHIC requires follows: MSH, PID, PV1, OBR, OBX, NTE. The required message segments, associated fields, and key demographic data are listed on the following pages.

List of All Data Elements

The demographic fields to be sent in specific segments are listed in the table below. The specific ORU required segments (and fields) follow.

NAME	Message location	HL7 DT	Length
*Account number	PID-18	CX	250
*Admission Date	PV1-44	TS	26
*Discharge Date	PV1 -45	TS	26
*Date of birth	PID-7	TS	26
*Facility Name	MSH-4	HD	227
Gender	PID-8	IS	1
Hospital ID	TBD	HD	6
Hospital Test (order)	OBR-4	CE	250
Hospital Test (result - LOINC)	OBX-3	CE	250
Medical Record Number	PID-3	CX	250
Ordering Physician (Last, First, MI)	OBR-16	XCN	250
*Patient Name (Last, First, MI)	PID-5	XPN	250
Physician NPI	OBR-16	XCN	250
*Social Security Number	PID-19	ST	19

*for linking lab file to HHIC patient files

MSH Segment

Seq	NAME	HHIC Use	Type	R/O	LEN
1	Field Separator	"|"	ST	R	1
	Encoding Characters	^~\&	ST	R	4
3	Sending Application	LIS e.g. "SENDER_GenericLABSYSTEM-LIS"	HD	R	227
	Sending Facility	The sender of the message information, hospital name. hospital name^ CLIA code^CLIA YourHospital-Honolulu^45D3456781^CLIA	HD	R	227
5	Receiving Application	CLH, DLS or Hospital name	HD	R	227
	Receiving Facility	The brief provider organization name assigned when the provider first registers with the lab	HD	R	227
7	Date/Time Of Message	20110602161633 YYYYMMDDHHMM[SS]	TS	R	26
	Message Type	ORU^R01	MSG	R	7
10	Message Control Id	The sending system must assign an identifier for the message that is unique within the	ST	R	50

		namespace of the sending facility			
	Processing ID	P	PT	R	3
12	Version ID	2.3	VID	R	60

PID Segment

Seq	NAME	HHIC Use	Type	R/O	LEN
3	Patient ID	Medical Record Number	ST	R	250
	Patient Name	Last^First^Middle	XPN	R	250
7	Date/Time Of Birth	YYYYMMDD	TS	RE	26
	Sex	F, M, or U	IS	R	1
18	Patient Account Number	Patient Account Number	ST	R	250
	SSN – Patient	Sent if available	ST	RE	16

PV1 Segment

SEQ	NAME	HHIC Use	TYPE	R/O	LEN
2	Patient Class	E (Emergency Department visits), I (Inpatient Admission), O (Outpatient)	IS	R	1
	Admission Date/Time	Date and time of the patient presentation.	TS	RE	26
45	Discharge Date/Time	Date and time of the patient discharge.	TS	RE	26

Common Order (ORC) Segment

Used to transmit fields that are common to all orders. The ORC is NOT a required segment for HHIC.

OBR Segment

Seq	NAME	HHIC Use	Type	R/O	LEN
3	Filler Order Number	LIS order number = internal access number	EI	R	50
	Universal Service Identifier	Ordered test code ^^^[lab order code]^[description]	CE	R	250
7	Observation Date/Time	YYYYMMDDHHMMSS	TS	R	26
	Ordering Provider	1434567516^LASTNAME^PHYSICIANFIRST [PhysicianIDNPI]^[PhysicianLast]^[PhysicianFirst]	XCN	R	250
22	Results Rpt/Status Chng - Date/Time	“activity end date/time”	TS	R	26
	Result status	Only “F”	ID	R	1

OBX Segment(See next page for "Summary of Required Lab Tests and LOINC")

Seq	NAME	HHIC Use	TYPE	R/O	LEN
3	Observation Identifier	Local RESULT code^LOINC 4544-3^Hematocrit^LN^HCT^Hematocrit^LAB Result code^test description LOINC Code^LOINC description^LN^local code^local description^L	CE	R	250
	Observation sub-ID	0	ST	R	20
5	Observation value	Result Example 1 - Hepatitis A IgM test was positive OBX|1|CE|5182-1^Hepatitis A Virus IgM Serum Antibody EIA^LN||G-A200^Positive^SNM| Example 2 - antimicrobial susceptibility testing OBX|1|SN|7059-9^Vancomycin Susceptibility, Gradient Strip^LN||<^1	*	C	9999
	Units	Unit of measure	CE	RE	250
7	Reference ranges	Upper and lower limit	ST	RE	60
	Abnormal flags	Result value - S, I, or R, and should be provided in addition to the numeric value in OBX-5 When findings other than susceptibility results are sent, the abnormal flag should be valued (e.g., "H", "N", or "A")	IS	RE	5
11	Observation Result Status	F= completed. Correct and final results	ID	R	1

NTE Segment

Seq	NAME	HHIC Use	TYPE	R/O	LEN
1	Set ID	NTE	SI	O	4
	Source of Comment	Used when source of comment must be identified	ID	X	8
3	Comment	Comment	FT	RE	65536
	Comment Type		CE	O	250

Table1. Summary of REQUIRED Laboratory Tests and LOINC

	Lab Test	Lab Test Name	LOINC	Units	LOINC SHORTNAME
Chemistry	Albumin	Albumin	1751-7	g/dL	Albumin SerPl-mCnc
	Alkaline phosphatase	Alkaline phosphatase	6768-6	U/L;units/L	ALP SerPl-cCnc
	Blood urea nitrogen (BUN)	Urea nitrogen	3094-0	mg/dL	BUN SerPl-mCnc
	Bilirubin (total)	Bilirubin	1975-2	mg/dL	Bilirub SerPl-mCnc
	Calcium	Calcium	17861-6	mg/dL	Calcium SerPl-mCnc
	Chloride	Chloride	2075-0	mmol/L	Chloride SerPl-sCnc
	Creatine kinase-MB	Creatine kinase.MB	13969-1	ng/mL; ug/L	CK MB SerPl-mCnc
	Creatinine	Creatinine	2160-0	mg/dL	Creat SerPl-mCnc
	Glucose	Glucose	2345-7	mg/dL	Glucose SerPl-mCnc
	Gamma glutamyl transferase	Gamma glutamyl transferase	2324-2	U/L;units/L	GGT SerPl-cCnc
	Potassium	Potassium	2823-3	mmol/L	Potassium SerPl-sCnc
	Phosphate	Phosphate	2777-1	mg/dL	Phosphate SerPl-mCnc
	BNP	Natriuretic peptide.B	30934-4	pg/mL	BNP SerPl-mCnc
	Sodium	Sodium	2951-2	mmol/L	Sodium SerPl-sCnc
	Troponin I	Troponin I.cardiac	10839-9	ug/L;ng/mL	Troponin I SerPl-mCnc
	SGOT	Aspartate aminotransferase	1920-8	U/L;units/L	AST SerPl-cCnc
	SGPT	Alanine aminotransferase	1742-6	U/L;units/L	ALT SerPl-cCnc
Blood Gas					
	pO2	Oxygen	2703-7	mm Hg	pO2 BldA
	pCO2	Carbon dioxide	2019-8	mm Hg	pCO2 BldA
	pH(arterial)	pH	2744-1		pH BldA
	Base excess	Base excess	1925-7	mmol/L	Base excess BldA-sCnc
	Bicarbonate	Bicarbonate	1960-4	mmol/L	HCO3 BldA-sCnc
Hematology					
	Hemoglobin	Hemoglobin	718-7	g/dL	Hgb Bld-mCnc
	Hematocrit	Hematocrit	4544-3	L/L;%	Hct Fr Bld Auto
	Partial thromboplastin time (PTT)	Coagulation surface induced	14979-9	Sec	aPTT Time PPP
	Prothrombin time (PT)	Coagulation tissue factor induced	5902-2	Sec	PT Time PPP
	INR	Coagulation tissue factor induced.INR	34714-6	INR(POC)	INR PPP
	Platelet count	Platelets	777-3	10^9/L	Platelet # Bld Auto
	White blood count (WBC)	Leukocytes	6690-2	10*3/uL	WBC # Bld Auto
Microbiology					
	Blood culture		600-7		
	Urine culture		630-4		
	Sputum culture		6460-0		

APPENDIX A.1: THE HEALTH LEVEL SEVEN (HL7) STANDARD

The ANSI HL7 standard is widely used for data exchange in the health care industry, and is quite lengthy, covering a variety of situations in patient care and health care finance. This document covers the subset of HL7 that will be used for LIS (laboratory information system) records received by **HHIC** from outside systems.

The basic unit transmitted in an HL7 implementation is the **message**. Messages are made up of several **segments**, each of which is one line of text, beginning with a three-letter code identifying the segment type. Segments are in turn made up of several **fields** separated by a delimiter character, "|". Below is an example LAB accession in HL7 2.3 format.

In this example, a message consisting of seven segments (MSH, PID, PV1, ORC, OBR, and OBX [0 thru 1]) is being sent to HHIC from a LAB database.

```
MSH|^~\&|YourHL7System|YourHIFACILITY |X| HHIC Database
|20110329082006||ORU^R01|201103290820062979|T|2.3
PID||55555^182P478_367903|15161516;1^^^1|55555^LAB^1|TEST^EMR^SAMPLE||1
9651015|F|||||||IB873749|45879|123456789|H
PV1||O|XOP^^^LAB|||16626|16626^TEST^PHYSICIAN||||||||||OP|182P478_367903560
475_101_1|||||||||||||||||||||||||20110329000000
ORC|RE||E2908978T8191219L1143|||||||||16626^TEST^PHYSICIAN^LABT02|LAB
OBR|1|20110329082006|201103290820062979|ABC^Automated Bld
Cnt|||20110329045100|||||||20110329081100||16626^TEST^PHYSICIAN^LABT02||||T
8191|219L1143^0|||H|F||^^^^^R
OBX|0|NM|6690-2^Leukocytes^LN^WBC^WBC^LAB|0|11.8|10(9)/L|3.8-
11.2|H|||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, #
300\Ewa Beach\HI\96706-1929\Glen Doctor, MD
OBX|1|NM|^^LN^RBC^RBC^LAB|0|3.01|10(12)/L|3.9-
5.2|L|||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, #
300\Ewa Beach\HI\96706-1929\Glen Doctor, MD
```

In the above example, the Message Header segment (**MSH**) carries the owner of the information being sent (**YourHIFACILITY**) and receiver (**HHIC Database**) and identifies the message as being of type **ORU**, Unsolicited Observation Result.

The Patient Identification segment (**PID**) carries the client's name (EMR TEST), birth date (19651015, in YYYYMMDD format), and other identifying fields.

PV1 carries the Patient Visit information, **ORC** carries Common Order information from the referring physician, **OBR** carries the observation request (e.g. perform biopsy), and several **OBX** segments carry the **LAB** laboratory observations, including clinical indications, gross description, and the diagnosis provided by the **LAB physician or** pathologist.

LAB will provide HL7 messages to communicate with **HHIC**. These files will be transmitted to the interface engine hosted at **HHIC**. Each HL7 file will contain one HL7 message that includes data for one**LAB** accession.

HL7 does not require the use of a particular coding system to identify either the observation or the result. In the past, users tended to use their own unique code systems for identifying tests and other clinical observations because standard codes were not available. Such local code systems suffice for transmitting information within single institutions, but present high barriers to aggregating data from many sources for research or for public health record systems. Standard code systems such as LOINC® now exist for many of these purposes, and we strongly encourage their use in reporting. Standard codes (LOINC) can be sent as the only code in the OBX-3 field, or they can be sent along with the local code (your local lab code) as the second code system represented in that field (See OBX segment).

APPENDIX A.2: MESSAGE SEGMENTS: FIELD SPECIFICATIONS AND USAGE

HL7 Segment Structure

Each segment consists of several fields, separated by the field separator character, "|". The table below defines how each segment (described on pages 7-17) is structured.

Field/ Column	Description
SEQ	The ordinal position of the field in the segment. Since **HHIC** does not use all possible fields in the HL7 standard, these are not always consecutive.
NAME	HL7 element name for the field.
HHIC Use	Short explanation of the use of this field.
TYPE	HL7 data type of the field. See Appendix A.11 for definition of HL7 data types.
R/O	Refers to if a field is required or optional. R means required for HL7 message for **LAB**. **RE** means indicated, required, but message will not be rejected if not present. **C** means conditional (Conditional on the trigger event or on some other field(s)). (See Appendix A.12)
LEN	Maximum length of the field

HL7 data types: Each field in the HL7 message has an HL7 data type. Appendix A.11 of this document lists and defines the HL7 data types needed by**HHIC**. The elemental data types Numeric (NM) and String (ST) consist of one value, while some data types, such as Patient Name are composites.

Delimiter characters: Field values of composite data types consist of several components separated by the **component separator**, "^". When components are further divided into sub-components, these are separated by the **sub-component separator**, "&". Some fields are defined to permit repetitions separated by the **repetition character**, "~". When these special characters need to be included within text data, their special interpretations are prevented by preceding them with the **escape character**, "\".

APPENDIX A.3: MSH SEGMENT

The MSH segment defines the intent, source, destination, and some specifics of the syntax of a message.

SEQ	NAME	HHIC Use	Type	R/O	LEN
1	Field Separator	"|"	ST	R	1
	Encoding Characters	^~\&	ST	R	4
3	Sending Application	LIS e.g. "SENDER_GenericLABSYSTEM-LIS"	HD	R	227
	Sending Facility	The sender of the message information, hospital name. hospital name^ CLIA code^CLIA YourHospital-Honolulu^45D3456781^CLIA	HD	R	227
5	Receiving Application	CLH, DLS or Hospital name	HD	R	227
	Receiving Facility	The brief provider organization name assigned when the provider first registers with the lab	HD	R	227
7	Date/Time Of Message	20110602161633 YYYYMMDDHHMM[SS]	TS	R	26
	Message Type	ORU^R01	MSG	R	7
10	Message Control Id	The sending system must assign an identifier for the message that is unique within the namespace of the sending facility	ST	R	50
	Processing ID	P	PT	R	3
12	Version ID	2.3	VID	R	60

Notes:

MSH-1 Determines the field separator in effect for this message. Requires the HL7 recommended field separator of "|".

MSH-2 Determines the component separator, repetition separator, escape character, and sub-component separator in effect for the rest of this message. **HHIC** requires the HL7 recommended values of ^~\&.
Definition: Four characters in the following order:

Component separator '^' ASCII (94)

Repetition Separator '~' ASCII (126)

Escape character '\' ASCII (92)

Subcomponent separator '&' ASCII (38)

MSH-3 Name of the sending application. When sending, LAB will use their LAB Information System identifier.

MSH-4 Identifies the sender (the owner of the message information). When sending, **LAB** will use "Hospital Name."

MSH-5 Name of the RECEIVING application. Regional or hospital lab that is processing the order.

MSH-6 Identifies the message receiver. This field identifies the organization responsible for the operations of the receiving application.

MSH-7 Date and time the message was created. This includes the time zone. See the TS data type.YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][+/-ZZZZ] is the HL7 format for the Time Stamp. Z is the time zone offset. Send values only as far as needed. When a system has only a partial date, e.g., month and year, but not day, the missing values may be interpreted as zeros. The time zone is assumed to be that of the sender.

Example: 20110526132010-0800 – May 26th, 2011, 13:20:10, Pacific Time.

MSH-9 Two components give the HL7 message type/HL7 triggering event. For outbound results (to HHIC) this field should be "ORU^R01", where ORU is the message ID for Observation Result / Unsolicited and R01 is an Unsolicited Transmission.

MSH-10 The message control ID is a string (which may be a number) uniquely identifying the message among all those ever sent by the sending system. LAB will use "xxauniquevalue." CCYYMMDDnnnnnnn may be used, (or DDD - Julian date instead of MMDD) and nnnnnnn is the sequence number for that day. Calendar Date: CCYYMMDD with CC = century, YY = last 2 digits of year, and valid ranges of month = 01 through 12 and day = 01 through 31.

MSH-11 The processing ID to be used by **LAB** is **P** for production. T = Training / testing.

MSH-12 -- "2.3" to indicate HL7 Version 2.3.

NOTE: We have used 2.3 as the default version. 2.3 or higher may be sent, up to 2.5.1.

APPENDIX A.4: PID SEGMENT

The PID segment is used by all applications as the primary means of communicating patient identification information. This segment contains permanent patient identifying and demographic information that, for the most part, is not likely to change frequently.

SEQ	NAME	HHIC Use	TYPE	R/O	LEN
3	Patient ID	Medical Record Number	CX	R	250
	Patient Name	Last^First^Middle	XPN	R	250
7	Date/Time Of Birth	YYYYMMDD	TS	RE	26
	Sex	F, M, or U	IS	R	1
18	Patient Account Number	Patient Account Number	CX	R	250
	SSN – Patient	Sent if available	ST	RE	16

Notes:

PID-3 The unique medical record number of the patient's chart within the system. Patient"s unique identifier(s) from the facility.

PID-5 Example:

Doe^Mary^A *[PatientLastName]^[PatientFirstName] ^[PatientMiddleName]. Last name and first name are required.*

PID-7 Give the year, month, and day of birth (YYYYMMDD). **LAB may** ignore any time component in the birth date. Time stamp (TS) data type must be in the format: YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][ ]. The user values the field only as far as needed. When a system has only a partial date, e.g., month and year, but not day, the missing values may be interpreted as zeros. The time zone is assumed to be that of the sender.

PID-8 Use F, M, or U (F = Female, M = Male, U = Unknown)

PID-18 This field is required and must contain an account number. Definition: This field contains the patient account number assigned by accounting to which all charges, payments, etc., are recorded. The entire number including the check digit will be considered the patient account number.

PID-19 Sent only if stored in lab system.

APPENDIX A.5: PV1 SEGMENT

The PV1 (Patient Visit Segment Definition) segment is used by Registration/Patient Administration applications to communicate information on a visit-specific basis.

SEQ	NAME	HHIC Use	TYPE	R/O	LEN
2	Patient Class	E (Emergency Department visits), I (Inpatient Admission), O (Outpatient)	IS	R	1
	Admission Date/Time	Date and time of the patient presentation.	TS	RE	26
45	Discharge Date/Time	Date and time of the patient discharge.	TS	RE	26

Notes:

PV1-2 Patient Class does not have a consistent industry-wide definition and is subject to site-specific variations. Patient Class = E (Emergency Department visits) or I (Inpatient Admission), or O (Outpatient). Literal values: “E”, “I” or “O”.

PV1-44 YYYYMMDDHHMM[SS[.S[S[S[S]]]]] [+/-ZZZZ]. Date and time patient arrived for services.

PV1-45 YYYYMMDDHHMM[SS[.S[S[S[S]]]]] [+/-ZZZZ] – Date and time patient was discharged from facility, as known/recorded/available.

APPENDIX A.6: COMMON ORDER (ORC) SEGMENT

Used to transmit fields that are common to all orders. The ORC is NOT a required segment by HHIC.

APPENDIX A.7: OBR SEGMENT

The Observation Request Segment carries general information about the sample, test, or result. For laboratory-based reporting, the OBR defines the attributes of the original request for laboratory testing. Essentially, the OBR describes a battery or panel of tests that is being requested or reported. The OBR is similar to a generic lab slip that is filled out when a physician requests a lab test. The individual test names and results for the panel of tests performed are reported in OBX segments, which are described below. As defined by the ORU syntax, there can be many OBXs per OBR, and there can be many OBRs per PID.

Example:

OBR|1|20110329082006|201103290820062979|ABC^Automated Bld Cnt|||20110329045100||||||20110329081100||16626^TEST^PHYSICIAN^LABT02||||T8191|219L1143^0|||H|F||^^^^^R

SEQ	NAME	HHIC Use	TYPE	R/O	LEN
3	Filler Order Number	LIS order number = internal access number	EI	R	50
	Universal Service Identifier	Ordered test code ^^^[lab order code]^[description]	CE	R	250
7	Observation Date/Time	YYYYMMDDHHMMSS	TS	R	26
	Ordering Provider	1434567516^LASTNAME^PHYSICIANFIRST [PhysicianID-NPI]^[PhysicianLastName]^[PhysicianFirstName]	XCN	R	250
22	Results Rpt/Status Chng - Date/Time	"activity end date/time"	TS	R	26
	Result status	Only "F"	ID	R	1

Notes:

OBR-3 This is the **LAB (LIS)** internal order number.

Example: PL2010-123456 - *[LABAccessionNumber].*

Definition:

It is assigned by the order filler (receiving) application. This string must uniquely identify the order (as specified in the order detail segment) from other orders in a particular filling application (e.g., clinical laboratory). This uniqueness must persist over time.

OBR-4 This is an element containing the **LAB** case sample procedure type ID and description.

Components: <identifier (ST)> ^ <text (ST)> ^ <name of coding system (ST)> ^<alternate identifier (ST)> ^ <alternate text (ST)> ^ <name of alternate coding system (ST)>

The LOINC is more desirable in the OBX segment, field 3. Panels will have one OBR followed by multiple OBX segments (one for each test in the panel).

OBR-7 This is the **LAB** collected date, including time and time zone. This field is the clinically relevant date/time of the observation. In the case of observations taken directly from a subject, it is the actual date and time the observation was obtained.

OBR-16 This is a complex element containing three components related to the ordering physician. **When the provider is assigned a National Provider ID (NPI) the NPI is transmitted as the ID**: 1) NPI or Hospital Physician ID (NPI strongly preferred), 2) last name of referring physician, and 3) first name of referring physician.

Example: 5551001234^Smith^Bob

OBR-22 This field is used to indicate the date and time that the results are composed into a report and released to the individual OBX), or that a status, is entered or changed.

OBR-25 This is the test status and will be "F" for finalized.

HL7 Table - Result status (For reference)

Value	Description
O	Order received; specimen not yet received
I	No results available; specimen received, procedure incomplete
S	No results available; procedure scheduled, but not done
A	Some, but not all, results available
P	Preliminary: A verified early result is available, final results not yet obtained
C	Correction to results
R	Results stored; not yet verified
F	Final results; results stored and verified. Can only be changed with a corrected result.
X	No results available; Order canceled.
Y	No order on record for this test. (Used only on queries)
Z	No record of this patient. (Used only on queries)

APPENDIX A.8: OBX SEGMENT

The Observation/Result segment is used to transmit the observations of the **LAB**. OBX segments have great flexibility to report information. When properly coded, OBX segments report a large amount of information in a small amount of space. OBX segments within the ORU message are widely used to report laboratory and other clinical information.

There can be many OBX segments identified like OBX|1|, OBX|2|, OBX|3|, OBX|4|, OBX|5|, and OBX|6|, etc.

Example:

OBX|0|NM|6690-2^Leukocytes^LN^WBC^WBC^LAB|0|11.8|10(9)/L|3.8-11.2|H|||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, # 300\Ewa Beach\HI\96706-1929\Glen Doctor, MD
OBX|1|NM|^^LN^RBC^RBC^LAB|0|3.01|10(12)/L|3.9-5.2|L|||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, # 300\Ewa Beach\HI\96706-1929\Glen Doctor, MD
OBX|2|NM|718-7^Hemoglobin^LN^HGB^Hemoglobin^LAB|0|9.2|g/dL|11.6-15.1|L|||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, # 300\Ewa Beach\HI\96706-1929\Glen Doctor, MD
OBX|3|NM|4544-3^Hematocrit^LN^HCT^Hematocrit^LAB|0|27.2|%|34.1-44.2|L|||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, # 300\Ewa Beach\HI\96706-1929\Glen Doctor, MD
OBX|4|NM|^^LN^MCV^MCV^LAB|0|90.3|fL|80-100|||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, # 300\Ewa Beach\HI\96706-1929\Glen Doctor, MD
OBX|5|NM|^^LN^MCH^MCH^LAB|0|30.4|pg|27-33||||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, # 300\Ewa Beach\HI\96706-1929\Glen Doctor, MD
OBX|6|NM|^^LN^MCHC^MCHC^LAB|0|33.7|g/dL|32-36||||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, # 300\Ewa Beach\HI\96706-1929\Glen Doctor, MD
OBX|7|NM|^^LN^RDW^RDW^LAB|0|14.4|%|11-15||||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, # 300\Ewa Beach\HI\96706-1929\Glen Doctor, MD
OBX|8|NM|777-3^Platelets^LN^PLTC^Platelet Count^LAB|0|119|10(9)/L|150-450|L|||F|||20110329081700|12D0664165^LAB-HMCW\91-2135 Fort Weaver Road, # 300\Ewa Beach\HI\96706-1929\Glen Doctor, MD

OBX Segment (continued)

SEQ	NAME	OBX - HHIC Use	TYPE	R/O	LEN
3	Observation Identifier	Local RESULT code^LOINC 4544-3^Hematocrit^LN^HCT^Hematocrit^LAB Result code^test description LOINC Code^LOINC description^LN^local code^local description^L	CE	R	250
4	Observation sub-ID	0	ST	R	20
5	Observation value	Result Example 1 - Hepatitis A IgM test was positive OBX|1|CE|5182-1^Hepatitis A Virus IgM Serum Antibody EIA^LN||G-A200^Positive^SNM| Example 2 - antimicrobial susceptibility testing OBX|1|SN|7059-9^Vancomycin Susceptibility, Gradient Strip^LN||<^1	*	C	9999
6	Units	Unit of measure	CE	RE	250
7	Reference ranges	Upper and lower limit	ST	RE	60
8	Abnormal flags	Result value - S, I, or R, and should be provided in addition to the numeric value in OBX-5 When findings other than susceptibility results are sent, the abnormal flag should be valued (e.g., "H", "N", or "A")	IS	RE	5
11	Observation Result Status	F= completed. Correct and final results	ID	R	1

Notes:

OBX-3 <identifier (ST)> ^ <text (ST)> ^ <name of coding system (IS)> ^ <alternate identifier (ST)> ^ <alternate text (ST)> ^ <name of alternate coding system (IS)>

3.1 LOINC Code

3.2 Text LOINCdescription

3.3 Name of Coding System 'LN'

3.4 Alternate Identifier Local code here

3.5 Text Local description here

3.6 Alternate Coding System "L"

It is strongly recommended that OBX-3 be populated with as specific a LOINC®code as possible to prevent any misinterpretation of reported results.

OBX-4 Used for processing but not mapped

OBX-5 Result value. Example for blood culture

For antimicrobial susceptibility testing, the OBX segment would appear as:

OBX|1|SN|7059-9^Vancomycin Susceptibility, Gradient Strip^LN||**<^1**|...

where OBX-3 uses a LOINC® code and OBX-5 has a numeric value. The value type listed inOBX-2 determines the structure of the reported result here (i.e., SN). The SN data type has the following structure:

<comparator> ^ <num1(NM)> ^ <separator or suffix> ^ <num2 (NM)>

Some examples of the SN representation are:

|>^100| Greater than 100

|^100^-^200| equal to range of 100 through 200

|^1^:^228| ratio of 1 to 128 (e.g., the results of a serological test)

|^2^+| categorical response (e.g., an interpretation of occult blood positivity)

For results of a culture that yielded Neisseria meningitides, OBX-2 would be listed as a coded element(CE) and OBX-5 would appear as:

L-22202^Neisseria meningitidis^SNM|

It is strongly recommended that the data types CE and SN be used whenever possible to minimize ambiguity in reporting. In those cases where laboratories have a local code which represents a canned comment, the local code can be placed in OBX5 as a CE data type, and the canned comment can be placed in an NTE directly following the OBX segment.

Example:

OBX|1|CE|600-7^Microorganism identified, Blood Culture^LN||^^^SALMPRES^^L|...
NTE|1|L|Numerous colonies of Salmonella were present on culture. A sub-
NTE|2|L|culture was inoculated and sent for further species identification.

OBX-6 Units, for example: |µg/mL^microgram/milliliter^ISO+|

OBX-7 Reference range. If numeric, the values of this field may report several values
in one of the following three formats:

1. lower limit-upper limit when both lower and upper limits are defined, e.g., for potassium "3.5 - 4.5"
2. > lower limit if no upper limit, e.g., ">10"
3. < upper limit if no lower limit, e.g., "<15"

OBX-8 Abnormal flags should be used for reporting microbiology sensitivity data. Abnormal flags for antimicrobial sensitivity reporting should conform to the recommendations of National Committee of Clinical Laboratory Standards (NCCLS, http://www.nccls.org). For most reported findings, the allowable values are S, I, or R, and should be provided in addition to the numeric value in OBX-5. For ELR, when findings other than susceptibility results are sent, the abnormal flag should be valued (e.g., "H", "N", or "A") to distinguish between tests that are interpreted as normal and those that are interpreted as abnormal.

OBX-11 Value Type refers to the content.

APPENDIX A.9: NTE Segment

The optional Notes and Comments (NTE) segment is allowed to repeat and may be inserted after any of the OBX segments. The note segment applies to the information in the segment that immediately precedes it, i.e., the observation reported in the preceding OBX segment. The NTE segment can carry any text relevant to the event or the observation and can give its source. The NTE segment is not further defined by HL7.

SEQ	NAME	HHIC Use	TYPE	R/O	LEN
1	Set ID	NTE	SI	O	4
	Source of Comment	Used when source of comment must be identified	ID	X	8
3	Comment	Comment	FT	RE	65536
	Comment Type		CE	O	250

Notes:

NTE-1 This field may be used where multiple NTE segments are included in a message. Their numbering must be described in the application message definition

NTE-2 Used when source of comment must be identified

NTE-3 Contains the comment contained in the segment

NTE-3 Contains a value to identify the type of comment text being sent in the specific comment record.

APPENDIX A.10: REFERENCES

See Version 2.3 of the Health Level 7 standard for a full description of all messages, segments, and fields. Information regarding HL7 is at www.hl7.org. See ELINCs standards at http://www.elincs.chcf.org

IMPACT SIIS 2.0 - Implementation Guide for HL7 Messages & Segments

http://www.impactportal.info/FileSystem/hl7/4-HL7Guide-ImpactSIIS%20through%202.5%202011.pdf

APPENDIX A.11:SELECTED HL7 Data Types and Segment Sequencing

Data Type	Data Type Name	Data Type	Data Type Name
CE	Coded element	**CQ**	Composite Quantity with Units
CWE	Coded with Exceptions	**CX**	Extended Composite Id with Check digit
DT	Date	**DTM**	Date/Time
EI	Entity Identifier	**ERL**	Error Location
FC	Financial Class	**FN**	Family Name
HD	Hierarchic Designator	**ID**	Coded Values for HL7 Tables
IS	Coded value for User-Defined Tables	**LA2**	Location with address variation 2
MSG	Message Type	**NM**	Numeric
PT	Processing Type	**SAD**	Street Address
SI	Sequence ID	**ST**	String
SN	Structured Numeric	**VID**	Version Identifier
TS	Time Stamp	**XCN**	Extended Composite ID Number and Name for Persons
XAD	Extended Address	**XTN**	Extended telephone number
XPN	Extended Person Name		

Segment Sequence and Nesting

The sequence of segments in a message instance is indicated by the sequence of segments in the message-structure specification. Braces, { . . . } surrounding a group of segments indicate one or more repetitions of the enclosed group may occur. Brackets, [. . .] surrounding a group of segments indicates that the enclosed group is optional. If a group of segments is optional and may repeat it is enclosed in brackets and braces, [{ . . . }].

MSH
PID
PV1
ORC
OBR
OBX
OBR
OBX
OBX
NTE

APPENDIX A.12: Optionality of Segments: Designation and Meaning

Usage refers to the optionality of individual segments and groups of segments. The following designations and their meanings are used in message structures:

Value	Description	Comment
R	Required	A conforming sending application shall populate all "R" elements with a non-empty value. HHIC shall process (save / print / archive/etc.) or ignore the information conveyed by required elements. HHIC shall not raise an error due to the presence of a required element, but may raise an error due to the absence of a required element.
RE	Required but may be empty	The element may be missing from the message, but shall be sent by the sending application if there is relevant data to report. A conforming sending application shall be **capable** of providing all "RE" elements. If the conforming sending application knows the required values for the element, then it shall send that element. If the conforming sending application does not know the required values, then that element will be omitted. HHIC will be expected to process (save/print/archive/etc.) or ignore data contained in the element, but shall be able to successfully process the message if the element is omitted (no error message should be generated because the element is missing).
X	Not supported	For conformant sending applications, the element shall not be sent. HHIC shall ignore the element if it is sent. However, HHIC will not generate an application error if it receives the element.
C	Conditional - Specific to Message Profile	Used only in a *shared* message-structure specification, i.e., a specification that is shared by multiple Message Profiles. A shared message-structure is defined when the message structures of multiple message types are very similar. The specific usage of these segments is specified in each section where used.

APPENDIX A.13: Sample ORU Messages

Example 1:

MSH|^~\&|LIS|M|||20090518161040||ORU^R01|91380000032|P|2.3|
PID|||15161516^^^^M||TEST^EMR SAMPLE^||19651015|M|||||||||46456|
PV1||O|XOP||||14516^TEST^PHYSICIAN||LAB|||||||^|||||||||||||||||||||||||||
ORC|RE|||||||||||||||^|
OBR|||E2905964|^^^ADIF^CBC|||200905041213||||||200905041223|^|14516^TEST^PH
YSICIAN||||M3
017||||H|F|CBC^ADIF|^^^^^R|^^~^^~^^||||^^|^^|^^||200905041213|
OBX|1|NM|WBC^WBC|1|10.7|10(9)/L|3.5-10.0|H|||C|||200905050732|C^LAB IT|
OBX|1|TX|WBC^WBC|2|*CORRECTED 05/05 AT 0732: ORIGINAL:
5.1||||||C|||200905050732|C^LAB
IT|
OBX|2|NM|RBC^RBC|1|2.96|10(12)/L|4.4-6.0|L|||F|||200905041231|C^LAB IT|
OBX|3|NM|HGB^Hemoglobin|1|10.3|g/dL|14-17|L|||F|||200905041231|C^LAB IT|
OBX|4|NM|HCT^Hematocrit|1|31.4|%|41-51|L|||F|||200905041231|C^LAB IT|
OBX|5|NM|MCV^MCV|1|106.0|fL|80-100|H|||F|||200905041231|C^LAB IT|
OBX|6|NM|MCH^MCH|1|34.8|pg|27-33|H|||F|||200905041231|C^LAB IT|
OBX|7|NM|MCHC^MCHC|1|32.9|g/dL|32-36||||F|||200905041231|C^LAB IT|
OBX|8|NM|RDW^RDW|1|20.4|%|11-15|H|||F|||200905041231|C^LAB IT|
OBX|9|NM|PLTC^Platelet Count|1|58|10(9)/L|150-450|L|||F|||200905041231|C^LAB IT|
OBX|10|NM|MPV^MPV|1|12.5|fL|6.9-10.9|H|||F|||200905041231|C^LAB IT|
OBX|11|TX|DFTYP^Diff Method|1|Auto||||||F|||200905041231|C^LAB IT|
OBX|12|NM|ANEUT^Neutrophils|1|69|%|40-70||||F|||200905041231|C^LAB IT|
OBX|13|NM|ALYM^Lymphs|1|17|%|20-45|L|||F|||200905041231|C^LAB IT|
OBX|14|NM|AMONO^Monocytes|1|11|%|4-10|H|||F|||200905041231|C^LAB IT|
OBX|15|NM|AEOS^Eosinophils|1|3|%|0-6||||F|||200905041231|C^LAB IT|
OBX|16|NM|ABASO^Basophils|1|0|%|0-2||||F|||200905041231|C^LAB IT|
OBX|17|NM|ANEUTA^Neutrophils, Absolute|1|3.52|10(9)/L|1.4-
7.0||||F|||200905041231|C^LAB
IT|
OBX|18|NM|ALYMA^Lymphs, Absolute|1|0.86|10(9)/L|0.7-
4.5||||F|||200905041231|C^LAB IT|
OBX|19|NM|AMONOA^Monocytes, Absolute|1|0.55|10(9)/L|0.1-
1.0||||F|||200905041231|C^LAB IT|
OBX|20|NM|AEOSA^Eosinophils, Absolute|1|0.13|10(9)/L|0-
0.6||||F|||200905041231|C^LAB IT|
OBX|21|NM|ABASOA^Basophils, Absolute|1|0.02|10(9)/L|0-
0.2||||F|||200905041231|C^LAB IT|

Example 2:

MSH|^~\&|LIS|M|||20090518161040||ORU^R01|91380000033|P|2.3|
PID|||15161516^^^^M||TEST^EMR SAMPLE^||19651015|M|||||||||46456|
PV1||O|XOP||||14516^TEST^PHYSICIAN||LAB|||||||^|||||||||||||||||||||||||||
ORC|RE|||||||||||||||^|
OBR|||E2905966|^^^HA1C^HemoglobinA1C|||200905041213|||||||200905041223|^|1451
6^TEST^PHYSICIAN||||M3017||||RL|F|HA1C^HA1C|^^^^^R|^^~^^~^^||||^^|^^|^^||2009
05041213|
OBX|1|NM|HA1C^Hemoglobin A1C|1|2.8|%|4.0-6.0|L|||F|||200905041232|C^LAB IT|
OBX|1|TX|HA1C^Hemoglobin A1C|2|Note: Values <7% meet the treatment goal for patients
with
diabetes|||||||||200905041232|C^LAB IT|
OBX|1|TX|HA1C^Hemoglobin A1C|3| mellitus.|||||||||200905041232|C^LAB IT|
MSH|^~\&|LIS|M|||20090518161041||ORU^R01|91380000034|P|2.3|
PID|||15161516^^^^M||TEST^EMR SAMPLE^||19651015|M|||||||||46456|
PV1||O|XOP||||14516^TEST^PHYSICIAN||LAB|||||||^|||||||||||||||||||||||||||
ORC|RE|||||||||||||||^|
OBR|||E2905965|^^^UMIC^Urinalysis|||200905041213|||||||200905041223|^|14516^TES
T^PHYSICIA
N||||M3017||||HU|F|UA^UMIC|^^^^^R|^^~^^~^^||||^^|^^|^^||200905041213|
OBX|1|TX|UCOL^Color|1|Yellow|||||F|||200905041241|C^LAB IT|
OBX|2|TX|UAPP^Appearance|1|Clear|||||F|||200905041241|C^LAB IT|
OBX|3|NM|USGB^Specific Gravity|1|1.030||1.005-1.030||||C|||200905050733|C^LAB IT|
OBX|3|TX|USGB^Specific Gravity|2|*CORRECTED 05/05 AT 0733: ORIGINAL:
1.015|||||C|||200905050733|C^LAB IT|
OBX|4|TX|UESTB^Leukocyte Esterase|1|Negative||NEG||||F|||200905041241|C^LAB IT|
OBX|5|TX|UNITB^Nitrite|1|Positive||NEG|A|||C|||200905050733|C^LAB IT|
OBX|5|TX|UNITB^Nitrite|2|*CORRECTED 05/05 AT 0733: ORIGINAL:
Negative||||||C|||200905050733|C^LAB IT|
OBX|6|NM|UPHB^PH|1|7.0||5.0-7.5||||F|||200905041241|C^LAB IT|
OBX|7|TX|UPRTB^Protein|1|Negative|mg/dL|NEG||||F|||200905041241|C^LAB IT|
OBX|8|TX|UGLB^Glucose|1|Negative|mg/dL|NEG||||F|||200905041241|C^LAB IT|
OBX|9|TX|UKETB^Ketones|1|Negative|mg/dL|NEG||||F|||200905041241|C^LAB IT|
OBX|10|NM|UROB^Urobilinogen|1|0.2|EU/dL|0.2-1.0||||F|||200905041241|C^LAB IT|
OBX|11|TX|UBILB^Bilirubin|1|Positive||NEG|A|||C|||200905050733|C^LAB IT|
OBX|11|TX|UBILB^Bilirubin|2|*CORRECTED 05/05 AT 0733: ORIGINAL:
Negative||||||C|||200905050733|C^LAB IT|
OBX|12|TX|UBLDB^Blood|1|Negative||NEG||||F|||200905041241|C^LAB IT|
OBX|13|TX|UWBC^WBC|1|0-1|/hpf|0-5||||F|||200905041241|C^LAB IT|
OBX|14|TX|URBC^RBC|1|0-2|/hpf|0-2||||F|||200905041241|C^LAB IT|
OBX|15|TX|UBAC^Bacteria|1|None|/hpf|NONE||||F|||200905041241|C^LAB IT|
OBX|16|TX|UMUC^Mucus|1|None|/lpf|||||F|||200905041241|C^LAB IT|
OBX|17|TX|USQEP^Squamous Ep|1|Occ|/lpf|||||F|||200905041241|C^LAB IT|
OBX|18|TX|UCOM^Comments|1|CLEAN CATCH||||||F|||200905041241|C^LAB IT|

Example 3:

MSH|^~\&|LIS|M|||20090518161041||ORU^R01|91380000035|P|2.3|
PID|||15161516^^^^M||TEST^EMR SAMPLE^||19651015|M|||||||||46456|
PV1||O|XOP||||14516^TEST^PHYSICIAN||LAB|||||||^|||||||||||||||||||||||||||
ORC|RE|||||||||||||||^|
OBR|||E2905967|^^^ZZ01^Wound Cult,
Aero|||200905041213|||||||200905041223|^Leg|14516^TEST^PHYSICIAN||||M3018||||MC
|F|WNDAE^Z
Z01|^^^^^R|^^~^^~^^||||^^|^^|^^||200905041213|
OBX|1|TX|SDES^Specimen Description|1|Leg|||||F|||200905041228|C^LAB IT|
OBX|2|TX|SREQ^Special Requests|1|None||||||F|||200905041228|C^LAB IT|
OBX|3|TX|CULT^Culture|1|Many (4+) Proteus mirabilis||||||F|||200905050758|C^LAB IT|
OBX|3|TX|CULT^Culture|2|Mod (3+) **Corrected Micro Report** Rhodotorula glutinis (
Previously|||||||||200905050758|C^LAB IT|
OBX|3|TX|CULT^Culture|3| reported as: Rhodotorula rubra|||||||||200905050758|C^LAB
IT|
OBX|3|TX|CULT^Culture|4|Mod (3+) Pseudomonas
aeruginosa|||||||||200905050758|C^LAB IT|
OBX|3|ST|CULT^Culture|5|. . . . . COMMENT . . . . . .
.|||||||||200905050758|C^LAB IT|
OBX|3|ST|CULT^Culture|6|Called to: Dr office and XOP/Ruth @ 05/05/2009 07:58AM By:
SG2515|||||||||200905050758|C^LAB IT|
OBX|3|ST|CULT^Culture|7|Read back done and verified as
correct.|||||||||200905050758|C^LAB IT|
OBX|4|TX|RPT^Report Status|1|Final 05/05/2009||||||F|||200905050758|C^LAB IT|
OBX|5|TX|ORG^Organism|1|Many (4+) Proteus mirabilis||||||F|||200905041245|C^LAB IT|
OBX|6|TX|MTYP^Method|1|Kirby Bauer||||||F|||200905041245|C^LAB IT|
OBX|7|TX|AUG^Amox/k Clav'ate|1|Susceptible|||SS^|||F|||200905041245|C^LAB IT|
OBX|8|TX|AMPI^Ampicillin|1|Susceptible|||SS^|||F|||200905041245|C^LAB IT|
OBX|9|TX|CFZ^Cefazolin|1|Susceptible|||SS^|||F|||200905041245|C^LAB IT|
OBX|10|TX|CTN^Cefotetan|1|Susceptible|||SS^|||F|||200905041245|C^LAB IT|
OBX|11|TX|CAX^Ceftriaxone|1|Susceptible|||SS^|||F|||200905041245|C^LAB IT|
OBX|12|TX|CIP^Ciprofloxacin|1|Susceptible|||SS^|||F|||200905041245|C^LAB IT|
OBX|13|TX|GM^Gentamicin|1|Intermediate|||I^|||F|||200905041245|C^LAB IT|
OBX|14|TX|TE^Tetracycline|1|Resistant|||R^|||F|||200905041245|C^LAB IT|
OBX|15|TX|TS^Trimeth/sulfa|1|Susceptible|||SS^|||F|||200905041245|C^LAB IT|
OBX|16|TX|ORG^Organism|1|Mod (3+) Pseudomonas
aeruginosa||||||F|||200905050758|C^LAB IT|
OBX|17|TX|MTYP^Method|1|MIC (ug/mL)||||||F|||200905050758|C^LAB IT|
OBX|18|TX|AK^Amikacin|1|2 Susceptible|||SS^|||F|||200905050758|C^LAB IT|
OBX|19|TX|AZT^Aztreonam|1|14 Intermediate|||I^|||F|||200905050758|C^LAB IT|
OBX|20|TX|CAZ^Ceftazidime|1|1 Susceptible|||SS^|||F|||200905050758|C^LAB IT|
OBX|21|TX|CAX^Ceftriaxone|1|1 Susceptible|||SS^|||F|||200905050758|C^LAB IT|
OBX|22|TX|CIP^Ciprofloxacin|1|<1 Susceptible|||SS^|||F|||200905050758|C^LAB IT|
OBX|23|TX|GM^Gentamicin|1|10 Resistant|||R^|||F|||200905050758|C^LAB IT|
OBX|24|TX|IMP^Imipenem|1|2 Susceptible|||SS^|||F|||200905050758|C^LAB IT|
OBX|25|TX|TZP^Piperacillin/Tazo|1|1 Susceptible|||SS^|||F|||200905050758|C^LAB IT|
OBX|26|TX|TIM^Ticar/k Clav'ate|1|2 Susceptible|||SS^|||F|||200905050758|C^LAB IT|
OBX|27|TX|TO^Tobramycin|1|6 Intermediate|||I^|||F|||200905050758|C^LAB

APPENDIX A.14: HHIC Use Only – Edits Applied After Receipt

Proposed Edits Applied During or After Receipt of the Data File

Duplicate Laboratory Record

Two or more laboratory records were submitted representing the same laboratory test collected at the same date and time.

Resolution: Remove duplicate laboratory records so only one valid laboratory record exists for a single laboratory test collected at a specified date and time.

Failure to Link Laboratory Record with Discharge Record

The laboratory record did not link to a unique inpatient discharge record. The fields used to perform this link are the Medical/Health Record Number, Admission Date, and Account Number.

Resolution: Verify and correct the Medical/Health Record Number, Admission Date, and Account Number.

Admission Lab Algorithm

For the purpose of improving the severity of illness model, the admission lab results will be incorporated into existing risk models, e.g. 3M's APR-DRGs or other appropriate models. While lab results throughout the inpatient stay may be found to have an important predictive component, the results of selected admission labs (the 32 identified for this study) are known to improve the predictive power of existing risk models such as 3M's APRDRGs. Thus, the admission lab results of the 32 lab tests identified for this study will be identified for this purpose. HHIC will use the following algorithm.[9]

> The first lab value on the day of admission will be used as the "admission lab" because it is most likely to reflect the patient's status prior to any major interventions. If a value is not available, particularly if the patient was admitted late in the day (e.g., after 6 PM), then next day values will be used if no major procedure is documented on the day of admission. If no value is available using this algorithm, a value within seven days prior to admission that is closest to the day of admission can be used. Otherwise, the value will be considered missing.

Future Validations/Definitions/Edits

Further validations and edits will be applied over the course of working with data files. They will be published as they are incorporated.

[9] The proposed algorithm is subject to change following as we work with providers and work with data in more detail.

Laboratory Observation Reporting Technical Specifications and Transmittal Instructions

Effective for Discharges on or after January 1, 2008

Table of Contents

ASCII File Layout 42
- INTRODUCTION 42
- GENERAL SPECIFICATIONS 42
- TABLE1. SUMMARY OF REQUIRED Laboratory Tests and LOINC 44
- Data Field Layout 45
- Sending Facility 46
- Account Number 46
- Medical Record Number 47
- Date of Birth 47
- Gender 48
- Social Security Number 48
- Patient First Name 49
- Patient Last Name 49
- Patient Middle Initial 50
- Admission Date/Time 50
- Discharge Date/Time 51
- Ordering Physician First Name 51
- Ordering Physician Last Name 51
- Ordering Physician Middle Initial 52
- Physician Identifier 52
- Hospital or Lab Reporting Results 53
- Create Date/Time 53
- Patient Class 54
- Hospital Test (Order) 54
- Hospital Test (result – LOINC) 55
- Observation Date/Time 55
- Results Rpt/Status Chng Date/Time 56
- Results Status 56
- Observation Value 56
- Units 57
- Reference Ranges 57
- Abnormal Flags 58
- Observation Results Status 58
- Comments 59
- Appendix B.1: HHIC Use Only – Edits Applied After Receipt 60

ASCII File Layout

INTRODUCTION

This document serves as a functional specification and technical requirements for integrating key lab results with Hawaii Health Information Corporation's (HHIC) inpatient database via an ASCII file layout. A library of 32 laboratory tests and the respective LOINC codes will be transmitted from each of our prospective Electronic Laboratory Reporting (ELR) providers.

HHIC uses the results of these lab tests to enhance the content of their existing statewide, all-payer hospital discharge database. The enhanced data set will be used to improve the predicative methodology to measure key patient outcomes, such as inpatient mortality.[10]

GENERAL SPECIFICATIONS

These instructions and specification are applicable to participating HHIC institutions submitting data to HHIC, effective with admissions of January, 2008.

Hospitalization-related **(Acute Inpatient)** laboratory results should be obtained from the hospital's clinical laboratory system/laboratory information system. Observed test results (e.g., finger stick) and other test results from glucometers, chemsticks, etc. should not be submitted. Submit test results specific to that laboratory test only. As an example, for the test of hemoglobin, do not submit a hemoglobin value that was reported as part of an arterial blood gas test result.

Units of Measure

Each laboratory test has a unique test code that represents both the laboratory test and the unit of measure. For example, the laboratory test lists Glucose with mg/dL as the unit of measurement. The laboratory test codes were designed to accept the submission of the units of measure used specified in the LOINC system. Please consult with the clinical laboratory system/laboratory information system personnel at your facility if you have questions regarding the laboratory units of measures outlined in Table 1.

Corrected Values

When two results are available for the same date and time the laboratory specimen was collected and one is labeled "corrected," submit the final corrected test result.

[10]This effort is supported by CER funding received from The Agency for Healthcare Research and Quality (AHRQ). Todd Seto, MD, from The Queen's Medical Center is the Primary Investigator and will direct the comparative effectiveness research component of the research. Jill Miyamura, PhD, HHIC, is Co-Principal Investigator. HHIC's role is to demonstrate the feasibility of enhancing inpatient all-payer data with clinical (laboratory) data to support the purpose of comparative effectiveness research. More information on the grant, its aims and methodology can be found at http://www.hcup-us.ahrq.gov/datainnovations.jsp.[10]

Data File Description

The file format will be a delimited text file where each column value is separated by a pipe (|) from the next column. Each line of the text file must contain a single record. An "end of file marker" must follow the line feed of the last record.

The file will be submitted in batch on a quarterly basis (at the beginning—and will move to a more frequent schedule as defined at a later time).

Each submission should include a summary document with the following information: hospital name/ID, time frame of messages submitted, number of messages sent in the batch.

Separate batch files should be submitted for each hospital.

Transmission Options

Data will be transmitted to HHIC in one of the following ways:

3. Secure File Transfer Protocol (SFTP)
4. VPN

HHIC will collaborate with each provider to determine the best method.

TABLE1. SUMMARY OF REQUIRED Laboratory Tests and LOINC

	Lab Test	Lab Test Name	LOINC	Units	LOINC SHORTNAME
Chemistry	Albumin	Albumin	1751-7	g/dL	Albumin SerPl-mCnc
	Alkaline phosphatase	Alkaline phosphatase	6768-6	U/L;units/L	ALP SerPl-cCnc
	Blood urea nitrogen (BUN)	Urea nitrogen	3094-0	mg/dL	BUN SerPl-mCnc
	Bilirubin (total)	Bilirubin	1975-2	mg/dL	Bilirub SerPl-mCnc
	Calcium	Calcium	17861-6	mg/dL	Calcium SerPl-mCnc
	Chloride	Chloride	2075-0	mmol/L	Chloride SerPl-sCnc
	Creatine kinase-MB	Creatine kinase.MB	13969-1	ng/mL; ug/L	CK MB SerPl-mCnc
	Creatinine	Creatinine	2160-0	mg/dL	Creat SerPl-mCnc
	Glucose	Glucose	2345-7	mg/dL	Glucose SerPl-mCnc
	Gamma glutamyl transferase	Gamma glutamyl transferase	2324-2	U/L;units/L	GGT SerPl-cCnc
	Potassium	Potassium	2823-3	mmol/L	Potassium SerPl-sCnc
	Phosphate	Phosphate	2777-1	mg/dL	Phosphate SerPl-mCnc
	BNP	Natriuretic peptide.B	30934-4	pg/mL	BNP SerPl-mCnc
	Sodium	Sodium	2951-2	mmol/L	Sodium SerPl-sCnc
	Troponin I	Troponin I.cardiac	10839-9	ug/L;ng/mL	Troponin I SerPl-mCnc
	SGOT	Aspartate aminotransferase	1920-8	U/L;units/L	AST SerPl-cCnc
	SGPT	Alanine aminotransferase	1742-6	U/L;units/L	ALT SerPl-cCnc
Blood Gas					
	pO2	Oxygen	2703-7	mm Hg	pO2 BldA
	pCO2	Carbon dioxide	2019-8	mm Hg	pCO2 BldA
	pH (arterial)	pH	2744-1		pH BldA
	Base excess	Base excess	1925-7	mmol/L	Base excess BldA-sCnc
	Bicarbonate	Bicarbonate	1960-4	mmol/L	HCO3 BldA-sCnc
Hematology					
	Hemoglobin	Hemoglobin	718-7	g/dL	Hgb Bld-mCnc
	Hematocrit	Hematocrit	4544-3	L/L;%	Hct Fr Bld Auto
	Partial thromboplastin time (PTT)	Coagulation surface induced	14979-9	Sec	aPTT Time PPP
	Prothrombin time (PT)	Coagulation tissue factor induced	5902-2	Sec	PT Time PPP
	INR	Coagulation tissue factor induced.INR	34714-6	INR(POC)	INR PPP
	Platelet count	Platelets	777-3	10^9/L	Platelet # Bld Auto
	White blood count (WBC)	Leukocytes	6690-2	10*3/uL	WBC # Bld Auto
Microbiolog					
	Blood culture		600-7		
	Urine culture		630-4		
	Sputum culture		6460-0		

Data Field Layout

DATA ELEMENT	DATA TYPE	HL7 Location (for reference)
*Sending Facility	A	MSH-4
*Account Number	A	PID-18
Medical Record Number	A	PID-3
*Date of Birth	D	PID-7
Gender	A	PID-8
*Social Security Number	N	PID-19
*Patient First Name	A	PID-5
*Patient Last Name	A	PID-5
*Patient Middle Initial	A	PID-5
*Admission Date/Time	D	PV1-44
*Discharge Date/Time	D	PV1-45
Ordering Physician First Name	A	OBR-16
Ordering Physician Last Name	A	OBR-16
Ordering Physician Middle Initial	A	OBR-16
Physician Identifier	N	OBR-16
Receiving Application	A	MSH-5
Create Date/Time	D	MSH-7
Patient Class	A	PV1-2
Hospital Test (order)	A	OBR-4
Hospital Test (result – LOINC)	A	OBX-3
Observation Date/Time	D	OBR-7
Results Rpt/Status Chng-Date/Time	D	OBR-22
Results Status	A	OBR-25
Observation Value	A	OBX-5
Units (of Measure)	A	OBX-6
Reference Ranges	A	OBX-7
Abnormal Flags	A	OBX-8
Observation Results Status	A	OBX-11
Comments	A	NTE-3

*for linking lab file to HHIC patient files

Sending Facility

Data Element:	Sending Facility
HL7 Location:	MSH-4
Data Type:	Alpha
Definition:	Identifies the sender (the owner of the message information). When sending, **LAB** will use "Hospital Name." NOTE: For files submitted by Clinical Laboratory, this number will be their internally assigned number for the hospitals.

Account Number

Data Element:	Account Number
HL7 Location:	PID-18
Data Type:	Alphanumeric
Definition:	The number assigned to the patient's visit by the hospital. The account number is typically used for charge and/or billing purposes.
Instructions:	Valid characters: A through Z, 0 through 9, . (period), and - (hyphen). Do not leave this field blank.

Medical Record Number

Data Element:	Medical Record Number
HL7 Location:	PID-3
Data Type:	Alphanumeric
Definition:	The number assigned to the patient's medical/health record by the hospital. The medical record number is typically used to do an audit of the history of treatment.
Instruction:	Valid characters: A through Z, 0 through 9, . (period), and - (hyphen). Do not leave this field blank.

Date of Birth

Data Element:	Date of Birth
HL7 Location:	PID-7
Data Type:	Date
Definition:	Month, day, and year (including century) of birth of the patient.
Instruction:	YYYYMMDD If the month, day or year of birth is a single digit, use a preceding zero. There should be no blanks in this field. Do not leave this field blank.

Gender

Data Element: Gender

HL7 Location: PID-8

Data Type: Alpha

Definition: Sex of patient

M = Male
F = Female
U = Unknown

Social Security Number

Data Element: Social Security Number

HL7 Location: PID-19

Data Type: Numeric

Definition: The number assigned by the Social Security Administration.

Instructions: Valid characters: 0 through 9, no hyphens or spaces.
If SSN is unknown leave blank.

Patient First Name

Data Element:	Patient First Name
HL7 Location:	PID-5
Data Type:	Alphanumeric
Definition:	The patient's first name.
Instructions:	Exclude middle names and middle initials Uppercase only

Patient Last Name

Data Element:	Patient Last Name
HL7 Location:	PID-5
Data Type:	Alphanumeric
Definition:	The patient's last name.
Instructions:	Uppercase Only

Patient Middle Initial

Data Element:	Patient Middle Initial
HL7 Location:	PID-5
Data Type:	Alphanumeric
Definition:	The patient's middle initial.
Instructions:	Include only the first middle initial. Uppercase only.

Admission Date/Time

Data Element:	Admission Date/Time
HL7 Location	PV1-44
Data Type:	Date
Definition:	Month, day, year and time of admission to the hospital as an **acute** care patient.
Instruction:	YYYYMMDDHHMMSS If the month, day or year of admission is a single digit, use a preceding zero. There should be no blanks in this field. Do not leave this field blank.

Discharge Date/Time

Data Element:	Discharge Date/Time
HL7 Location:	PV1-45
Data Type:	Date
Definition:	Month, day, year and time of discharge from the hospital as an **acute** care patient.
Instruction:	YYYYMMDDHHMMSS If the month, day or year of discharge is a single digit, use a preceding zero. There should be no blanks in this field. Do not leave this field blank.

Ordering Physician First Name

Data Element:	Physician First Name
HL7 Location:	OBR-16
Data Type:	Alphanumeric
Definition:	The physician's first name.
Instructions:	Exclude middle names and middle initials Uppercase only

Ordering Physician Last Name

Data Element:	Physician Last Name
HL7 Location:	OBR-16
Data Type:	Alphanumeric
Definition:	The physician's last name.
Instructions:	Uppercase only

Ordering Physician Middle Initial

Data Element:	Physician Middle Initial
HL7 Location:	OBR-16
Data Type:	Alphanumeric
Definition:	The physician's middle initial.
Instructions:	Include only the first middle initial. Uppercase only.

Physician Identifier

Data Element:	Physician Identifier
HL7 Location:	OBR-16
Data Type:	Numeric
Definition:	Either the National Provider Identifier (NPI) that is issued to the individual physician by CMS or the identifier that is assigned to each physician by the hospital.
Instructions:	Leave blank if unknown.

Hospital or Lab Reporting Results

Data Element:	Hospital or Lab Reporting Results
HL7 Location:	MSH-5
Data Type:	Alpha
Definition:	Name of the hospital or lab that is processing the order.

Create Date/Time

Data Element:	Create Date/Time
HL7 Location:	MSH-7
Data Type:	Date
Definition:	Date and time the message was created.
Instructions:	YYYYMMDDHHMMSS If the month, day or year of create date is a single digit, use a preceding zero. There should be no blanks in this field. Do not leave this field blank.

Patient Class

Data Element: Patient Class

HL7 Location: PV1-2

Data Type: Alpha

Definition: Patient Class

E Emergency Department visits
I Inpatient Admission
O Outpatient

Hospital Test (Order)

Data Element: Hospital Test (Order)

HL7 Location: OBR-4

Data Type: Alpha

Definition: This is the local (ordered) test code.

Hospital Test (result – LOINC)

Data Element:	Hospital Test (result – LOINC)
HL7 Location:	OBX-3
Data Type:	Alpha
Definition:	LOINC Code
Instructions:	It is strongly recommended that OBX-3 be populated with as specific a LOINC®code as defined in Table 1 to prevent any misinterpretation of reported results.

Observation Date/Time

Data Element:	Observation Date/Time
HL7 Location:	OBR-7
Data Type:	Date
Definition:	Month, day, year and time of lab test.
Instruction:	YYYYMMDDHHMMSS If the month, day or year of observation is a single digit, use a preceding zero. There should be no blanks in this field. Do not leave this field blank.

Results Rpt/Status Chng Date/Time

Data Element: Results Rpt/Status Chng Date/Time

HL7 Location: OBR-22

Data Type: Date

Definition: Month, day, year and time of lab test.

Instruction: YYYYMMDDHHMMSS
If the month, day or year of results is a single digit, use a preceding zero.
There should be no blanks in this field.
Do not leave this field blank.

Results Status

Data Element: Results Status

HL7 Location: OBR-25

Data Type: Alpha

Definition: The current status of the results of the lab test.

Instruction: Only test status of "F" for finalized should be included.

Observation Value

Data Element: Observation Value

HL7 Location: OBX-5

Data Type: Alpha

Definition: Result of lab test.

Units

Data Element: Units

HL7 Location: OBX-6

Data Type: Alpha

Definition: Units of measure.

Reference Ranges

Data Element: Reference Ranges

HL7 Location: OBX-7

Data Type: Alpha

Definition: Reference range. If numeric, the values of this field may report several values in one of the following three formats:

4. lower limit-upper limit when both lower and upper limits are defined, e.g., for potassium "3.5 - 4.5"
5. > lower limit if no upper limit, e.g., ">10"
6. < upper limit if no lower limit, e.g., "<15"

Abnormal Flags

Data Element: Abnormal Flags

HL7 Location: OBX-8

Data Type: Alpha

Definition: Abnormal flags should be used for reporting microbiology sensitivity data. Abnormal flags for antimicrobial sensitivity reporting should conform to the recommendations of National Committee of Clinical Laboratory Standards (NCCLS, http://www.nccls.org). For most reported findings, the allowable values are S, I, or R, and should be provided in addition to the numeric value in OBX-5. When findings other than susceptibility results are sent, the abnormal flag should be valued (e.g., "H", "N", or "A") to distinguish between tests that are interpreted as normal and those that are interpreted as abnormal.

Observation Results Status

Data Element: Observation Results Status

HL7 Location: OBX-11

Data Type: Alpha

Definition: F= completed. Correct and final results

Comments

Data Element: Comments

HL7 Location: NTE-3

Data Type: Alpha

Definition: Contains the comment contained in the segment.

Appendix B.1: HHIC Use Only – Edits Applied After Receipt

Proposed Edits Applied During or After Receipt of the Data File

Duplicate Laboratory Record

Two or more laboratory records were submitted representing the same laboratory test collected at the same date and time.

Resolution: Remove duplicate laboratory records so only one valid laboratory record exists for a single laboratory test collected at a specified date and time.

Failure to Link Laboratory Record with Discharge Record

The laboratory record did not link to a unique inpatient discharge record. The fields used to perform this link are the Medical Record Number, Admission Date, and Account Number.

Resolution: Verify and correct the Medical Record Number, Admission Date, and Account Number.

Admission Lab Algorithm

For the purpose of improving the severity of illness model, the admission lab results will be incorporated into existing risk models, e.g. 3M's APR-DRGs or other appropriate models. While lab results throughout the inpatient stay may be found to have an important predictive component, the results of selected admission labs (the 32 identified for this study) are known to improve the predictive power of existing risk models such as 3M's APRDRGs. Thus, the admission lab results of the 32 lab tests identified for this study will be identified for this purpose. HHIC will use the following algorithm.[11]

> The first lab value on the day of admission will be used as the "admission lab" because it is most likely to reflect the patient's status prior to any major interventions. If a value is not available, particularly if the patient was admitted late in the day (e.g., after 6 PM), then next day values will be used if no major procedure is documented on the day of admission. If no value is available using this algorithm, a value within seven days prior to admission that is closest to the day of admission can be used. Otherwise, the value will be considered missing.

Future Validations/Definitions/Edits

Further validations and edits will be applied over the course of working with data files. These will be published as they are incorporated.

[11] The proposed algorithm is subject to change following as we work with providers and work with data in more detail.

Appendix C: Data Elements

DATA ELEMENT	Linking Variable
Sending Facility	Y
Account Number	Y
Medical Record Number	N
Date of Birth	Y
Gender	N
Social Security Number	Y
Patient First Name	Y
Patient Last Name	Y
Patient Middle Initial	Y
Admission Date/Time	Y
Discharge Date/Time	Y
Ordering Physician First Name	N
Ordering Physician Last Name	N
Ordering Physician Middle Initial	N
Physician Identifier	N
Receiving Application	N
Create Date/Time	N
Patient Class	N
Hospital Test (order)	N
Hospital Test (result – LOINC)	N
Observation Date/Time	N
Results Rpt/Status Chng-Date/Time	N
Results Status	N
Observation Value	N
Units (of Measure)	N
Reference Ranges	N
Abnormal Flags	N
Observation Results Status	N
Comments	N

Appendix D: HL7 Interface Engine Evaluation Criteria

Criteria	Definition
Scalability	The ability of the system, network, or process, to handle growing amounts of work/volume
Web Monitoring	Remote web server and website monitoring with alerts via SMS, e-mail, or phone
Filtering Ability	Connection can be implemented as a filter to modify a message received from an external system (such as code translation).
Product Support/Maintenance	Company is responsive and replies quickly. Configuration files can be backed up in less than 30 minutes and patches are timely and work accordingly.
Security/Transport	Virtual Private Networks(VPN), Secure File Transfer Protocol (SFTP) and Transmission Control Protocol/Internet Protocol (TCP/IP) are supported
Usability and Functionality	Crosswalks to cross reference data elements used by multiple applications; easy of setup and configuration
Capital Costs (3 years)	Initial price of software, hardware and maintenance fees
Resource Availability	Support and education available online; few outside resources needed
Technology Direction	Compatibility with other systems; version updates yearly
Outside Recommendations	Ease of Use/Customer Support/Product Functionality
Proof of Concept	HL7 Interface Demonstration

Appendix E: HL7 Integration Engine Evaluation

Weighting

	Weighting	Rankings (1-5 points) 5 = BEST							
		Rhapsody	Weighted Score	Corepoint	Weighted Score	Informatica*	Weighted Score	Iguana**	Weighted Score
Scalability									
Ability to support 100% of transaction volumes	2	3	6	3	6	2	4	2	4
Infrastructure	2	5	10	5	10	3	6	3	6
Can handle future message types at no additional cost	4	3	12	3	12	1	4	3	12
TOTAL	8	TOTAL	28	TOTAL	28	TOTAL	14	TOTAL	22
Web Monitoring									
Remote access	3	3	9	3	9	0	0	1	3
Error handling	4	3	12	3	12	0	0	1	4
TOTAL	7	TOTAL	21	TOTAL	21	TOTAL	0	TOTAL	7
Filtering Ability									
Remotely	2	3	6	3	6	0	0	0	0
Locally	4	4	16	4	16	0	0	3	12
TOTAL	6	TOTAL	22	TOTAL	22	TOTAL	0	TOTAL	12
Support/Maintenance/Upgrades/Backup									
Customer Support	4	2	8	4	16	2	8	2	8
Backup	3	3	9	3	9	0	0	3	9
Ease of upgrading/timing of patches	3	3	9	4	12	0	0	3	9
TOTAL	10	TOTAL	26	TOTAL	37	TOTAL	8	TOTAL	26
Security/Transport									
VPN	4	3	12	3	12	0	0	2	8
TCP/IP	3	3	9	3	9	0	0	2	6
FTP	3	3	9	3	9	0	0	2	6
TOTAL	10	TOTAL	30	TOTAL	30	TOTAL	0	TOTAL	20
Usability and Functionality									
LOINC matching (mapping code sets)	4	3	12	3	12	0	0	2	8
Use of lookup tables	4	3	12	3	12	0	0	2	8
Translation across HL7 formats	4	4	16	4	16	3	12	3	12
TOTAL	12	TOTAL	40	TOTAL	40	TOTAL	12	TOTAL	28
Capital Costs (3 years)									
Initial price	4	3	12	3	12	2	8	4	16
Hardware	3	3	9	3	9				
Maintenance fee	3	3	9	3	9	2	6	3	9
TOTAL	10	TOTAL	30	TOTAL	30	TOTAL	14	TOTAL	25
Resource / Skill Set Availability / Manpower									
Few outside consultants needed	4	2	8	3	12	0	1	2	8
Little programming required	4	3	12	3	12				
In-house development benefits company	4	4	16	4	16	4	16	2	8
TOTAL	12	TOTAL	36	TOTAL	40	TOTAL	17	TOTAL	16
Technology Direction									