# HL7 Messaging

The goal of this documentation is to present an encapsulated version of the changes required to enable the registry application to send HL7 messages.

This documentation will address the disparate pieces that help the code to run. The code itself will be put into a git hub location.

* HL7 Messaging Changes
  + Summary
    - External References
  + Compilation Changes
    - ivy
    - macker
  + Database Changes
    - ERD of the changes.
      * EPIC\_LOG Fields
  + Import Changes
    - Appointment
  + Configuration Changes
    - Log4j
    - HL7 Destination
    - Questionnaire Related Configuration
    - Study Code Mapping
  + Example Messages
  + Code Changes
    - HL7Sender
    - HL7Generator
    - EpicExportData
    - EpicExportResult
    - ReportUtils
    - RegistryShortFormScoreProvider

# HL7 Messaging Changes

## Summary

These changes will enable the registry data to be converted to epic lab results and be sent to a chosen port.

### External References

* [Anatomy of an HL7 message](https://catalyze.io/learn/hl7-102-anatomy-of-an-hl7-message)
* [HAPI at sourceforge](http://hl7api.sourceforge.net/index.html)

## Compilation Changes

**Add to ivy.xml**

<!-- HAPI is for HL7 messages -->

<dependency org="ca.uhn.hapi" name="hapi" rev="2.2" conf="default" transitive="false"/>

<dependency org="ca.uhn.hapi" name="hapi-base" rev="2.2" conf="default" transitive="false"/>

<dependency org="ca.uhn.hapi" name="hapi-hl7overhttp" rev="2.2" conf="default" transitive="false"/>

<dependency org="ca.uhn.hapi" name="hapi-structures-v21" rev="2.2" transitive="false"/>

<dependency org="ca.uhn.hapi" name="hapi-structures-v22" rev="2.2" transitive="false"/>

<dependency org="ca.uhn.hapi" name="hapi-structures-v26" rev="2.2" transitive="false"/>

<!-- the multiple versions of hapi-structures are required since the lab results message and the PDF message use different messaging versions -->

## Database Changes

**Add to macker.xml**

<!-- add to allow of access rule "Survey server dependencies were violated" -->

<include class="edu.ufl.survey.server.\*\*"/>

<include class="edu.ufl.survey.client.api.\*"/>

<!-- add to allow of access rule "Registry client dependencies were violated" -->

<include class="edu.ufl.registry.client.\*\*"/>

<include class="edu.ufl.registry.shared.\*\*"/>

<!-- add to allow of access rule "Registry server dependencies were violated" -->

<include class="edu.ufl.registry.server.\*\*"/>

<include class="edu.ufl.registry.client.\*\*"/>

<include class="edu.ufl.registry.shared.\*\*"/>

<include class="edu.ufl.survey.client.api.\*\*"/>

<include class="edu.ufl.survey.server.\*\*"/>

### ERD of the changes.

**SQL to add the entry into the SURVEY\_COMPLETE\_PUSH table**

INSERT INTO SURVEY\_COMPLETE\_PUSH (SURVEY\_RECIPIENT\_ID, RECIPIENT\_NAME, RECIPIENT\_DISPLAY\_NAME, PUSHED\_SURVEY\_SEQUENCE, FAILED\_COUNT, IS\_ENABLED)

VALUES (2, 'hl7', 'Create HL7 Message', null, 0, 'Y');

**SQL to add the EPIC\_LOG table**

-- Create table for storing statuses of messages sent to Epic

CREATE TABLE EPIC\_LOG(

ID NUMBER,

SURVEY\_REG\_ID NUMBER(19,0) NOT NULL,

PATIENT\_ID VARCHAR2(50) NOT NULL,

SUCCESS VARCHAR2(50) NOT NULL,

MESSAGE VARCHAR2(2000),

OUTGOING CLOB DEFAULT '',

META\_VERSION NUMBER,

DT\_CREATED TIMESTAMP(6),

DT\_CHANGED TIMESTAMP(6),

CONSTRAINT EPIC\_LOG\_PK PRIMARY KEY (ID),

CONSTRAINT EPIC\_LOG\_SURVEY\_REG\_ID\_FK FOREIGN KEY (SURVEY\_REG\_ID) REFERENCES SURVEY\_REGISTRATION,

CONSTRAINT EPIC\_LOG\_PATIENT\_ID\_FK FOREIGN KEY (PATIENT\_ID) REFERENCES PATIENT

);

CREATE SEQUENCE EPIC\_LOG\_SEQ;

#### EPIC\_LOG Fields

ID - Id of the log entry for a completed questionnaire

SURVEY\_REG\_ID - Id of the SURVEY\_REGISTRATION ( aka. the appointment )

PATIENT\_ID - Id of the patient ( aka. the MRN )

SUCCESS - Status of whether an HL7 message was received and processed correctly

MESSAGE - Response from EPIC side, either an ACK or an error displaying the cause of the failure

OUTGOING - Full text of the message sent to or attempted to EPIC

META\_VERSION - Metadata version

DT\_CREATED - Date log was created

DT\_CHANGED - Date log was modified

## Import Changes

### Appointment

In the Appointment.xlsx ( src/main/resources/default/xchg/import\_types , included in the repository ) there was added another field required for sending the PDF messages.

The EPID, corresponds to the EMPI within EPIC, this is required for the pdf document to be properly associated to the patient's media files.

|  |  |  |  |
| --- | --- | --- | --- |
| **DataSource** | **Field** | **Qualifier** | **Formatter** |
| PatientAttribute | EPID |  | AttributeFormat(string) |

## Configuration Changes

### Log4j

**Add to src/main/conf/log4j-xxxx.xml files and log4j.xml**

<category name="edu.ufl">

<priority value="DEBUG"/>

</category>

### HL7 Destination

### Questionnaire Related Configuration

**Add to src/main/conf/context.xml**

<!-- Destination Information for HAPI Connection http:localhost-->

<Parameter name="HL7Message.destinationHost" value="localhost"/>

<Parameter name="HL7Message.destinationPort" value="8080"/>

<Parameter name="HL7Message.destinationUri" value="/HL7WebService/hl7servlet"/>

<Parameter name="HL7Message.destinationUseTLS" value="false"/>

### This section of the configuration handles ranges within the HL7 Message.

### The parameter is HL7Message.<Study Description> (This configuration is accessed from the EpicExportData.setEpicExportResults() );

### The values are ranges (This configuration is accessed from the HL7Generator.rangeAndCategory() );

### Study Code Mapping

**Add to src/main/conf/context.xml**

<!-- Questionnaire Titles and Ranges -->

<!-- parameters for the score ranges for the surveys -->

<Parameter name="HL7Message.PROMIS Bank v1.0 - Anger" value="No Range" />

<Parameter name="HL7Message.painIntensity" value="0,1-4,5-6,>6" />

<Parameter name="HL7Message.PROMIS Anxiety Bank" value="No Range" />

<Parameter name="HL7Message.PROMIS Depression Bank" value="No Range" />

<Parameter name="HL7Message.PROMIS Fatigue Bank" value="No Range" />

<Parameter name="HL7Message.opiodRisk" value="0,1-3,4-7,>7" />

<Parameter name="HL7Message.PROMIS Pain Behavior Bank" value="No Range" />

<Parameter name="HL7Message.painCatastrophizingScale" value=">29" />

<Parameter name="HL7Message.PROMIS Pain Intensity Bank" value="No Range" />

<Parameter name="HL7Message.PROMIS Parent Proxy Bank v1.0 - Pain Interference" value="No Range" />

<Parameter name="HL7Message.PROMIS Physical Function Bank" value="No Range" />

<Parameter name="HL7Message.PROMIS Bank v1.0 - Sleep Disturbance" value="No Range" />

<Parameter name="HL7Message.PROMIS Bank v1.0 - Sleep-Related Impairment" value="No Range" />

This configuration is used to map the Study Code to the EPIC LRR codes. ( This configuration is accessed from the HL7Generator.generateOBX() )

* The Pain Intensity configuration values correspond to each of the Average, Now, Worst, and Least answers.
* Those entries with two values also provide the percentile score.
* Any plan to change these values should also involve changes to HL7Generator.generateOBX().

## Example Messages

**Add to src/main/conf/context.xml**

<!-- StudyCode#### = code from the database, values are the EPIC LRR value-->

<Parameter name="StudyCode1001" value="5963,5999,6000,6001" /> <!-- Pain Intensity -->

<Parameter name="StudyCode1019" value="5973" /> <!-- Pain Catastrophizing -->

<Parameter name="StudyCode1027" value="5972,8526" /> <!-- Pain Behavior -->

<Parameter name="StudyCode1028" value="5969,8533" /> <!-- Physical Function -->

<Parameter name="StudyCode1029" value="5965,8527" /> <!-- Fatigue -->

<Parameter name="StudyCode1030" value="5968,8531" /> <!-- Depression -->

<Parameter name="StudyCode1031" value="5967,8530" /> <!-- Anxiety -->

<Parameter name="StudyCode1032" value="5966,8528" /> <!-- Sleep Disturbance -->

<Parameter name="StudyCode1033" value="5970,8529" /> <!-- Sleep-Related Impairment -->

<Parameter name="StudyCode1034" value="5971,8532" /> <!-- Anger -->

<Parameter name="StudyCode1026" value="5964,8525" /> <!-- Pain Interference -->

<Parameter name="StudyCode1080" value="5974" /> <!-- Opioid Risk Tool -->

These messages are examples of the HL7 messages that are sent to the destination.

* The debug of the HL7Generator will show the message in the log
* A copy of the message is put into the OUTGOING field on the related EPIC\_LOG row.

PDF Message

MSH|^~\&|CHOIR|UF|ONBASE|UF|201503241503||ORU^R01|201503241503300000510941|P|2.6

PID|1||49586667^^^^EPI||Fraizer^Joe||19670903|M||||||||||30000051094

OBR|1||CHOIR1|CHOIR^Patient Reported Health Outcomes^GVCHOIR|||201503121015||||FINAL|||201503241503||22027661^^^^^^^^^^^^PROVID||||||201503241503|||F

PV1||||||||||||||||||30000051094

TXA|1|CHFM Clinic|CHOIR-PAIN|||201503241503

OBX|1|ED|^BASE64ENCODE||PDF^^^^JVBERi0x...<BASE64 ENCODED PDF FILE>...1MAolJUVPRgo=

Lab Results Message

MSH|^~\&|CHOIR|UF|EPIC|UF|201503241503||ORU^R01|201503241503300000510940|P|2.1

PID|1||44550695^^^^MR||Fraizer^Joe||19670903|M||||||||||30000051094

OBR|1||CHOIR1|CHOIR^Patient Reported Health Outcomes^GVCHOIR|||201503121015||||FINAL|||201503241503||22027661^^^^^^^^^^^^PROVID||||||201503241503|||F

OBX|1|NM|6001^Pain Intensity Least - PROMIS^GVCHOIRLRR||5||Moderate||||F|||201503121015

OBX|2|NM|5999^Pain Intensity Now - PROMIS^GVCHOIRLRR||7||Severe||||F|||201503121015

OBX|3|NM|5963^Pain Intensity Average - PROMIS^GVCHOIRLRR||2||Mild||||F|||201503121015

OBX|4|NM|6000^Pain Intensity Worst - PROMIS^GVCHOIRLRR||6||Moderate||||F|||201503121015

OBX|5|NM|5964^PROMIS Pain Interference Bank^GVCHOIRLRR||62||||||F|||201503121015

OBX|6|NM|5965^PROMIS Fatigue^GVCHOIRLRR||54||||||F|||201503121015

OBX|7|NM|5966^PROMIS Sleep Disturbance^GVCHOIRLRR||51||||||F|||201503121015

OBX|8|NM|5967^PROMIS Anxiety^GVCHOIRLRR||70||||||F|||201503121015

OBX|9|NM|5968^PROMIS Depression^GVCHOIRLRR||57||||||F|||201503121015

OBX|10|NM|5972^PROMIS Pain Behavior^GVCHOIRLRR||61||||||F|||201503121015

OBX|11|NM|5969^PROMIS Physical Function^GVCHOIRLRR||65||||||F|||201503121015

OBX|12|NM|5970^PROMIS Sleep-Related Impairment^GVCHOIRLRR||58||||||F|||201503121015

OBX|13|NM|5971^PROMIS Anger^GVCHOIRLRR||63||||||F|||201503121015

OBX|14|NM|5973^Pain Catastrophizing Scale^GVCHOIRLRR||25||||||F|||201503121015

OBX|15|NM|5974^Opioid Risk^GVCHOIRLRR||12||Severe||||F|||201503121015

OBX|16|NM|8525^PROMIS Pain Interference Bank^GVCHOIRLRR||88||||||F|||201503121015

OBX|17|NM|8527^PROMIS Fatigue^GVCHOIRLRR||66||||||F|||201503121015

OBX|18|NM|8528^PROMIS Sleep Disturbance^GVCHOIRLRR||54||||||F|||201503121015

OBX|19|NM|8530^PROMIS Anxiety^GVCHOIRLRR||98||||||F|||201503121015

OBX|20|NM|8531^PROMIS Depression^GVCHOIRLRR||76||||||F|||201503121015

OBX|21|NM|8526^PROMIS Pain Behavior^GVCHOIRLRR||86||||||F|||201503121015

OBX|22|NM|8533^PROMIS Physical Function^GVCHOIRLRR||93||||||F|||201503121015

OBX|23|NM|8529^PROMIS Sleep-Related Impairment^GVCHOIRLRR||79||||||F|||201503121015

OBX|24|NM|8532^PROMIS Anger^GVCHOIRLRR||90||||||F|||201503121015

## Code Changes

### Process Description

#### Lab Results

1. Using the information of which survey was competed, the **SurveyCompleteHandlerHl7** calls the constructor of the **EpicExportData**
2. The **EpicExportData** constructor pulls more data from the database to create the **EpicExportResult** objects to organize the data.
3. The **SurveyCompleteHandlerHl7**  provides the **EpicExportData** instance containing the complete data of the survey's questionnaires to the **HL7Generator**.
4. The **HL7Generator** uses the **HAPI** libraries to change the data within the **EpicExportData** instance into a formatted HL7 message within a String.
5. The **SurveyCompleteHandlerHl7**  then provides the string version of the message to the **HL7Sender** , which gets the remote connection and sends the message.

#### PDF Results

1. The **ReportUtils** processes the survey into a PDF and then calls the constructor of the **EpicExportData**
2. The **EpicExportData** constructor pulls more data from the database to create the **EpicExportResult** objects to organize the data.
3. The **ReportUtils** provides the **EpicExportData** instance containing the complete data of the survey's questionnaires along with a byte array of the PDF file to the **HL7Generator**.
4. The **HL7Generator** uses the **HAPI** libraries to change the data within the **EpicExportData** instance into a formatted HL7 message within a String.
5. The **ReportUtils** then provides the string version of the message to the **HL7Sender** which gets the remote connection and sends the message.

The files below are included within the repository

### HL7Sender

* Takes a String message sends it out according to the configuration using the HAPI libraries

### HL7Generator

* Generates the HL7Messages to be sent using the HL7Sender.
* Hl7Generator.generateHL7() takes in an EpicExportData instance and builds the message for that object.
* Hl7Generator.generateHL7PDF() takes in an EpicExportData instance and the BASE64 encoded PDF builds the PDF version of message.

### EpicExportData

* The constructor of this class accumulates the data for a participant's survey
* It creates and stores EpicExportResult instances for each of the Questionnaires taken.
* The data stored is used to create the OBRs within the HL7 message

### EpicExportResult

* Stores the Instance of the taking of a questionnaire
* It is processed to produce an OBX within the HL7 Message

### SurveyCompleteHandlerHl7

* This handler is triggered when a survey is complete.
* It begins and manages the process of sending a new HL7 message

### ReportUtils

* Added a section to process the Pdf version of the message
* It uses the encoded version of the Pdf file data within the message

### RegistryShortFormScoreProvider

* This class is included because it uses a HL7Generator method
* The method determines the rangeAndCategory of the Opioid Risk scores.