MEDICAL INTERNATIONAL RESEARCH

spiroCONNECT
HL7 interface

Ver. 2.6

(March 2020)

Contents

1. Introduction

This information is aimed at developers of medical software who wish to interface their product so that they can communicate, using HL7, with the MIR spiroConnect.

This document describes the functions supported by spiroConnect regarding the HL7 standard.

spiroConnect ver.2.6 supports HL7 version 2.x.

HL7 provides standards for inter-operability to improve care delivery, optimize workflow, reduce ambiguity and enhance knowledge transfer among all of our stakeholders, including healthcare providers, government agencies, the vendor community, fellow SDOs and patients.

The full standard specification is available from the Health Level Seven International (HL7) organization website (www.hl7.org), and it is assumed within this document that the reader either understands or has access to it.

WARNING:

2. Interface Properties

The spiroCONNECT HL7 interface implements and manage the exchanging of the following messages:

- Patient Demographics Request - Query by parameter
- Patient Demographics Answer - Find candidates segment response
- Outgoing Results Message – Unsolicited tx of an observation message

SpiroCONNECT support network Connection and transfer files exchange methods.

2.1 Network Connection

The interface is configured to work consuming a webservice in a Master/Slave database communication; it requires a reliable TCP/IP network connection between the Master database and spiroCONNECT.

Using this interface spiroCONNECT works in Slave-mode and it allows the user to query for a patient, by ID or Name. Consuming the webservice, if the patient has been found, spiroCONNECT gets patient data in HL7 format, from the Master database.

Patient data should be stored and updated always on the Master database; a copy of the received patient data it's used by spiroCONNECT just to allow the operator to perform diagnostic tests and send back the results.

The communication procedure is "on-demand": spiroCONNECT user search for patient data one by one.
The Master sends the patient data matching with the request and it is always ready to receive and store the test results sent from spiroCONNECT.

2.2 File Exchange

The interface is configurated to receive and send files in HL7 format in a Master/Slave database communication; it requires a shared input folder (Inbox) to receive Patient.HL7 file.

If Patient.HL7 file is present in **Inbox** folder SpiroCONNECT starts in slave mode ready to perform diagnostic test.

When spiroCONNECT stop working sends back results to **Outbox** shared folder saving SPIRO_xxxxx.HL7 file and .jpg curves images.

3. Interface Methods

3.1 Network Connection

Before using the spiroCONNECT HL7 interface, a webservice connected to the Master database must be implemented.
This new webservice must provide two different methods:

- CommunicateDemographicsData
- CommunicateResults

(see wsDemo Appendix 1 for more information about the webservice).

Then a copy of the `wsDemo.xml` file, updated with the new webservice address, must be saved in spiroCONNECT folder as `wsMaster.xml`.

3.2 Shared Folders

Patient.HL7 input file must be saved in the shared folder HL7/ Inbox of the spiroCONNECT application.

The results file is saved in the shared folder HL7/Outbox of the spiroCONNECT application.

(see Appendix 2 for more information on the shared folder method).

4. Interface Description

According to HL7 specifications spiroCONNECT HL7 interface accepts as separator the first character sent after MSH in the MSH mandatory segment.

The suggested separator characters are:

- | Field separator.
- ^ Component separator
- & Subcomponent separator
- ~ Field repeat separator
- \ Escape character

The following message segments are supported:

- MSH Message header
- QPD Query Parameter Definition
- MSA Message acknowledgement
- QAK Query acknowledgement
- RCP Response Control Parameter
- PID Patient information
- OBR Observation request
- OBX Observation result

5. MSH – Message Header

The MSH segment must be the first segment and it must set also MIRHL7INTERFACE as receiving Application. Each message can contain only one MSH segment.

The following fields are supported:

Sequence	Field	Required
MSH-1	Field Separator	YES
MSH-2	Encoding characters	YES
MSH-3	Sending application	YES
MSH-5	Receiving application	No
MSH-7	Message Date/Time (yyyymmddhhmmss)	YES
MSH-9	Message Type	YES
MSH-12	Version ID	YES
MSH-13	Sequence Number (constant)	YES

6. QPD – Query Parameter Definition

The following fields are supported:

Sequence	Field	Required
QPD-1	Message Query Name	YES
QPD-3	User Parameters @PID.5.1^[LastName]~@PID.5.2^[FirstName] @PID.3.5^[PatientID]	YES

7. MSA – Message acknowledgement

The following fields are supported:

Sequence	Field	Required
MSA-1	Acknowledge Status AA for ACK AE or AR for NAK	YES

8. QAK – Query acknowledgement

The following fields are supported:

Sequence	Field	Required
QAK-2	Query Response Status OK for record found NF for not found	YES

9. RCP – Response Control Parameter

The following fields are supported:

Sequence	Field	Required
RCP-1	Query priority (I)	YES

10. PID – Patient Identification

The following fields are supported:

Sequence	Field	Required
PID-3	Patient Identifier List (^^^^ID)	YES
PID-5	LastName^FirstName	YES
PID-7	Date of birth (YYYYMMDD)	YES
PID-8	Gender (M/F)	YES
*PID-19**	Patient Weight	No*
PID-22	Ethnic Group	YES
*PID-23**	Patient Height	No*

* If this information is missing the user will add it manually on spiroCONNECT.

About the PID-22 Ethnic Group field the following codes are supported:

ID	EthnicGroup
1	Caucasian
2	Oriental
3	Chinese
4	Japanese

5	Polynesian
6	North Indian
7	South Indian
8	Pakistan
9	African descent
10	Not defined
12	NHANESIII Caucasian
13	NHANESIII African-American
14	NHANESIII Mexican-American
15	NHANESIII Others
16	Aboriginal
17	NHANESIII Asian
18	GLI Caucasian
19	GLI African descendent
20	GLI Northeast Asian
21	GLI Southeast Asian
22	GLI Others

11. OBR – Observation Request Segment

The following fields are supported:

Sequence	Field	Required
OBR-4	Universal Service Identifier SPIRO_MIR SPIRO_MIR1 SPIRO_MIR2 SPIRO_MIR3 OXI_MIR	YES
OBR-14	Specimen Received Date yyyymmdd	YES

12. OBX – Observation Results Segment

The following fields are supported:

Sequence	Field	Required
OBX-1	Set ID observation	No
OBX-2	Value Type	No
OBX-3	Observation identifier	YES
OBX-5	Observation value	YES
OBX-6	Measure Unit	YES

13. Patient Demographics Request

Each demographic request message must contain at least the following segments:

- MSH
- QPD
- RCP

The MSH segment must specify encoding characters and MIRHL7INTERFACE as receiving application.

The QPD segment is required to search for the patient information.
This query accepts two alternative parameters: Patient ID or Patient Last name and name.

```
QPD|IHE Query|@PID.5.1^[LastName]~@PID.5.2^[FirstName]
QPD|IHE Query|@PID.3.5^[PatientID]
```

The RCP segment is used to set the query priority as Immediate.

14. Patient Demographics Answer

Each demographic answer message must contain at least the following segments:

- MSH
- MSA
- QAK
- PID

The MSH segment must specify encoding characters and MIRHL7INTERFACE as receiving application.

The MSA segment contains the Acknowledge Status

```
AA for ACK
AE or AR for NAK
```

The QAK segment contains the Query Response Status

```
OK for record found
NF for not found
```

The PID segment is required to receive the patient information such as name, gender, date of birth and ethnic group.

15. Outgoing Results Message

Each outgoing results message will contain the following segments:

- MSH
- PID
- OBR
- OBX

The OBR segment contains the identifier SPIRO_MIR or SPIRO_MIR1 or SPIRO_MIR2 or SPIRO_MIR3 and OXI_MIR and the session date and time.
Below the list of SPIROMETRY and OXIMETRY fields and values.

SPIROMETRY:

The OBX segment contains results PRE, POST and Predicted values for the main parameters measured:

FVC, FEV1, FEV1/FVC, FEF25-75%, PEFR, ELA, VEXT, FIVC, FEV1/VC

The following fields are supported:

Sequence	Field	Values
OBX-1	ID observation	(null) 1 2 3 4 5 6 7 8 9 10 11

		12 13 14 15 16 17
OBX-2	Value Type	NM
OBX-3	Observation identifier	H W Predicted FVC-PRE FVC-POST FVC-PRED FEV1-PRE FEV1-POST FEV1-PRED FEV1/FVC-PRE FEV1/FVC-POST FEV1/FVC-PRED FEF25-75%-PRE FEF25-75%-POST FEF25-75%-PRED PEFR-PRE PEFR-POST PEFR-PRED ELA-PRE ELA-POST ELA-PRED Vext-PRE Vext-POST

		Vext-PRED FIVC-PRE FIVC-POST FIVC-PRED FEV1/VC-PRE FEV1/VC-POST FEV1/VC-PRED QCR QCG SpiroInterpretation FET-PRE FET-POST FET-PRED EVC EVC-PRED IVC IVC-PRED VC VC-PRED
OBX-5	Observation value	#.#0 [pdf file path]
OBX-6	Measure Unit	cm Kg L L/s %

OBSERVATION QCR that contains the Quality Report Message transmits a string with four chars.

Each char is set at value 0 or 1.

0 value means "no message" with empty string
1 value corresponds at different message based on position in string.

5 base messages correspond to the following strings:

String	Base Message
0000	String empty (trial is acceptable*)
1000	Repeat test and start faster
0100	Repeat test without coughing
0010	Breathe out for a longer time
0001	Breathe out ALL air in the lungs

Messages could be mix in all combination allowed

Example:

QCR String	Message
1100	Repeat test and start faster, Repeat test without coughing
1010	Repeat test and start faster, Breathe out for a longer time

*Note: Combination 0000 with no message corresponds to **Acceptability Condition** of test.

OBSERVATION QCG transmits the Quality Control Grade of the session and contains one of the following letters:

Letter	Quality Maneuver

A	At least two acceptable () maneuvers, with the largest two FEV1 values matching within 100 mL and the largest two FEV6 values matching better 100 mL.
B	At least two acceptable (1) maneuvers, with FEV1 values matching between 101 and 150 mL.
C	At least two acceptable (1) maneuvers, with FEV1 values matching between 151 and 200 mL.
D	Only one acceptable (1) maneuver,or more than one, but the FEV1 values match >200 mL (with no interpretation).
F	No acceptable (*) maneuvers (with no interpretation).

SpiroInterpretation contains the Automatics Interpretation that transmits a numeric chart corresponding the following diagnosis string:

Code	**Result Interpretation**
0	Normal Spirometry
1	Mild Restriction
2	Moderate Restriction
3	Moderately Severe Restriction
4	Severe Restriction
5	Very Severe Restriction
6	Mild Obstruction
7	Moderate Obstruction
8	Moderately Severe Obstruction
9	Severe Obstruction
10	Very Severe Obstruction
11	Obstruction And Possible Restriction
12	Not Available

OXIMETRY:

The OBX segment contains results for the main parameters measured:

SpO2 min, SpO2 avg, SpO2 Max, BPM min, BPM avg, BPM Max, T90, T89, T5, T40, T120 and Delta Index.

The following fields are supported:

Sequence	Field	Values
OBX-1	ID observation	(null) 1 2 3 4 5 6 7 8 9 10
OBX-2	Value Type	NM
OBX-3	Observation identifier	H W RECTIME SPO2-MIN SPO2-AVG SPO2-MAX BPM-MIN BPM-AVG BPM-MAX T90-TIME T89-TIME

		T5-TIME T40-TIME T120-TIME DeltaIndex
OBX-5	Observation value	#.#0 [hhmmss]
OBX-6	Measure Unit	cm Kg hhmmss % BPM Index

Appendix 1

wsDemo webservice

The following operations are supported:

- CommunicateDemographicsData
- CommunicateDemographicsDatawithClientCode
- CommunicateResults
- CommunicateResultswithCode

For a formal definition, please review the Service Description below.

```
<?xml version="1.0" encoding="utf-8"?>
<wsdl:definitions xmlns:tm="http://microsoft.com/wsdl/mime/textMatching/"
xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/"
xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/"
xmlns:tns="http://tempuri.org/"
xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
xmlns:s="http://www.w3.org/2001/XMLSchema"
xmlns:soap12="http://schemas.xmlsoap.org/wsdl/soap12/"
xmlns:http="http://schemas.xmlsoap.org/wsdl/http/"
targetNamespace="http://tempuri.org/"
xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/">
  <wsdl:types>
    <s:schema elementFormDefault="qualified"
targetNamespace="http://tempuri.org/">
      <s:element name="CommunicateDemographicsData">
        <s:complexType>
          <s:sequence>
            <s:element minOccurs="0" maxOccurs="1" name="HL7request"
type="s:string" />
          </s:sequence>
        </s:complexType>
      </s:element>
     <s:element name="CommunicateDemographicsDatawithClientCode">
        <s:complexType>
          <s:sequence>
            <s:element minOccurs="0" maxOccurs="1" name="HL7request"
type="s:string" />
            <s:element minOccurs="0" maxOccurs="1" name="ClientCode"
type="s:string" />
          </s:sequence>
        </s:complexType>
      </s:element>
```

```
      <s:element name="CommunicateDemographicsDataResponse">
        <s:complexType>
          <s:sequence>
            <s:element minOccurs="0" maxOccurs="1"
name="CommunicateDemographicsDataResult" type="s:string" />
          </s:sequence>
        </s:complexType>
      </s:element>
      <s:element
name="CommunicateDemographicsDatawithClientCodeResponse">
        <s:complexType>
          <s:sequence>
            <s:element minOccurs="0" maxOccurs="1"
name="CommunicateDemographicsDatawithClientCodeResult" type="s:string" />
          </s:sequence>
        </s:complexType>
      </s:element>
      <s:element name="CommunicateResults">
        <s:complexType>
          <s:sequence>
            <s:element minOccurs="0" maxOccurs="1" name="HL7results"
type="s:string" />
            <s:element minOccurs="0" maxOccurs="1" name="GraphFileName"
type="s:string" />
            <s:element minOccurs="0" maxOccurs="1" name="GraphFile"
type="s:string" />
          </s:sequence>
        </s:complexType>
      </s:element>
      <s:element name="CommunicateResultsResponse">
        <s:complexType>
          <s:sequence>
            <s:element minOccurs="0" maxOccurs="1"
name="CommunicateResultsResult" type="s:string" />
          </s:sequence>
        </s:complexType>
      </s:element>
     <s:element name="CommunicateResultswithCode">
        <s:complexType>
          <s:sequence>
            <s:element minOccurs="0" maxOccurs="1" name="HL7results"
type="s:string" />
            <s:element minOccurs="0" maxOccurs="1" name="GraphFileName"
type="s:string" />
            <s:element minOccurs="0" maxOccurs="1" name="GraphFile"
type="s:string" />
            <s:element minOccurs="0" maxOccurs="1" name="ClientCode"
type="s:string" />
```

```
        </s:sequence>
       </s:complexType>
      </s:element>
      <s:element name="CommunicateResultswithCodeResponse">
       <s:complexType>
        <s:sequence>
         <s:element minOccurs="0" maxOccurs="1"
name="CommunicateResultswithCodeResult" type="s:string" />
        </s:sequence>
       </s:complexType>
      </s:element>
    </s:schema>
  </wsdl:types>
  <wsdl:message name="CommunicateDemographicsDataSoapIn">
    <wsdl:part name="parameters"
element="tns:CommunicateDemographicsData" />
  </wsdl:message>
  <wsdl:message name="CommunicateDemographicsDataSoapOut">
    <wsdl:part name="parameters"
element="tns:CommunicateDemographicsDataResponse" />
  </wsdl:message>
 <wsdl:message
name="CommunicateDemographicsDatawithClientCodeSoapIn">
    <wsdl:part name="parameters"
element="tns:CommunicateDemographicsDatawithClientCode" />
  </wsdl:message>
  <wsdl:message
name="CommunicateDemographicsDatawithClientCodeSoapOut">
    <wsdl:part name="parameters"
element="tns:CommunicateDemographicsDatawithClientCodeResponse" />
  </wsdl:message>
  <wsdl:message name="CommunicateResultsSoapIn">
    <wsdl:part name="parameters" element="tns:CommunicateResults" />
  </wsdl:message>
  <wsdl:message name="CommunicateResultsSoapOut">
    <wsdl:part name="parameters" element="tns:CommunicateResultsResponse"
/>
  </wsdl:message>
  <wsdl:message name="CommunicateResultswithCodeSoapIn">
    <wsdl:part name="parameters" element="tns:CommunicateResultswithCode"
/>
  </wsdl:message>
  <wsdl:message name="CommunicateResultswithCodeSoapOut">
    <wsdl:part name="parameters"
element="tns:CommunicateResultswithCodeResponse" />
  </wsdl:message>
  <wsdl:portType name="ServiceSoap">
    <wsdl:operation name="CommunicateDemographicsData">
```

```
      <wsdl:input message="tns:CommunicateDemographicsDataSoapIn" />
      <wsdl:output message="tns:CommunicateDemographicsDataSoapOut" />
    </wsdl:operation>
    <wsdl:operation name="CommunicateDemographicsDatawithClientCode">
      <wsdl:input
message="tns:CommunicateDemographicsDatawithClientCodeSoapIn" />
      <wsdl:output
message="tns:CommunicateDemographicsDatawithClientCodeSoapOut" />
    </wsdl:operation>
    <wsdl:operation name="CommunicateResults">
      <wsdl:input message="tns:CommunicateResultsSoapIn" />
      <wsdl:output message="tns:CommunicateResultsSoapOut" />
    </wsdl:operation>
     <wsdl:operation name="CommunicateResultswithCode">
      <wsdl:input message="tns:CommunicateResultswithCodeSoapIn" />
      <wsdl:output message="tns:CommunicateResultswithCodeSoapOut" />
    </wsdl:operation>
    </wsdl:portType>
  <wsdl:binding name="ServiceSoap" type="tns:ServiceSoap">
    <soap:binding transport="http://schemas.xmlsoap.org/soap/http" />
    <wsdl:operation name="CommunicateDemographicsData">
      <soap:operation
soapAction="http://tempuri.org/CommunicateDemographicsData"
style="document" />
      <wsdl:input>
        <soap:body use="literal" />
      </wsdl:input>
      <wsdl:output>
        <soap:body use="literal" />
      </wsdl:output>
    </wsdl:operation>
 <wsdl:operation name="CommunicateDemographicsDatawithClientCode">
      <soap:operation
soapAction="http://tempuri.org/CommunicateDemographicsDatawithClientCode"
style="document" />
      <wsdl:input>
        <soap:body use="literal" />
      </wsdl:input>
      <wsdl:output>
        <soap:body use="literal" />
      </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="CommunicateResults">
      <soap:operation soapAction="http://tempuri.org/CommunicateResults"
style="document" />
      <wsdl:input>
        <soap:body use="literal" />
      </wsdl:input>
```

```
      <wsdl:output>
        <soap:body use="literal" />
      </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="CommunicateResultswithCode">
      <soap:operation
soapAction="http://tempuri.org/CommunicateResultswithCode"
style="document" />
      <wsdl:input>
        <soap:body use="literal" />
      </wsdl:input>
      <wsdl:output>
        <soap:body use="literal" />
      </wsdl:output>
    </wsdl:operation>
  </wsdl:binding>
  <wsdl:binding name="ServiceSoap12" type="tns:ServiceSoap">
    <soap12:binding transport="http://schemas.xmlsoap.org/soap/http" />
    <wsdl:operation name="CommunicateDemographicsData">
      <soap12:operation
soapAction="http://tempuri.org/CommunicateDemographicsData"
style="document" />
      <wsdl:input>
        <soap12:body use="literal" />
      </wsdl:input>
      <wsdl:output>
        <soap12:body use="literal" />
      </wsdl:output>
    </wsdl:operation>
   <wsdl:operation name="CommunicateDemographicsDatawithClientCode">
      <soap12:operation
soapAction="http://tempuri.org/CommunicateDemographicsDatawithClientCode"
style="document" />
      <wsdl:input>
        <soap12:body use="literal" />
      </wsdl:input>
      <wsdl:output>
        <soap12:body use="literal" />
      </wsdl:output>
    </wsdl:operation>
    <wsdl:operation name="CommunicateResults">
      <soap12:operation soapAction="http://tempuri.org/CommunicateResults"
style="document" />
      <wsdl:input>
        <soap12:body use="literal" />
      </wsdl:input>
      <wsdl:output>
        <soap12:body use="literal" />
```

```
      </wsdl:output>
    </wsdl:operation>
     <wsdl:operation name="CommunicateResultswithCode">
      <soap12:operation
soapAction="http://tempuri.org/CommunicateResultswithCode"
style="document" />
      <wsdl:input>
        <soap12:body use="literal" />
      </wsdl:input>
      <wsdl:output>
        <soap12:body use="literal" />
      </wsdl:output>
    </wsdl:operation>
  </wsdl:binding>
  <wsdl:service name="Service">
    <wsdl:port name="ServiceSoap" binding="tns:ServiceSoap">
      <soap:address
location="https://www.spirometry.com/ws_spiroconnect/demoWS.asmx" />
    </wsdl:port>
    <wsdl:port name="ServiceSoap12" binding="tns:ServiceSoap12">
      <soap12:address
location="https://www.spirometry.com/ws_spiroconnect/demoWS.asmx" />
    </wsdl:port>
  </wsdl:service>
</wsdl:definitions>
```

Examples

Listed below are the possible examples of transmission and reception.

spiroConnect asks for patient data to webservice

searching for last name and name

```
MSH|^~\&|MIRHL7INTERFACE||||201308161051||QBP^Q22^QBP_Q21|||2.5|123
QPD|IHE PDQ Query||@PID.5.1^MARTINI~@PID.5.2^DAVID
RCP|I
```

searching for patient ID

```
MSH|^~\&|MIRHL7INTERFACE||||201308161054||QBP^Q22^QBP_Q21|||2.5|123
QPD|IHE PDQ Query||@PID.3.5^MRTDVD75E06H601X
RCP|I
```

spiroCONNECT gets patient data from webservice

```
MSH|^~\&|MIRHL7INTERFACE||||20130529110237||RSP^K22^RSP_K22|||2.5|123
MSA|AA
```

```
QAK||OK
PID|||^^^^MRTDVD75E06H601X||MARTINI^DAVID||19750605|M||||||||||78|||1|180
```

spiroCONNECT sends test results to webservice

SPIROMETRY

MSH|^~\&|MIRHL7INTERFACE||||201705311300||ORU^R01^ORU_R01|||2.5|12
3
PID|||^^^^RSSMRA80P23H501F||||||||||||||||||15
OBR||||SPIRO_MIR||||||||||20170531
OBX|1|NM|H||174|CM
OBX|1|NM|W||67|KG
OBX|2|NM|FVC-PRE||3.62|L
OBX|2|NM|FVC-POST||0|L
OBX|2|NM|FVC-PRED||5.13|L
OBX|3|NM|FEV1-PRE||1.95|L
OBX|3|NM|FEV1-POST||0|L
OBX|3|NM|FEV1-PRED||4.13|L
OBX|4|NM|FEV1/FVC-PRE||53.9|%
OBX|4|NM|FEV1/FVC-POST||0|%
OBX|4|NM|FEV1/FVC-PRED||80.63|%
OBX|5|NM|FEF25-75%-PRE||1.65|L/s
OBX|5|NM|FEF25-75%-POST||0|L/s
OBX|5|NM|FEF25-75%-PRED||4.03|L/s
OBX|6|NM|PEFR-PRE||3.21|L/s
OBX|6|NM|PEFR-POST||0|L/s
OBX|6|NM|PEFR-PRED||9.9|L/s
OBX|7|NM|ELA-PRE||97|Years
OBX|7|NM|ELA-POST||0|Years
OBX|7|NM|ELA-PRED||36|Years
OBX|8|NM|Vext-PRE||60|%
OBX|8|NM|Vext-POST||0|%
OBX|8|NM|Vext-PRED||0|%
OBX|9|NM|FIVC-PRE||0|L
OBX|9|NM|FIVC-POST||0|L
OBX|9|NM|FIVC-PRED||5.13|L
OBX|10|NM|FEV1/VC-PRE||0|%
OBX|10|NM|FEV1/VC-POST||0|%
OBX|10|NM|FEV1/VC-PRED||80.63|%
OBX|11|NM|QCR||0010|
OBX|12|NM|QCG||F|
OBR|1|||SPIRO_MIR1||||||||||20170531
OBX|2|NM|FVC-PRE||3.62|L
OBX|3|NM|FEV1-PRE||1.95|L
OBX|4|NM|FEV1/FVC-PRE||53.9|%

OBX|5|NM|FEF25-75%-PRE||1.65|L/s
OBX|6|NM|PEFR-PRE||2.48|L/s
OBX|7|NM|ELA-PRE||97|Years
OBX|8|NM|Vext-PRE||60|%
OBX|9|NM|FIVC-PRE||0|L
OBX|10|NM|FEV1/VC-PRE||0|%
OBX|11|NM|QCR||0010|
OBR|2|||SPIRO_MIR2|||||||||20170531
OBX|2|NM|FVC-PRE||1.66|L
OBX|3|NM|FEV1-PRE||1.66|L
OBX|4|NM|FEV1/FVC-PRE||100|%
OBX|5|NM|FEF25-75%-PRE||2.51|L/s
OBX|6|NM|PEFR-PRE||2.64|L/s
OBX|7|NM|ELA-PRE||103|Years
OBX|8|NM|Vext-PRE||140|%
OBX|9|NM|FIVC-PRE||0|L
OBX|10|NM|FEV1/VC-PRE||0|%
OBX|11|NM|QCR||1011|
OBR|3|||SPIRO_MIR3|||||||||20170531
OBX|2|NM|FVC-PRE||0.66|L
OBX|3|NM|FEV1-PRE||0.66|L
OBX|4|NM|FEV1/FVC-PRE||100|%
OBX|5|NM|FEF25-75%-PRE||3|L/s
OBX|6|NM|PEFR-PRE||3.21|L/s
OBX|7|NM|ELA-PRE||122|Years
OBX|8|NM|Vext-PRE||50|%
OBX|9|NM|FIVC-PRE||0.52|L
OBX|10|NM|FEV1/VC-PRE||0|%
OBX|11|NM|QCR||0011|

The image in jpg format of the graph is sent together with HL7 results using the web-method CommunicateResults.

OXIMETRY

MSH|^~\&|MIRHL7INTERFACE||||201307181549||ORU^R01^ORU_R01|||2.5|12
3
PID|||^^^^MRTDVD75E06H601X||||||||||||||||||1
OBR||||OXI_MIR|||||||||20130718
OBX|1|NM|H||180|CM
OBX|1|NM|W||78|KG
OBX|2|NM|RECTIME||000018|hhmmss
OBX|3|NM|SPO2-MIN||98|%
OBX|3|NM|SPO2-AVG||98|%

OBX|3|NM|SPO2-MAX||98|%
OBX|4|NM|BPM-MIN||61|BPM
OBX|4|NM|BPM-AVG||67.2|BPM
OBX|4|NM|BPM-MAX||73|BPM
OBX|5|NM|T90-TIME|||hhmmss
OBX|6|NM|T89-TIME||000000|hhmmss
OBX|7|NM|T5-TIME||000000|hhmmss
OBX|8|NM|T40-TIME||000000|hhmmss
OBX|9|NM|T120-TIME||000000|hhmmss
OBX|10|NM|DeltaIndex||0|Index

The image in jpg format of the graph is sent together with HL7 results using the web-method CommunicateResults.

Appendix 2

Input Patient.HL7 file example:

MSH|^~\&|MIRHL7INTERFACE||||20130529110237||RSP^K22^RSP_K22|||2.5|
123
MSA|AA
QAK||OK
PID|||^^^^**MRTDVD75E06H601**X||MARTINI^DAVID||19750605|M||||||||||7
8|||1|180

Output SPIRO_**MRTDVD75E06H601**1.HL7 file contain:

- Best FVC e VC values in Observation SPIRO_MIR;
- Last 3 best FVC e VC tests in observation SPIRO_MIR1, SPIRO_MIR2 and OBR|1|||SPIRO_MIR3

Example:

MSH|^~\&|MIRHL7INTERFACE||||202003261449||ORU^R01^ORU_R01|||2.5|12
3
PID|||^^^^MRTDVD75E06H601X||||||||||||||||||15
OBR||||SPIRO_MIR||||||||||20200326
OBX|1|TX|Predicted||NHANES III|

OBX|1|NM|H||180|CM
OBX|1|NM|W||78|KG
OBX|2|NM|FVC-PRE||2.46|L
OBX|2|NM|FVC-POST||0|L
OBX|2|NM|FVC-PRED||5.35|L
OBX|3|NM|FEV1-PRE||2.46|L
OBX|3|NM|FEV1-POST||0|L
OBX|3|NM|FEV1-PRED||4.22|L
OBX|4|NM|FEV1/FVC-PRE||100|%
OBX|4|NM|FEV1/FVC-POST||0|%
OBX|4|NM|FEV1/FVC-PRED||78.98|%
OBX|5|NM|FEF25-75%-PRE||0.59|L/s
OBX|5|NM|FEF25-75%-POST||0|L/s
OBX|5|NM|FEF25-75%-PRED||3.85|L/s
OBX|6|NM|PEFR-PRE||9.23|L/s
OBX|6|NM|PEFR-POST||0|L/s
OBX|6|NM|PEFR-PRED||10.26|L/s
OBX|7|NM|ELA-PRE||92|Years
OBX|7|NM|ELA-POST||0|Years
OBX|7|NM|ELA-PRED||44|Years
OBX|8|NM|Vext-PRE||977|mL
OBX|8|NM|Vext-POST||0|mL
OBX|8|NM|Vext-PRED||0|mL
OBX|9|NM|FIVC-PRE||0|L
OBX|9|NM|FIVC-POST||0|L
OBX|9|NM|FIVC-PRED||5.35|L
OBX|10|NM|FEV1/VC-PRE||31.06|%
OBX|10|NM|FEV1/VC-POST||0|%
OBX|10|NM|FEV1/VC-PRED||78.98|%
OBX|12|NM|QCG||F|
OBX|13|NM|SpiroInterpretation||3|
OBX|14|NM|FET-PRE||0.38|L
OBX|14|NM|FET-POST||0|L
OBX|14|NM|FET-PRED||6|L
OBX|15|NM|EVC||7.92|L
OBX|15|NM|EVC-PRED||5.35|L
OBX|16|NM|IVC||0|L
OBX|16|NM|IVC-PRED||5.35|L
OBX|17|NM|VC||7.92|L
OBX|17|NM|VC-PRED||5.35|L
OBR|1|||SPIRO_MIR1|||||||||20200326
OBX|2|NM|FVC-PRE||2.46|L
OBX|3|NM|FEV1-PRE||2.46|L
OBX|4|NM|FEV1/FVC-PRE||100|%
OBX|5|NM|FEF25-75%-PRE||0.59|L/s
OBX|6|NM|PEFR-PRE||9.23|L/s
OBX|7|NM|ELA-PRE||92|Years
OBX|8|NM|Vext-PRE||977|mL

OBX|9|NM|FIVC-PRE||0|L
OBX|10|NM|FEV1/VC-PRE||31.06|%
OBX|11|NM|QCR||1011|
OBX|14|NM|FET-PRE|||L
OBX|15|NM|EVC-PRE||7,92|L
OBX|16|NM|IVC-PRE||0|L
OBX|17|NM|VC-PRE||7,92|L
OBR|2|||SPIRO_MIR2||||||||||20200326
OBX|2|NM|FVC-PRE||2.07|L
OBX|3|NM|FEV1-PRE||2.07|L
OBX|4|NM|FEV1/FVC-PRE||100|%
OBX|5|NM|FEF25-75%-PRE||6.64|L/s
OBX|6|NM|PEFR-PRE||7.39|L/s
OBX|7|NM|ELA-PRE||101|Years
OBX|8|NM|Vext-PRE||197|mL
OBX|9|NM|FIVC-PRE||1.97|L
OBX|10|NM|FEV1/VC-PRE||26.14|%
OBX|11|NM|QCR||1011|
OBX|14|NM|FET-PRE|||L
OBX|15|NM|EVC-PRE||6,89|L
OBX|16|NM|IVC-PRE||0|L
OBX|17|NM|VC-PRE||6,89|L
OBR|3|||SPIRO_MIR3||||||||||20200326
OBX|2|NM|FVC-PRE||1.48|L
OBX|3|NM|FEV1-PRE||1.48|L
OBX|4|NM|FEV1/FVC-PRE||100|%
OBX|5|NM|FEF25-75%-PRE||7.01|L/s
OBX|6|NM|PEFR-PRE||7.95|L/s
OBX|7|NM|ELA-PRE||112|Years
OBX|8|NM|Vext-PRE||220|mL
OBX|9|NM|FIVC-PRE||1.58|L
OBX|10|NM|FEV1/VC-PRE||18.69|%
OBX|11|NM|QCR||1011|
OBX|14|NM|FET-PRE|||L
OBX|15|NM|EVC-PRE||4,45|L
OBX|16|NM|IVC-PRE||0|L
OBX|17|NM|VC-PRE||4,45|L