DoseWatch
HL7 Interface Specification
For DoseWatch version 3.3 software

CE

DOC2609819
Revision 3 (30-Aug-2022)

Revision History

Revision	Date	Reason for Change
1	17-Sep-2021	Initial release
2	22-Feb-2022	Add TLS support
3	30-Aug-2022	Add PDQ, PDQm and RDS support

Table of Contents

1 Document Information

1.1 Purpose

This document describes the purpose, message content and behavior of DoseWatch HL7 interface. It is provided to customers or 3rd party system vendors whenever an HL7 dataflow between DoseWatch and another system is to be implemented.

Reader is assumed to have basic knowledge of HL7 standard and IHE PIR and SWF profiles and transactions.

This version of the specifications applies to DoseWatch 3.3 release.

1.2 External references

[1] IHE Radiology Technical Framework, Revision 19.0, June 17, 2022 – Final Text

[2] IHE IT Infrastructure Technical Framework, Revision 20.0, March 10, 2022 – Final Text

[3] IHE Patient Demographics Query for mobile (PDQm) Trial Implementation, 2.4.0, 2022-02-28

[4] IHE Patient Identifier Cross-referencing for mobile (PIXm) Trial Implementation, 3.0.2, 2022-02-08

[5] HL7 Messaging standard, version 2.5.1, February 21st, 2007

[6] HL7 Messaging standard, version 2.3.1, April 14th, 1999

[7] HL7 Radiation Dose Summary for Diagnostic Procedures on FHIR Implementation Guide, 0.1.0, 2021-12-08

1.3 Symbols and abbreviations

ACK	Acknowledgment Message
ADT	Admit Discharge Transfer
CVIS	CardioVascular Information System
DICOM	Digital Imaging and COmmunications in Medicine
EVN	Event Type Segment
FHIR	Fast Healthcare Interoperability Resources
HIS	Hospital Information System
HL7	Health Level Seven
MPI	Master Patient Index
MSA	Message Acknowledgment Segment
MRG	Merge Patient Information Segment
OBR	Observation Request
OBX	Observation Segment
ORM	Order Message
ORU	Observation Result

PACS	Picture Archiving and Communication System
PAS	Patient Administration System
PDQ	Patient Demographic Query
PDS	Patient Demographic Supplier
PIX	Patient Identification Cross Referencing
PV1	Patient Visit Information
RIS	Radiology Information System
ZDS	Segment that handle Study Instance UID

2 Introduction

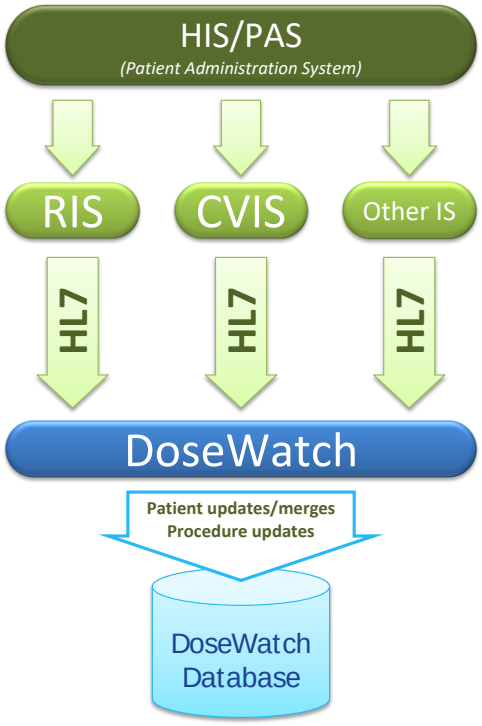
As an inform action system, DoseWatch features an HL7 interface to integrate within the customer's information systems ecosystem. DoseWatch HL7 interfacing supports both inbound and outbound interfacing.

The **inbound HL7 interface** is used for the following functions:

- Apply patient demographics updates to DoseWatch database (based on HL7 ADT messages).
- Apply examination updates after the examination is performed (based on HL7 ORM messages). This would typically be when the procedure performed was updated in the RIS/CVIS after the study was completed, updating the weight and size of the patient, etc.

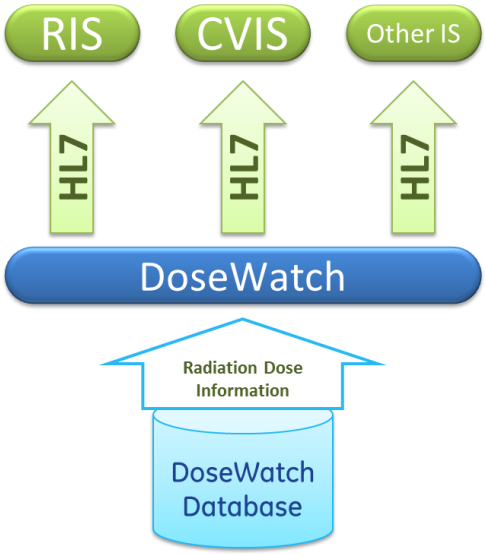
When needed, DoseWatch can receive HL7 messages from different information systems, e.g., RIS, CVIS or others.

For the sake of performances and message flow management, it is preferred that these systems will not forward to DoseWatch all messages received from HIS/PAS, but only those messages related to patients they managed and have medical imaging examinations.



The **outbound HL7 interface** allows DoseWatch to share radiation dose information with other information systems.

Since the HL7 standard does not specify messages to convey the radiation dose, the detailed message content proposed here-after may need some adaptation after discussion with the addressee information system integration specialist.



By default, DoseWatch HL7 implementation follows the IHE Radiology Technical Framework for the related transactions and message content.

The DoseWatch HL7 Interface is flexible and may be configured to some extend to adapt to specific requirements of the third-party system's HL7 implementation.

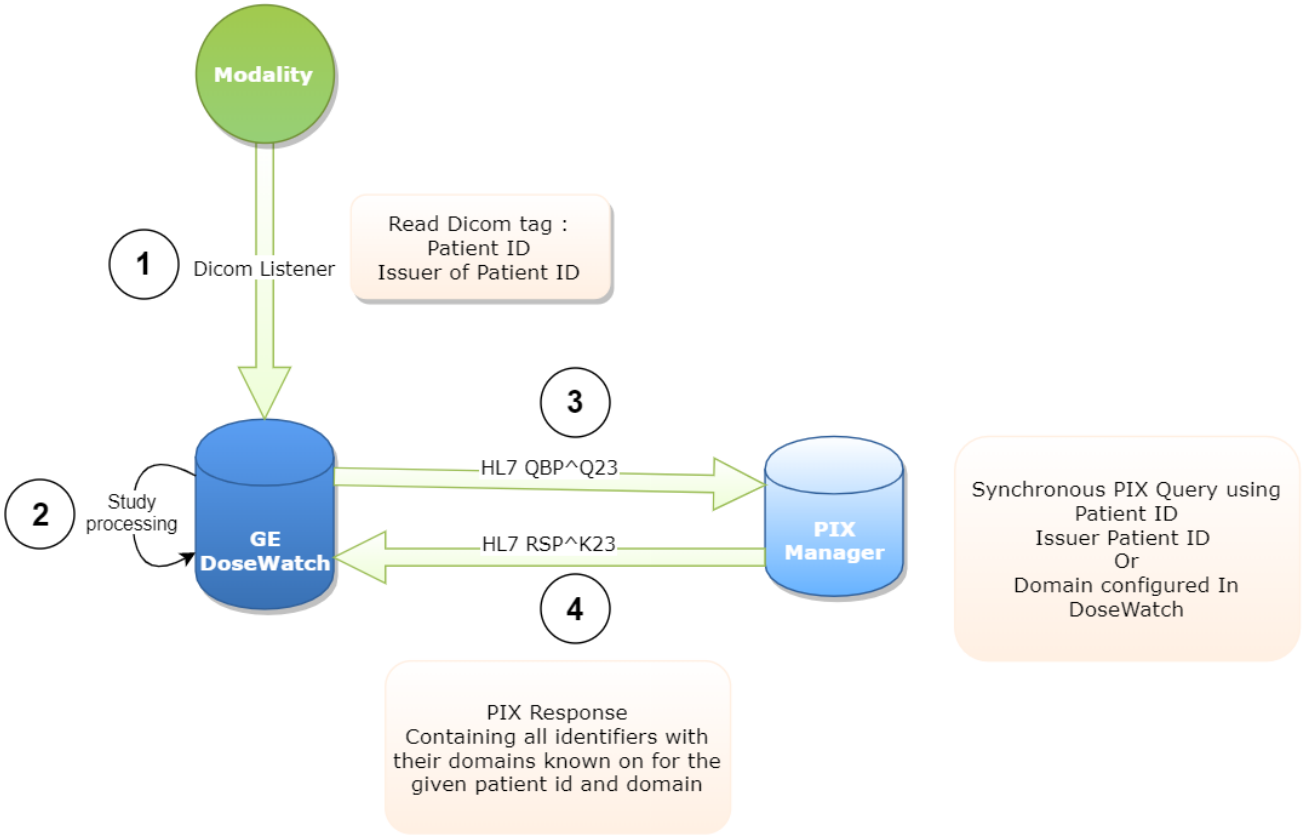
DoseWatch outbound HL7 interface has been validated with different modality and information systems vendors during IHE Connectathons:

- 2012 (Bern, Switzerland)
- 2014 (Vienna, Austria)
- 2015 (Luxembourg, Luxembourg)
- 2016 (Bochum, Germany)
- 2017 (Cleveland, USA, and Venice, Italy)
- 2018 (Den Haag, Netherlands)
- 2019 (Rennes, France)
- 2020 (Cleveland, USA)
- 2021 (Online event, EU)

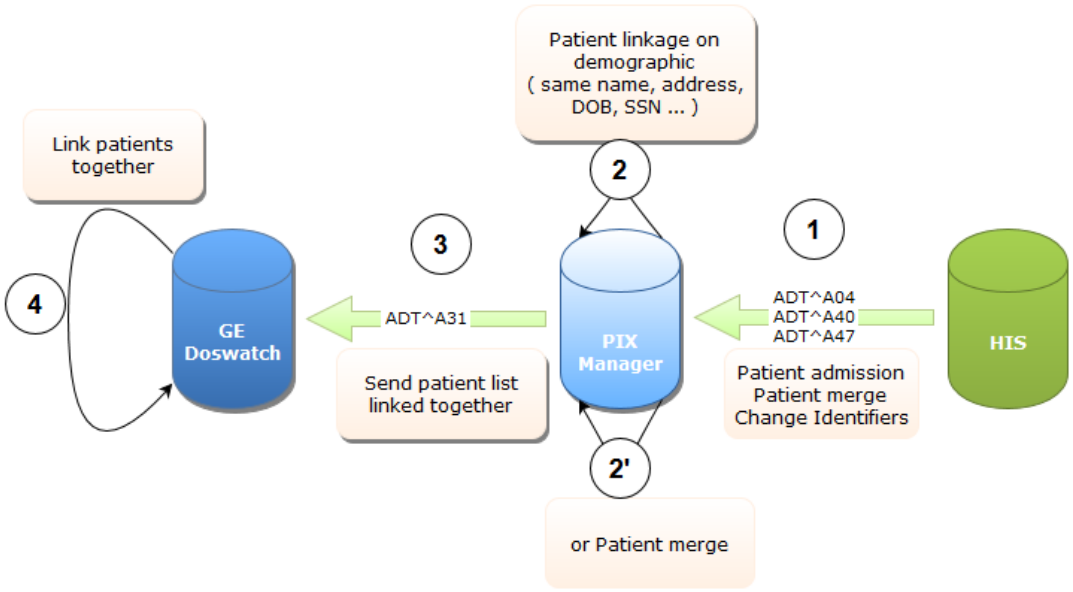
The **Patient Identifier Cross-referencing (PIX) interface** allows DoseWatch to link/unlink multiple patient identifiers from different patient identification domains so that a unified patient dose record can be presented to DoseWatch users.

The PIX interface work with two types of messages:

- Synchronous messages with QBP^Q23 query (IHE ITI-9: PIX Query)



- Asynchronous messages with ADT^A31 (IHE ITI-10: PIX Update notification)



DoseWatch PIX interface has been validated with different modalities and information systems vendors during IHE Connectathons:

- 2014 (Vienna, Austria)
- 2015 (Luxembourg, Luxembourg)
- 2016 (Bochum, Germany)
- 2017 (Cleveland, USA, and Venice, Italy)
- 2018 (Den Haag, Netherlands)
- 2019 (Rennes, France)
- 2020 (Cleveland, USA)
- 2021 (Online event, EU)

2.1 How to read the Segment tables

The HL7 Segment tables provided in this document reproduce the IHE Radiology Technical Framework and Infrastructure Technical Framework transactions of interest for DoseWatch.

The reader should refer to this framework if more information is needed about the interpretation of the LEN, DT and OPT columns.

For example, the OPT column IS NOT the optionality from DoseWatch perspective. The HL7 fields used by DoseWatch are indicated in the Comments column of the Segment tables.

Any deviation from the message specifications of this document must be reviewed with DoseWatch system integration specialist.

3 Inbound messages for Patient/Procedure updates

Here are all messages supported in DoseWatch for inbound messages:

Message Name	HL7 name	DoseWatch Default Behavior	Section
ADT^A01	Admit/Visit Notification	De-activated – Create command	ADT^A01 message specification
ADT^A08	Update Patient Information	Update Command	ADT^A08 message specification
ADT^A28	Add Person or Update Information	Update Command Create Command optionally	ADT^A28 Message Specification
ADT^A31	Update Person Information	Update Command	ADT^A31 Message Specification
ADT^A40	Merge Patient – Patient Identifier List	Merge Command	ADT^A40 Message Specification
ADT^A47	Change Patient Identifier List	Update Command	ADT^A47 Message Specification
ORM^O01	General Order Message	Update Command	ORM^O01 Message Specification
ORU^R01	Observation Result	Update Command	ORM^O01 Message Specification

Messages supported in DoseWatch

The create command is a specific command in DoseWatch which is de-activated by default; it creates a new patient. DoseWatch is not intended to create patients with HL7 messages but when a DICOM object representing a Study is received.

The update command will update an existing patient or study in DoseWatch. If the patient or study doesn't exist no action is done in DoseWatch.

The merge command will merge the patient contained in the segment MRG with all its studies into the patient contained in the PID segment.

3.1 Common Segments

This section describes the content of the HL7 Segments used within supported messages, including how segment elements and element components are mapped into DoseWatch database.

3.1.1 MSH Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	1	ST	R	Field Separator	
2	4	ST	R	Encoding Characters	
3	180	HD	O	Sending Application	
4	180	HD	O	Sending Facility	
5	180	HD	O	Receiving Application	
6	180	HD	O	Receiving Facility	
7	26	TS	R	Date/Time of Message	
8	40	ST	O	Security	
9	7	CM	R	Message Type	Message type retrieved from MSH-9.2 For Patient Update: • "ADT^A08", or • "ADT^A08^ADT_A08" For Patient Merge: • "ADT^A40", or • "ADT^A40^ADT_A39" For Procedure Update: • "ORM^O01"
10	20	ST	R	Message Control ID	The message Control ID is read in PIX QBP query
11	3	PT	R	Processing ID	
12	60	VID	R	Version ID	
13	15	NM	O	Sequence Number	
14	180	ST	O	Continuation Pointer	
15	2	ID	O	Accept Acknowledgment Type	
16	2	ID	O	Application Acknowledgment Type	
17	2	ID	O	Country Code	
18	16	ID	C	Character Set	
19	60	CE	O	Principal Language of Message	
20	20	ID	O	Alternate Character Set Handling Scheme	

Field MSH-18 Character Set shall only be valued if the message utilizes character sets other than ISO IR-6, also known as ASCII.

3.1.2 MSA Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	2	ID	R	Acknowledgment Code	Not stored.
2	20	ST	R	Message Control ID	Not stored.
3	80	ST	O	Text Message	Not stored.
4	15	NM	O	Expected Sequence Number	Not stored.
5	1	ID	O	Delayed Acknowledgment Type	Not stored.
6	100	CE	O	Error Condition	Not stored.

Field MSA-2 Message Control ID shall contain the Message ID from the MSH-10 Message Control ID of the incoming message for which this acknowledgement is sent.

3.1.3 EVN Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	3	ID	O	Event Type Code	Not stored.
2	26	TS	R	Recorded Date/Time	Not stored.
3	26	TS	O	Date/Time Planned Event	Not stored.
4	3	IS	O	Event Reason Code	Not stored.
5	60	XCN	O	Operator ID	Not stored.
6	26	TS	R2	Event Occurred	Not stored.

Field EVN-1 Event Type Code is optional; however, if present, its value shall be equal to the second component of the field MSH-9 Message Type.

3.1.4 PID Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	4	SI	O	Set ID – Patient ID	Not stored.
2	20	CX	O	Patient ID	
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1.1. • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1. • UniversalId is read from PID-3.1.4.2. • UniversalIdType is read from PID-3.1.4.3. Each element of the list must be separated by the '~' character.
4	20	CX	O	Alternate Patient ID	Not stored.
5	48	XPN	R	Patient Name	DoseWatch reads the following fields • Last Name is read from PID-5.1.1. • First Name is read from PID-5.1.2. • Middle Name is read from PID-5.1.3. • Suffix is read from PID-5.1.4 • Prefix is read from PID-5.1.5
6	48	XPN	O	Mother's Maiden Name	Not stored.
7	26	TS	R2	Date/Time of Birth	Date of birth is read from PID-7.1.
8	1	IS	O	Sex	Sex code is read from PID-8. DoseWatch manages all values specified in the standard: • F converted to "Female" • M converted to "Male" • U converted to "Unknown" (default if nothing specified) • A converted to "Ambig" for ambiguous • N converted to "Not_app" for not applicable • O converted to "Other"
9	48	XPN	O	Patient Alias	Not stored.
10	80	CE	R2	Race	Not stored.
11	106	XAD	R2	Patient Address	Not stored.
12	4	IS	O	Country Code	Not stored.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
13	40	XTN	O	Phone Number – Home	Not stored.
14	40	XTN	O	Phone Number – Business	Not stored.
15	60	CE	O	Primary Language	Not stored.
16	1	IS	O	Marital Status	Not stored.
17	80	CE	O	Religion	Not stored.
18	20	CX	C	Patient Account Number	Not stored.
19	16	ST	O	SSN Number – Patient	Not stored.
20	25	DLN	O	Driver's License Number – Patient	Not stored.
21	20	CX	O	Mother's Identifier	Not stored.
22	80	CE	O	Ethnic Group	Not stored.
23	60	ST	O	Birth Place	Not stored.
24	1	ID	O	Multiple Birth Indicator	Not stored.
25	2	NM	O	Birth Order	Not stored.
26	80	CE	O	Citizenship	Not stored.
27	60	CE	O	Veterans Military Status	Not stored.
28	80	CE	O	Nationality	Not stored.

3.1.5 PV1 Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	4	SI	O	Set ID - PV1	Not stored.
2	1	IS	R	Patient Class	Not stored.
3	80	PL	O	Assigned Patient Location	Not stored.
4	2	IS	O	Admission Type	Not stored.
5	250	CX	O	Preadmit Number	Not stored.
6	80	PL	O	Prior Patient Location	Not stored.
7	250	XCN	O	Attending Doctor	Not stored.
8	250	XCN	O	Referring Doctor	DoseWatch reads the following fields • Last Name is read from PV1-8.1.2. • First Name is read from PV1-8.1.3. • Middle Name is read from PV1-8.1.4. • Suffix is read from PV1-8.1.5 • Prefix is read from PV1-8.1.6
9	250	XCN	B	Consulting Doctor	Not stored.
10	3	IS	O	Hospital Service	Not stored.
11	80	PL	O	Temporary Location	Not stored.
12	2	IS	O	Preadmit Test Indicator	Not stored.
13	2	IS	O	Re-admission Indicator	Not stored.
14	6	IS	O	Admit Source	Not stored.
15	2	IS	O	Ambulatory Status	Not stored.
16	2	IS	O	VIP Indicator	Not stored.
17	250	XCN	O	Admitting Doctor	Not stored.
18	2	IS	O	Patient Type	Not stored.
19	250	CX	O	Visit Number	Not stored.
20	50	FC	O	Financial Class	Not stored.
21	2	IS	O	Charge Price Indicator	Not stored.
22	2	IS	O	Courtesy Code	Not stored.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
23	2	IS	O	Credit Rating	Not stored.
24	2	IS	O	Contract Code	Not stored.
25	8	DT	O	Contract Effective Date	Not stored.
26	12	NM	O	Contract Amount	Not stored.
27	3	NM	O	Contract Period	Not stored.
28	2	IS	O	Interest Code	Not stored.
29	4	IS	O	Transfer to Bad Debt Code	Not stored.
30	8	DT	O	Transfer to Bad Debt Date	Not stored.
31	10	IS	O	Bad Debt Agency Code	Not stored.
32	12	NM	O	Bad Debt Transfer Amount	Not stored.
33	12	NM	O	Bad Debt Recovery Amount	Not stored.
34	1	IS	O	Delete Account Indicator	Not stored.
35	8	DT	O	Delete Account Date	Not stored.
36	3	IS	O	Discharge Disposition	Not stored.
37	47	DLD	O	Discharged to Location	Not stored.
38	250	CE	O	Diet Type	Not stored.
39	2	IS	O	Servicing Facility	Not stored.
40	1	IS	B	Bed Status	Not stored.
41	2	IS	O	Account Status	Not stored.
42	80	PL	O	Pending Location	Not stored.
43	80	PL	O	Prior Temporary Location	Not stored.
44	26	TS	O	Admit Date/Time	Not stored.
45	26	TS	O	Discharge Date/Time	Not stored.
46	12	NM	O	Current Patient Balance	Not stored.
47	12	NM	O	Total Charges	Not stored.
48	12	NM	O	Total Adjustments	Not stored.
49	12	NM	O	Total Payments	Not stored.
50	250	CX	O	Alternate Visit ID	Not stored.
51	1	IS	O	Visit Indicator	Not stored.
52	250	XCN	B	Other Healthcare Provider	Not stored.

3.1.6 MRG Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	250	CX	R	Prior Patient Identifier List	Merge Patient ID retrieved from MRG-1.1.1 Merge Domain ID retrieved from MRG-1.1.4.1
2	250	CX	B	Prior Alternate Patient ID	Not stored.
3	250	CX	O	Prior Patient Account Number	Not stored.
4	250	CX	B	Prior Patient ID	Not stored.
5	250	CX	O	Prior Visit Number	Not stored.
6	250	CX	O	Prior Alternate Visit ID	Not stored.
7	250	XPN	O	Prior Patient Name	Not stored.

3.1.7 ORC Segment

The ORC Segment is not used by DoseWatch. Order data is read from the OBR Segment (see Section OBR Segment).

3.1.8 OBR Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	4	SI	O	Set ID – OBR	Not stored.
2	75	EI	C	Placer Order Number	Not stored.
3	75	EI	O	Filler Order Number	Not used in default DoseWatch HL7 interface. Optionally, may provide the Imaging Service Request (a.k.a Accession Number) which, by default, is read from OBR-18.
4	200	CE	R	Universal Service ID	Study Code is read from OBR-4.1. Study Description is read from OBR-4.2.
5	2	ID	O	Priority	Not stored.
6	26	TS	O	Requested Date/Time	Not stored.
7	26	TS	O	Observation Date/Time	Not stored.
8	26	TS	O	Observation End Date/Time	Not stored.
9	20	CQ	O	Collection Volume	Not stored.
10	60	XCN	O	Collector Identifier	Not stored.
11	1	ID	O	Specimen Action Code	Not stored.
12	60	CE	R2	Danger Code	Not stored.
13	300	ST	C	Relevant Clinical Info	Not stored.
14	26	TS	O	Specimen Received Date/Time	Not stored.
15	300	CM	C	Specimen Source	Not stored.
16	80	XCN	R	Ordering Provider	Not stored.
17	40	XTN	O	Order Callback Phone Number	Not stored.
18	60	ST	O	Placer Field 1	Accession Number (a.k.a Imaging Service Request) is read from OBR-18.
19	60	ST	O	Placer Field 2	Study ID (a.k.a Requested Procedure ID) is read from OBR-19.
20	60	ST	O	Filler Field 1	Not stored.
21	60	ST	O	Filler Field 2	Not stored.
22	26	TS	O	Results Rpt/Status Chng – Date/Time	Not stored.
23	40	CM	O	Charge to Practice	Not stored.
24	10	ID	O	Diagnostic Serv Sect ID	Not stored.
25	1	ID	O	Result Status	Not stored.
26	400	CM	O	Parent Result	Not stored.
27	200	TQ	B	Quantity/Timing	Not stored.
28	150	XCN	O	Results Copies To	Not stored.
29	150	CM	O	Parent	Not stored.
30	20	ID	O	Transportation Mode	Not stored.
31	300	CE	O	Reason for Study	Not stored.
32	200	CM	O	Principal Result Interpreter	Not stored.
33	200	CM	O	Assistant Result Interpreter	Not stored.
34	200	CM	O	Technician	Not stored.
35	200	CM	O	Transcriptionist	Not stored.
36	26	TS	O	Scheduled Date/Time	Not stored.
37	4	NM	O	Number of Sample Containers	Not stored.
38	60	CE	O	Transport Logistics of Collected Sample	Not stored.
39	200	CE	O	Collector's Comment	Not stored.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
40	60	CE	O	Transport Arrangement Responsibility	Not stored.
41	30	ID	O	Transport Arranged	Not stored.
42	1	ID	O	Escort Required	Not stored.
43	200	CE	O	Planned Patient Transport Comment	Not stored.
44	80	CE	O	Procedure Code	Not stored.
45	80	CE	O	Procedure Code Modifier	Not stored.

3.1.9 OBX Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	4	SI	O	Set ID – OBX	Not stored.
2	2	ID	C	Value Type	Not stored.
3	250	CE	R	Observation Identifier	Not stored.
4	20	ST	C	Observation Sub-ID	Not stored.
5	99999	Varies	C	Observation Value	Patient's weight and size are retrieved from OBX-5.1.1 or OBX-12.5.1 and OBX-11.5.1.1 (Venus integration) Information from Nuclear Medicine examination is retrieved from OBX-5.x.1 (Venus integration)
6	250	CE	O	Units	Not stored.
7	60	ST	O	References Range	Not stored.
8	5	IS	O	Abnormal Flags	Not stored.
9	5	NM	O	Probability	Not stored.
10	2	ID	O	Nature of Abnormal Test	Not stored.
11	1	ID	R	Observation Result Status	Not stored.
12	26	TS	O	Effective Date of Reference Range Values	Not stored.
13	20	ST	O	User Defined Access Checks	Not stored.
14	26	TS	O	Date/Time of the Observation	Not stored.
15	250	CE	O	Producer's Reference	Not stored.
16	250	XCN	O	Responsible Observer	Not stored.
17	250	CE	O	Observation Method	Not stored.
18	22	EI	O	Equipment Instance Identifier	Not stored.
19	26	TS	O	Date/Time of the Analysis	Not stored.
20				Reserved for harmonization with V2.6	Not stored.
21				Reserved for harmonization with V2.6	Not stored.
22				Reserved for harmonization with V2.6	Not stored.
23	23	XON	O	Performing Organization Name	Not stored.
24	24	XAD	O	Performing Organization Address	Not stored.
25	25	XCN	O	Performing Organization Medical Director	Not stored.

3.1.10 ZDS Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	200	RP	R	Study Instance UID	Study Instance UID is read from ZDS-1.1

Z Segment Study Instance UID Element Components:

Component Number	Component Name	Contains
1	Reference Pointer	DICOM compliant Study Instance UID value
2	Application ID	Implementation specific (e.g., name of the sending application).
3	Type of Data	"Application"
4	Subtype	"DICOM"

3.2 ADT Messages – Patient Management

3.2.1 ADT Messages Semantic

All ADT Messages received by DoseWatch shall be composed of the following segments:

Segment	Name	Used for message	Chapter in HL7 2.5
MSH	Message Header	All	2
EVN	Event Type	All	3
PID	Patient	All	3
MRG	Merge	ADT^A40 ADT^A47	3
NK1	Next of Kin	ADT^A01 ADT^A08 ADT^A28 ADT^A31	3 (Not used by DoseWatch)
PV1	Patient Visit	ADT^A01 ADT^A08 ADT^A28 ADT^A31	3 (Not used by DoseWatch)

The ADT messages received by DoseWatch for ADT should have this semantic:

Segment	Description	DoseWatch Behavior
MSH	Message Header	Used
EVN	Event Type	Used
PID	Patient	Used
[PD1]	Patient Additional Demographic	Ignored
[{NK1}]	Next of Kin	Used
PV1	Patient Visit	Used
[PV2]	Patient Visit - Additional Information	Ignored
[{OBX}]	Observation/Result	Ignored
[{AL1}]	Patient Allergy Information	Ignored
[{DG1}]	Diagnosis	Ignored
[DRG]	Diagnosis Related Group	Ignored
[{		
PR1	Procedures	Ignored
[{ROL}]	Role	Ignored
}]		
[{GT1}]	Guarantor	Ignored
[{		
IN1	Insurance	Ignored
[IN2]	Insurance Additional Information	Ignored

[{IN3}]	Insurance Additional Information, Certification	Ignored
[{ROL}]	Role	Ignored
}]		
[ACC]	Accident	Ignored
[UB1]	UB82	Ignored
[UB2]	UB92 Data	Ignored
[PDA]	Patient Death and Autopsy	Ignored
[MRG]	Merge	Used

Please refer to the HL7 V2.5.1 for all ADT messages used. This version has been used as advised by IHE in their technical Framework.

3.2.2 Patient Creation Message

3.2.2.1 ADT^A01 message specification

The event A01 is an Admin/Visit notification message. It is intended to be used for “Admitted” patients only.

The message ADT^A01 is by default de-activated in DoseWatch as we don’t want patients to be created in HL7 but when a DICOM study is received. The patient creation can be re-activated in some very specific cases but it’s not the regular DoseWatch behavior.

3.2.2.2 MSH Segment

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ADT”; the second component shall have value of A01.

3.2.2.3 PID Segment

The used fields by DoseWatch from the PID Segment are listed in the following table. All other fields are conditional and shall be present if the value of the field has been changed.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1.1 • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1 • UniversalId is read from PID-3.1.4.2 • UniversalIdType is read from PID-3.1.4.3 The patient ID read is the first identifier of the list. If several identifiers are present in the list only the first one will be processed by DoseWatch
5	48	XPN	R	Patient Name	• Last Name is read from PID-5.1.1.1 • First Name is read from PID-5.1.2 • Middle Name is read from PID-5.4.3 • Suffix is read from PID-5.1.4 • Prefix is read from PID-5.1.5
7	26	TS	O	Date/Time Of Birth	The format should be YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][+/-ZZZZ]^<degree of precision> Usually, DoseWatch receives date formatted this way YYYYMMDD

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
8	1	IS	O	Administrative Sex	Sex code is read from PID-8. DoseWatch manages all values specified in the standard: • F converted to “Female” • M converted to “Male” • U converted to “Unknown” (default if nothing specified) • A converted to “Ambig” for ambiguous • N converted to “Not_app” for not applicable • O converted to “Other”

The patient identifier list PID-3 shall contain only one identifier. If it contains several identifiers, DoseWatch will read only the first identifier and ignore other identifiers. If an assigning authority is specified with the patient ID and properly declared in DoseWatch, the patient is created with all assigning authority information. If not DoseWatch will use the default “domain” configured in the software.

3.2.2.4 PV1 Segment

The PV1 Segment is not used by DoseWatch for ADT_A01 messages.

3.2.2.5 ADT^A01 Message Example

```
MSH|^~\&|PatientManager|IHE|DOSEWATCH|GE|20150311023733||ADT^A01^ADT_A01|20150311023733|P|2.5||||||UNICODE
UTF-8
EVN||20150311023733||||20150311023733|
PID|||DDS-36932^^^DDS&1.3.6.1.4.1.12559.11.1.4.1.2&ISO^PI||LAST
^FIRST^M^Sr^Dr^^L|^^^^^^M|19930228|M|||Oudelandsepoort^^Tholen^^4691CE^NLD|||||||875^^^IHEPAM&1.3.6.1.4.1.12559.
11.5.3 ^AN||||||||||||||N
PV1||N
```

The fields marked in grey are the fields read and stored in the DoseWatch database with the command CREATE_PATIENT.

3.2.2.6 Audit Trail

Since DoseWatch 2.3 when a patient is created an entry is created in the DoseWatch Audit Trail. The message displayed will be “Patient <Patient ID> [<Patient Last Name>,<Patient First Name>] was automatically created with HL7 message id <HL7 Message ID>”.

3.2.3 Patient Update Messages

3.2.3.1 ADT^A08 message specification

The A08 message is an update Information event. This event is triggered when any patient information has changed. For example, an A08 event can be used to notify the receiving systems of change of address or name change.

3.2.3.1.1 MSH Segment

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ADT”; the second component shall have value of A08. The third component is optional; however, if present, it shall have a value of ADT_A01.

3.2.3.1.2 PID Segment

The used fields from the PID Segment are listed in the following table. All other fields are conditional and shall be present if the value of the field has been changed.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1.1 • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1 • UniversalId is read from PID-3.1.4.2 • UniversalIdType is read from PID-3.1.4.3 Each element of the list must be separated by the '~' character. All identifiers from the list are read
5	48	XPN	R	Patient Name	• Last Name is read from PID-5.1.1.1 • First Name is read from PID-5.1.2 • Middle Name is read from PID-5.4.3 • Suffix is read from PID-5.1.4 • Prefix is read from PID-5.1.5
7	26	TS	O	Date/Time Of Birth	The format should be YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][+/-ZZZZ]^<degree of precision> Usually, DoseWatch receives date formatted this way YYYYMMDD
8	1	IS	O	Administrative Sex	Sex code is read from PID-8. DoseWatch manages all values specified in the standard: • F converted to "Female" • M converted to "Male" • U converted to "Unknown" (default if nothing specified) • A converted to "Ambig" for ambiguous • N converted to "Not_app" for not applicable • O converted to "Other"

The PID-3 uses a list to define several patient identifiers used for this patient. Usually only one patient ID is given with this message. A patient ID may be specified with its assigning authority. If no assigning authority is specified, a default one will be used as configured in DoseWatch.

When multiple patient identifiers are provided within PID-3, DoseWatch can read them. Patients are separated with the character '~' and patients with their assigning authorities are linked together. DoseWatch stores the list of patient IDs with their assigning authorities only if the given domains have been properly declared in DoseWatch. If a domain has not been declared in DoseWatch, the patient ID given is ignored.

The following segment explains how the PID list is managed:

PID|||IHEBLUE-1034^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO^PI~IHEFACILITY-1034^^^IHEFACILITY&1.3.6.1.4.1.21367.3000.1.6&ISO^PI~IHEGREEN-1034^^^IHEGREEN&1.3.6.1.4.1.21367.13.20.2000&ISO^PI|….

In DoseWatch, if the domain with the assigning authority IHEBLUE (universal id 1.3.6.1.4.1.21367.13.20.3000) is declared in DoseWatch, the Patient Id IHEBLUE-1034 will be found in database searching it in the domain IHEBLUE first then in the default domain declared in DoseWatch. This allows for small facilities not using any assigning authorities not to specify any authority in the message. Once the patient is found it is updated with all information found in the message.

For the other element found in the PID, DoseWatch will search if the IHEFACILITY and IHEGREEN domains are declared in the system. If not, these identifiers are ignored. If yes, the identifiers IHEFACILITY-1034 and IHEGREEN-1034 will be linked to the patient ID IHEBLEUE-1034.

3.2.3.1.3 PV1 Segment

The PV1 Segment is not used by DoseWatch for ADT_A08 messages.

3.2.3.1.4 ADT^A08 Message Examples

```
MSH|^~\&|PatientManager|IHE|DOSEWATCH|GE|20150421090810||ADT^A08^ADT_A01|270|D|2.5||||||UNICODE UTF-8|FR||
EVN||20150421090810|||||
PID|||DDS36932^^^DDS&1.3.6.1.4.1.12559.11.1.4.1.2&ISO^PI~IHEBLUE1034^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO^PI||LA
ST^FIRST^M^Sr^Dr^^L|^^^^^^M|19930228|M|||Oudelandsepoort^^Tholen^^4691CE^NLD|||||||875^^^IHEPAM&1.3.6.1.4.1.125
59.11.5.3 ^AN|||||||||||||N
PD1||U||||||||||N|||||||||
PV1|1|N
```

The fields marked in grey are the fields read and stored in the DoseWatch database with the command UPDATE_PATIENT.

3.2.3.1.5 Audit Trail

Since DoseWatch 2.3, when a patient is updated, an entry is created in the DoseWatch Audit Trail. The message displayed will be “Patient <Patient ID> [<Old Patient Last Name>,<Old Patient First Name>] was automatically updated to [<New Patient Last Name>,<New Patient First Name>, DOB <New Date of Birth>] with HL7 message id <HL7 Message ID>”.

3.2.3.2 ADT^A28 Message Specification

The event A28 is an Add Person or Patient Information message. It is used usually to synchronize systems after the ADT^01 message usage. The ADT^A01 is used for admission and to attach demographic information to a patient, the message ADT^A28 can be used for example to send the prior message to a PIX manager or other systems linked to the HIS. DoseWatch considers the message A28 as an update message. We do not create a new patient, but we try to update it if it exists in database. If we do not know it, the message is ignored. DoseWatch behaves like the ADT^A08 message for this message. Report to the section “ADT^A08 message specification” to see what DoseWatch reads in the message.

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ADT”; the second component shall have value of A28. The third component is optional; however, if present, it shall have a value of ADT_A05.

3.2.3.2.1 ADT^A28 Message Examples

```
MSH|^~\&|PatientManager|IHE|DOSEWATCH|GE|20150421090810||ADT^A28^ADT_A05|270|D|2.5||||||UNICODE UTF-8|FR||
EVN||20150421090810|||||
PID|||DDS36932^^^DDS&1.3.6.1.4.1.12559.11.1.4.1.2&ISO^PI~IHEBLUE1034^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO^PI||LA
ST^FIRST^M^Sr^Dr^^L|^^^^^^M|19930228|M|||Oudelandsepoort^^Tholen^^4691CE^NLD|||||||875^^^IHEPAM&1.3.6.1.4.1.125
59.11.5.3 ^AN|||||||||||||N
PD1||U||||||||||N|||||||||
PV1|1|N
```

The fields marked in grey are the fields read and stored in the DoseWatch database with the command UPDATE_PATIENT.

3.2.3.2.2 Audit Trail

Since DoseWatch 2.3, when a patient is updated, an entry is created in the DoseWatch Audit Trail. The message created will be “Patient <PatientID> [<Old Patient Last Name>,<Old Patient First Name>] was automatically updated to [<New Patient Last Name>,<New Patient First Name>, DOB <New Date of Birth>] with HL7 message id <HL7 Message ID>”

3.2.3.3 ADT^A31 Message Specification

The message A31 is an update Person Information message. It is like an A08 (update patient information) event but this message can be used to update person information on an MPI. DoseWatch interprets this message like ADT^A08. Report to the section “ADT^A08 message specification” to see what is read in the message. This message is used for the transaction PIX-Update which explained more in details in the section “5.3”.

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ADT”; the second component shall have value of A31. The third component is optional; however, if present, it shall have a value of ADT_A05.

3.2.3.3.1 ADT^A31 Message Example

```
MSH|^~\&|PatientManager|IHE|DOSEWATCH|GE|20150421091341||ADT^A31^ADT_A05|271|D|2.5||||||UNICODE UTF-8|FR||
EVN||20150421091341|||||
PID|||DDS36932^^^DDS&1.3.6.1.4.1.12559.11.1.4.1.2&ISO^PI~IHEBLUE1034^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO^PI||LAST^FIRST^M^Sr^Dr^^L|^^^^^^M|19930228|M|||Oudelandsepoort^^Tholen^^4691CE^NLD||||||875^^^IHEPAM&1.3.6.1.4.1.12559.11.5.3 ^AN||||||||||||N
PD1||U||||||||||N|||||||||
PV1|1|N
```

The fields marked in grey are the fields read and stored in the DoseWatch database with the command LINK_PATIENT.

3.2.3.3.2 Audit Trail

Since DoseWatch 2.3 when a patient is updated with a list of identifiers, an entry in the DoseWatch Audit Trail is created. The message displayed will be “Identities for patient <PatientID> [<Patient Last Name>,<Patient First Name>] was automatically retrieved with HL7 message id <HL7 Message ID>”.

3.2.3.4 ADT^A47 Message Specification

The A47 message is a change patient identifier list event. This message is used to change an incorrect patient identifier. The correct patient identifier is given in the PID segment; the incorrect patient identifier is in the segment MRG.

3.2.3.4.1 MSH Segment

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ADT”; the second component shall have value of A47.

3.2.3.4.2 PID Segment

The required fields in the PID Segment are listed in the following table. All other fields are conditional and shall be present if the value of the field has been changed.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1.1 • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1 • UniversalId is read from PID-3.1.4.2 • UniversalIdType is read from PID-3.1.4.3 The patient ID read is the first identifier of the list. If several identifiers are present in the list only the first one will be processed by DoseWatch.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
5	48	XPN	R	Patient Name	• Last Name is read from PID-5.1.1.1 • First Name is read from PID-5.1.2 • Middle Name is read from PID-5.4.3 • Suffix is read from PID-5.1.4 • Prefix is read from PID-5.1.5
7	26	TS	O	Date/Time Of Birth	The format should be YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][+/-ZZZZ]^<degree of precision> Usually, DoseWatch receives date formatted this way YYYYMMDD
8	1	IS	O	Administrative Sex	Sex code is read from PID-8. DoseWatch manages all values specified in the standard: • F converted to “Female” • M converted to “Male” • U converted to “Unknown” (default if nothing specified) • A converted to “Ambig” for ambiguous • N converted to “Not_app” for not applicable • O converted to “Other”

The patient identifier list PID-3 shall contain only one identifier. If it contains several identifiers, DoseWatch will read only the first identifier and ignore other identifiers. If an assigning authority is specified with the patient Id and properly declared in DoseWatch, the patient is created with all assigning authority information. If not DoseWatch will use the default “domain” configured in the software.

3.2.3.4.3 MRG Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	250	CX	R	Prior Patient Identifier List	• Patient ID is read from PID-3.1.1 • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1 Only the patient identifier domain is read if available (no UniversalId read).

Other fields in the MRG segment are not read. Patient ID is read to search the old patient ID to change. If no assigning authority is specified in the message, the default assigning authority configured in DoseWatch is used. Only the PID-3.1.4.1 is read (the namespace id). No universal id is read for the MRG. The namespace ID is de facto required for DoseWatch if available.

3.2.3.4.4 ADT^A47 Message Example

```
MSH|^~\&|PatientManager|IHE|DOSEWATCH|GE|20150421092845||ADT^A47^ADT_A30|273|D|2.5||||||UNICODE UTF-8|FR||
EVN||20150421092845|||||
PID|||DDS36932^^^DDS&1.3.6.1.4.1.12559.11.1.4.1.2&ISO^PI||LAST^FIRST^M^Sr^Dr^^L|^^^^^^M|19930228|M|||Oudelandsepo
ort^^Tholen^^4691CE^NLD||||||875^^^IHEPAM&1.3.6.1.4.1.12559.11.5.3 ^AN||||||||||||N
PD1||U|||||||||N|||||||||
MRG|IHEBLUE1034^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO^PI||||||GE^Change_Marc^^^m^^L^A
```

The fields marked in grey are the fields read and stored in the DoseWatch database with the command UPDATE_PATIENT. The old patient id 00001084 in the domain 350000121 has been changed by the patient id 6426820. Other identifiers are ignored.

3.2.3.4.5 Audit Trail

Since DoseWatch 2.3 when a patient has an update on its identifier an entry in the DoseWatch Audit Trail is created. The message displayed will be “Patient <Old Patient ID> [<Patient Last Name>,<Patient First Name>] has its identifier automatically updated to [<New Patient ID>] with HL7 message id <HL7 Message ID>”.

3.2.4 Patient Merge Messages

3.2.4.1 ADT^A40 Message Specification

3.2.4.1.1 MSH Segment

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ADT”; the second component shall have value of A40. The third component is optional; however, if present, it shall have a value of ADT_A39.

3.2.4.1.2 PID Segment

The following table lists required fields in the PID segment:

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1.1. • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1.

3.2.4.1.3 MRG Segment

The PID segment contains the dominant patient information, including Patient ID (and Issuer of Patient ID). The MRG segment identifies the “old” or secondary patient records to be de-referenced.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	20	CX	R	Prior Patient Identifier List	• Patient ID is read from MRG-1.1.1 • Patient Identifier Domain/Assigning Authority is read from MRG-1.1.4.1 Only the patient identifier domain is read if available (no UniversalId read).

A separate merge message shall be sent for each patient record to be merged. For example, if Patients A and C are all to be merged into Patient B, two A40 messages shall be sent. In the first message patient B would be identified in the PID segment and Patient A would be identified in the MRG segment. In the second MRG message, patient B would be identified in the PID segment, and Patient C would be identified in the MRG segment.

Modification of any patient demographic information shall be done by sending a separate Update Patient Information (A08) message for the current Patient ID. An A40 message is the only method that may be used to update a Patient ID.

3.2.4.1.4 ADT^A40 Message Example

```
MSH|^~\&|ADT_Openxtrem_2015|Openxtrem|DOSEWATCH|GE|20150421094305||ADT^A40^ADT_A39|282|D|2.5||||||UNICODE UTF-8|FR||
EVN||20150421094305|||||
PID|||DDS36932^^^DDS&1.3.6.1.4.1.12559.11.1.4.1.2&ISO^PI||LAST^FIRST^M^Sr^Dr^^L|^^^^^^M|19930228|M|||Oudelandsepoort^^Tholen^^4691CE^NLD||||||875^^^IHEPAM&1.3.6.1.4.1.12559.11.5.3 ^AN||||||||||||N
PD1||U||||||||||N|||||||||
MRG|IHEBLUE1034^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO^PI||||||GE^Change_Marc^^^m^^L^A
```

The fields marked in grey are the fields read and stored in the DoseWatch database with the command MERGE_PATIENT.

3.2.4.1.5 Audit Trail

Since DoseWatch 2.3 when a patient is merged in another an entry in the DoseWatch Audit Trail is created. The message displayed will be “All studies from patient <Old Patient ID> [<Old Patient Last Name>,<Old Patient First Name>] were automatically merged into the patient <New Patient ID> [<New Patient Last Name>,<New Patient First Name>] with HL7 message id <HL7 Message ID>”.

If the new patient identity given in the PID segment does not exist, you will see before:

"Patient <Patient ID> [<Patient Last Name>,<Patient First Name>] was automatically created for a patient merge with HL7 message id <HL7 Message ID>”

3.2.5 ACK message sent by DoseWatch

ACK messages sent by DoseWatch do not reflect the result of what happens internally. ACK are generated replying the transmission was ok with a code AA (Application Accept).

3.2.5.1 ACK semantic

The Ack sent by DoseWatch has this semantic:

Segment	Description
MSH	Message Header
MSA	Message Acknowledgement

3.2.5.2 ACK message example

```
MSH|^~\&|DOSEWATCH|GE|PatientManager|IHE|20150422085402.894||ACK^A28^ACK|A270|P|2.5||||||UNICODE UTF-8|EN|
MSA|AA|270|
```

3.3 Procedure Updates

3.3.1 ORM^O01 Message Specification

In the IHE RAD-13 transaction, the message ORM^O01 is used by the department system scheduler (order filler) to send the image manager (DoseWatch here), updated order or procedure information. The ORM message from the Department System Scheduler (Order Filler) and Image manager may reference a previously scheduled/Requested Procedure identified by a Study Instance UID. DoseWatch uses the ORM message to update information concerning a specific examination. Different information in the study can be changed as the study description, patient weight and size, physicians… This information is stored in OBR segments, OBX segments, PV1 segments or ZDS segments. If several patient identifiers are sent for a patient, patient IDs are linked together.

3.3.1.1 ORM^O01 Message Semantic

ORM^O01 message received by DoseWatch should follow this semantic:

Segment	Description	DoseWatch Behavior
MSH	Message Header	Used
PID	Patient	Used
PV1	Patient Visit	Used
ORC	Common Order	Used
OBR	Observation Request	Used
{[OBX]}	Observation/Result	Used
[ZDS]	Z Segment Study Instance UID	Used

Other segments may be provided by the RIS, but they are ignored by DoseWatch.

3.3.1.2 MSH Segment

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ORM”; the second component shall have value of O01. The third component is optional; however, if present, it shall have a value of ORM_O01.

3.3.1.3 PID Segment

The following table lists required fields in the PID segment.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1.1 • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1 • UniversalId is read from PID-3.1.4.2 • UniversalIdType is read from PID-3.1.4.3 Each element of the list must be separated by the ‘~’ character. All identifiers from the list are read
5	48	XPN	R	Patient Name	• Last Name is read from PID-5.1.1.1 • First Name is read from PID-5.1.2 • Middle Name is read from PID-5.4.3 • Suffix is read from PID-5.1.4 • Prefix is read from PID-5.1.5
7	26	TS	O	Date/Time Of Birth	The format should be YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][+/-ZZZZ]^<degree of precision> Usually, DoseWatch receives date formatted this way YYYYMMDD
8	1	IS	O	Administrative Sex	Sex code is read from PID-8. DoseWatch manages all values specified in the standard: • F converted to “Female” • M converted to “Male” • U converted to “Unknown” (default if nothing specified) • A converted to “Ambig” for ambiguous • N converted to “Not_app” for not applicable • O converted to “Other”

3.3.1.4 PV1 Segment

See required fields in Section PV1 Segment.

3.3.1.5 ORC Segment

The ORC Segment is not used by DoseWatch. Order data is read from the OBR Segment (see next section).

3.3.1.6 OBR Segment

See required fields in Section OBR Segment.

3.3.1.7 ZDS Segment

See required fields in Section ZDS Segment.

Please refer to the HL7 V2.3.1 for the ORM message used. This version is a valid choice in the IHE technical framework.

3.3.2 DoseWatch behavior upon the reception of ORM^O01 message

When DoseWatch receives a message ORM^O01, it will extract all available information in the message and will try to find the study in database searching by:

- Study Instance UID first if the study Instance UID was present in the ZDS segment.
- If no study found or no study instance UID in the HL7 message, it searches the study by StudyID if sent in the Placer Field 2 of the OBR segment.
- If no study found, it searches the study by accession number if provided in the message in the Placer Field 1 of the OBR segment.
    - If no study found DoseWatch will ignore the update of the study
    - If one or several examinations found, the study description will be updated using the field found in OBR-4.2 (See OBR Segment).
- Finally, if several patient identifiers are sent in the PID segment, patient identifiers are linked together. This allows the use of a MPI feature without any PIX manager.
- If the study is not found in DoseWatch with the given identifiers, an error is raised in the processing and no study won't be updated. It is the responsibility of the modality or the PACS to inform the RIS in case of internal generated UID (in Emergency Case). A specific IHE workflow exists it is called Patient Information Reconciliation and it is not yet supported by DoseWatch.

3.3.3 ORM^O01 message example

```
MSH|^~\&|XPLORE|EDL|CENTRICITY|GE|201009140750||ORM^O01|A10002129258|P|2.3.1||||||8859/1
PID|||ZZTest-02.1^^^DOM1|XXX^XXX|ZZTESTDW1.2^HERVE-02.1||19670221160233|M||1 ALLEE DU
DOUBS^^DIJON^^21000||SANS|||||10047467
PV1||N|4314^^^^^^^^EXT MEDECINE NUCLEAIRE||||TOMI^XXX^XXX|^REFERRING^PHYSICIAN^||MNU|||||||||10047467
ORC|SC||AccNum-02.1.d||XO||1^once^^20120705150749^^R||201207050750|||00973^XXX^XXX|||||4314^EXT MEDECINE
NUCLEAIRE^EDL||
OBR|||AccNum-02.1.d|Proc-102^Req. Proc. 02.1.d.e2 AFTER update^EDL|||201207050749|||||||||00973^XXX^XXX||AccNum-
02.1.d|RP-02.1.d.e2|SPS-02.1.d.e2||||NM|||1^once^^201207050749^^R|||||
OBX||ST|^BODY WEIGHT||62|kg|||||F
OBX||ST|^BODY HEIGHT||1.90|m|||||F
ZDS|1.2.528.1.1001.2002.3003.1111.201207020210.2^XPLORE^Application^DICOM
```

The fields marked in grey are the fields read and stored in the DoseWatch database with the command UPDATE_STUDY.

3.3.4 Audit Trail

Since DoseWatch 2.3 when a study is updated with an ORM message an entry in the DoseWatch Audit Trail is created. The message displayed will be "Study with accession number <Accession Number>, Patient ID <Patient ID> and study Instance UID <StudyInstanceUID> was automatically updated with HL7 message id <HL7 Message ID>".

3.4 HL7 inbound interface for Nuclear Medicine

This Section describes data acquisition about radiopharmaceutical administration to patient for NM imaging procedures using HL7 messages.

DoseWatch currently supports such integration with:

- Nicesoft Venus NMIS (see Section 3.4.1)
- Softway Medical - Pharma Manager NMIS (see Section 3.4.23.4.2)
- Systec Inoue - ShadeQuest/RIS (see Section 3.4.3)

Editors willing to develop an HL7 interface to communicate with DoseWatch can refer to Section 3.4.4 for generic requirements specifications.

3.4.1 ORU^R01 NiceSoft Venus integration

Venus NMIS from NiceSoft produces custom HL7 ORU messages containing Nuclear Medicine radiopharmaceutical data. DoseWatch uses the ORU message to update or create information concerning a specific examination of nuclear medicine. Different information in the study can be changed as the activity, radiopharmaceutical, site injected… This information is stored in OBR segments or OBX segments.

3.4.1.1 Message acquisition

Nicesoft Venus HL7 interface does not support the HL7 MLP communication. Instead, a shared folder is used where Venus stores one file per message.

DoseWatch shall poll this shared folder and read message files based on their arrival date/time in the folder.

It is Nicesoft project manager responsibility to get the shared folder implemented with the customer IT.

3.4.1.2 MSH Segment

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ORU”; the second component shall have value of R01. The third component is optional; however, if present, it shall have a value of ORU_R01.

3.4.1.3 PID Segment

The following table lists required fields in the PID segment.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1.1 • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1 • UniversalId is read from PID-3.1.4.2 • UniversalIdType is read from PID-3.1.4.3 Each element of the list must be separated by the ‘~’ character. All identifiers from the list are read
5	48	XPN	R	Patient Name	• Last Name is read from PID-5.1.1.1 • First Name is read from PID-5.1.2 • Middle Name is read from PID-5.4.3 • Suffix is read from PID-5.1.4 • Prefix is read from PID-5.1.5
7	26	TS	O	Date/Time Of Birth	The format should be YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][+/-ZZZZ]^<degree of precision> Usually, DoseWatch receives date formatted this way YYYYMMDD
8	1	IS	O	Administrative Sex	Sex code is read from PID-8. DoseWatch manages all values specified in the standard: • F converted to “Female” • M converted to “Male” • U converted to “Unknown” (default if nothing specified) • A converted to “Ambig” for ambiguous • N converted to “Not_app” for not applicable • O converted to “Other”

3.4.1.4 PV1 Segment

See required fields in Section PV1 Segment.

3.4.1.5 OBR Segment

See required fields in Section OBR Segment (3.1.8).

3.4.1.6 OBX Segment

See required fields in Section OBX Segment (3.1.9).

Nicesoft Venus HL7 interface provides data elements about radiopharmaceutical administration in dedicated, numbered OBX segments.

When multiple administrations are involved for the NM procedure, information about each administration is grouped within the same OBX segment and separated with “&”. Refer to ORU^R01 message example below.

3.4.1.7 ORU^R01 message example

The example below shows a message sent for an NM procedure involving two pharmaceuticals’ injections. Information describing each injection are separated by “&” in each OBX segment.

```
MSH|^~\&|VENUS|SEGAMI|DOSE|DOSE|20191107114126||ORU^R01|00000939|P|2.3.1||||||8859/1||
PID|50301||50301||AAA^AAA||19900101|F|AAA^AAA^AAA||street^^city^^zipcode^||||||||
PV1||N|^^^|||||^^^^^|^^^^^|MN|||||||||||||||||||||||||||
OBR||229683690|63620|229683690^|||20191107114500||||||||||||A10168864349|||20191107114126114126||INJECTION_||
|^^^20191107114500^^|||||||JME||||^^^^INJECTION||20191107114500
OBX|0|ST|DOSE^Dose injectée||48.576&48.061|MBq|
OBX|1|ST|HOT^Produit chaud||TEKCIS 4GBq^MCVI001&TEKCIS 4GBq^MCVI001||
OBX|2|ST|COLD^Produit froid||NANOCOLL^F00219001&NANOCOLL^F00219001||
OBX|3|ST|VOLUME^Volume Injectée||.22&.22|ml|
OBX|4|ST|SITE^Site Injection||SEIN DROIT&SEIN DROIT||
OBX|5|ST|INJECTION^Heure Injection||1136&1138||
OBX|6|ST|DELAI^Heure Camera||1306&1308||
OBX|7|ST|NUMERO^Numéro Seringue||67553&67554||
OBX|8|ST|TECHNICIEN^Technicien||JME&JME||
OBX|9|ST|TECHNIQUE^Technique||SCINTIGRAPHIE DU GANGLION SENTINELLE 1h30 après injection I.V de 48.576 MBq (1.313 mCi) de TC99M-TEKCIS 4GBq, soit une dose efficace de XX mSv. Point d'injection : SEIN DROIT.&SCINTIGRAPHIE DU GANGLION SENTINELLE 1h30 après injection I.V de 48.061 MBq (1.299 mCi) de TC99M-TEKCIS 4GBq, soit une dose efficace de XX mSv. Point d'injection : SEIN DROIT.||
OBX|10|ST|C_POIDS^Constante du type Poids||49&49|kg|
OBX|11|ST|C_TAILLE^Constante du type Taille||169&169|cm|
```

The fields marked in grey are those fields read and stored in the DoseWatch database, although not all are visible in DoseWatch as of now.

3.4.2 ORU^R01 Softway Medical - Pharma Manager integration

Pharma Manager from Softway Medical produces custom HL7 ORU messages containing Nuclear Medicine radiopharmaceutical data. DoseWatch uses the ORU message to update or create information concerning a specific examination of nuclear medicine. Different information in the study can be changed as the activity, radiopharmaceutical, site injected… This information is stored in OBX segments.

3.4.2.1 Message acquisition

Softway Medical – Pharma Manager HL7 interface does not support the HL7 MLP communication. Instead, a shared folder is used where Pharma Manager stores one file per message.

DoseWatch shall poll this shared folder and read message files based on their arrival date/time in the folder.

It is Softway Medical project manager responsibility to get the shared folder implemented with the customer IT.

3.4.2.2 MSH Segment

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ORU”; the second component shall have value of R01. The third component is optional; however, if present, it shall have a value of ORU_R01.

3.4.2.3 PID Segment

The following table lists required fields in the PID segment.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1 • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1 • UniversalId is read from PID-3.1.4.2 • UniversalIdType is read from PID-3.1.4.3 Each element of the list must be separated by the ‘~’ character. All identifiers from the list are read
5	48	XPN	R	Patient Name	• Last Name is read from PID-5.1 • First Name is read from PID-5.2 • Middle Name is read from PID-5.3 • Suffix is read from PID-5.4 • Prefix is read from PID-5.5
7	26	TS	O	Date/Time Of Birth	Date of Birth is read from PID-7. The format should be YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][+/-ZZZZ]^<degree of precision> Usually, DoseWatch receive date formatted this way YYYYMMDD
8	1	IS	O	Administrative Sex	Sex code is read from PID-8. DoseWatch manage all values specified in the standard: • F converted to “Female” • M converted to “Male” • U converted to “Unknown” (default if nothing specified) • A converted to “Ambig” for ambiguous • N converted to “Not_app” for not applicable • O converted to “Other”

3.4.2.4 PV1 Segment

See required fields in Section PV1 Segment (**Error! Reference source not found.**).

3.4.2.5 OBR Segment

See required fields in Section OBR Segment (3.1.8).

3.4.2.6 OBX Segment

See required fields in Section OBX Segment (3.1.9).

Softway Medical – Pharma Manager HL7 interface provides data elements about radiopharmaceutical administration in a dedicated JSON format inside an OBX segment.

When multiple administrations are involved for the NM procedure, several injections can be found in the JSON format.

3.4.2.7 ORU^R01 message example

The example below shows a message sent for an NM procedure involving a pharmaceutical injection. Information describing the injection is inside the JSON string in the OBX segment.

```
MSH|^~\&|PHARMAMANAGER|PHM|DOSEWATCH|GE|202008311152||ORU^R01|20200831115 24|P|2.5|||||FRA|8859/1|||
PID|||0900371760||LASTNAME^FIRSTNAME||19720930|F|||||||||||||||||||||||||||
OBR||4|10082788443|MYOVIEW|||||||||||||||||||||||||||||||||||||||||||||||
OBX|1|TX|4^INJECTION||{ "INJECTIONDACS":{ "ID_INJECTION":4, "DATE_INJECTION":"20200304", "HEURE_INJECTION":"1000",
"PATIENT":"LASTNAME FIRSTNAME", "NUM_DOSSIER":"", "NIP":"0900371760", "POIDS":110, "TAILLE":182, "EXAMEN":"MYOVIEW",
"EXAMEN_LIBELLE":"MYOVIEW", "SITE_INJECTION":"Pied G", "NUCLEIDE":"TC 99 M", "ACTIVITE_INJECTEE":"847.00", "UNITE":"MBq",
"OPERATEUR":"BOUVERET", "LOT":"ZCEP092", "PRODUIT_REA":"g\u00e9n\u00e9rateur Tc99m 8,6", "LOT_TROUSSE":"1125437",
"PRODUIT_TROUSSE":"MYOVIEW" } }||||||F|||||||||||||
```

The fields marked in grey are those fields read and stored in the DoseWatch database, although not all are visible in DoseWatch as of now.

3.4.3 ORU^R01 Systec Inoue - ShadeQuest/RIS integration

ShadeQuest/RIS from Systec Inoue produces custom HL7 ORU messages containing Nuclear Medicine isotope data. DoseWatch uses the ORU message to update or create information concerning a specific examination of nuclear medicine. Different information in the study can be changed as the activity, injection datetime… This information is stored in OBX segments.

3.4.3.1 Message acquisition

Systec Inoue – ShadeQuest/RIS HL7 interface supports the HL7 MLP communication.

3.4.3.2 MSH Segment

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ORU”; the second component shall have value of R01. The third component is optional; however, if present, it shall have a value of ORU_R01.

3.4.3.3 PID Segment

The following table lists required fields in the PID segment.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1
5	48	XPN	R	Patient Name	• Last Name is read from PID-5.2 • First Name is read from PID-5.1 • Middle Name is read from PID-5.3 • Suffix is read from PID-5.4 • Prefix is read from PID-5.5
7	26	TS	O	Date/Time Of Birth	Date of Birth is read from PID-7. The format should be • YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][+/-ZZZZ]^<degree of precision> Usually, DoseWatch receive date formatted this way YYYYMMDD

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
8	1	IS	O	Administrative Sex	Sex code is read from PID-8. DoseWatch manage all values specified in the standard: • F converted to “Female” • M converted to “Male” • U converted to “Unknown” (default if nothing specified) • A converted to “Ambig” for ambiguous • N converted to “Not_app” for not applicable • O converted to “Other”

3.4.3.4 PV1 Segment

See required fields in Section PV1 Segment (**Error! Reference source not found.**).

3.4.3.5 OBR Segment

See required fields in Section OBR Segment (3.1.8).

3.4.3.6 OBX Segment

See required fields in Section OBX Segment (3.1.9).

Systec Inoue provides one information per OBX. OBX index may vary depending on the available data (for example, patient’s height and weight are not always provided). Radiopharmaceutical is currently not supported, only the isotope is available.

HL7 messages without isotope information are not processed by DoseWatch.

3.4.3.7 ORU^R01 message example

The example below shows a message sent for an NM procedure involving a pharmaceutical injection.

```
MSH|^~\&|SendApp|RIS|DOSE|DOSE|20200101121212.777||ORU^R01^ORU_R01|MIS2021081900036776|P|2.3.1||||||8859/1||
PID|||PATIENTID||FIRSTNAME^LASTNAME||20210220|F
PV1|||I|^^^|||||^^^^^
OBR|1|ACCESSIONNUMBER||610320^STUDYDESCRIPTION^||||||||||||||ACCESSIONNUMBER
OBX|1|NM|HEIGHT^Patient Height||62|cm|||||F
OBX|2|NM|WEIGHT^Patient Weight||6.69|kg|||||F
OBX|3|ST|Isotope||99mTc||||||F
OBX|4|NM|Administered Activity||19.5|MBq|||||F
OBX|5|ST|Accession Number||ACCESSIONNUMBER||||||F
OBX|6|DT|Injection Date and Time||2021-07-27 10:38||||||F
OBX|7|ST|Study description||STUDYDESCRIPTION||||||F
```

The fields marked in grey are those fields read and stored in the DoseWatch database, although not all are visible in DoseWatch as of now.

3.4.4 Generic requirements specifications

Editors who are considering the ad hoc development of an HL7 interface to DoseWatch for Nuclear Medicine can follow the requirements in this Section.

Editors must contact DoseWatch Project Manager to get their HL7 message structure and content reviewed and approved prior development.

3.4.4.1 Message Communication

While DoseWatch HL7 interface engine can poll message files from a shared folder, it is recommended to communicate message using HL7 MLP.

3.4.4.2 MSH Segment

Field MSH-9 Message Type shall have at least two components. The first component shall have a value of “ORU”; the second component shall have value of R01.

The third component is optional; however, if present, it shall have a value of ORU_R01.

3.4.4.3 PID Segment

See required fields in Section **Error! Reference source not found.**.

It is expected that the patient identifier provided within the HL7 message about radiopharmaceutical administration is used when performing the related image acquisitions.

If this is not the case at the considered site, please inform DoseWatch Project Manager for further investigation.

3.4.4.4 PV1 Segment

See required fields in Section **Error! Reference source not found.**.

3.4.4.5 OBR Segment

See required fields in Section **Error! Reference source not found.**.

It is expected that the Accession Number provided within the HL7 message about radiopharmaceutical administration is used when performing the related image acquisitions.

If this is not the case at the considered site, please inform DoseWatch Project Manager for further investigation.

3.4.4.6 OBX Segment

All information related to the administered radiopharmaceutical shall be provided within OBX Segment. The relevant information elements are listed in the table below.

Editor can choose

1. to convey each element in a dedicated, numbered OBX segment,
2. or to group all information within a single OBX segment.

Option 1 is preferred and recommended.

Information Element	Field Value	Example	Format	Length	Description
Dispense Unit Identifier	Mandatory	67553	String	-	Unique identifier of the administration (Syringe ID for example)
Radiopharmaceutical & Isotope	Mandatory	Carbon^14^ D-xylose | ^14^Carbon	String	255	The radiopharmaceutical and the radioisotope
Administered Activity	Mandatory	48.06	Number	-	The activity when the radiopharmaceutical is administered to the patient. Unit: MBq
Injection Date & Time	Recommended	201911071138	YYYYMMDDHHMM	-	Date & Time of radiopharmaceutical administration to the patient for imaging purposes.
Administration path	Recommended	Intravenous route Via radial artery Bilateral	String	255	Route of administration (Ideally assembling the route of administration, site of administration and laterality if available)

Operator	Optional	John Doe	String	255 per part	The person responsible for the administration of radiation (first name, last name, middle name, name suffix, name prefix).
Referring Physician	Optional	Jane Doe	String	255 per part	The person responsible for referring the patient for the procedure (first name, last name, middle name, name suffix, name prefix).

3.4.4.7 HL7 message for multiple radiopharmaceutical administrations

When an NM procedure requires multiple administration of pharmaceuticals, it is strongly recommended to issue one HL7 message per administration. In such case

1. the patient and examination context provided within the PID, PV1 and OBR segments shall be shared across messages related to the same NM procedure.
2. The dispense Unit Identifier shall be used to distinguish the multiple administrations associated to the same procedure.

3.4.5 DoseWatch behavior upon the reception of ORU^R01 message

DoseWatch can process radiopharmaceutical administration data received before or after the related image acquisition (which DoseWatch receives DICOM data for).

It is however strongly recommended to send the HL7 message as soon as possible after the administration event.

DoseWatch shall process a single message per administration, so the message is expected to be sent once all data elements are available in the emitting system. I.e., if a second HL7 message is sent about a radiopharmaceutical administration later, e.g., to add the injection date/time, it shall be ignored.

4 Outbound HL7 Interface Technical Specifications

4.1 Sharing Radiation Dose

DoseWatch supports an HL7 Outbound interface to share some of the radiation dose information stored in its database with other information systems.

An example of information to be shared is the examination dose report:

Exam dose summary for "<study description>" on <Study Date> <Study Time>:

Total number of exposures: <*number*>

Topogram:	kV=120	mAs=98		
HYPO SI:	kV=120	mAs=1503	CTDIvol=52.23	DLP=298
HYPO ART:	kV=120	mAs=1594	CTDIvol=61.81	DLP=316
HYPO VEIN:	kV=120	mAs=1466	CTDIvol=55.71	DLP=290
CRANE Tardif:	kV=120	mAs=5363	CTDIvol=59.58	DLP=1092

End of exam dose summary.

By default, DoseWatch is configured to use HL7 ORM or ORU messages and OBR/OBX segments to communicate this information.

However, since HL7 Standard does not specify how to communicate radiation dose information through HL7 V2 messages, the type and content of the outbound interface messages can be configured and customized to some extend to adapt to the destination systems requirements.

Any such adaptation needed must be discussed and agreed with DoseWatch Data Engineering Team and may be subject to additional services charges.

Depending on the amount of information provided by other systems such as modality devices, and departmental information systems, DoseWatch may not be able to provide all data listed in the following tables. Integration testing at customer site is required to confirm the actual outbound message content.

4.1.1 Common Segments

This section describes the content of the HL7 Segments used within supported messages, including how segment elements and element components are mapped from DoseWatch database.

4.1.1.1 MSH Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	1	ST	R	Field Separator	
2	4	ST	R	Encoding Characters	
3	180	HD	O	Sending Application	DoseWatch
4	180	HD	O	Sending Facility	
5	180	HD	O	Receiving Application	
6	180	HD	O	Receiving Facility	
7	26	TS	R	Date/Time of Message	
8	40	ST	O	Security	
9	7	CM	R	Message Type	"ORM^O01" or "ORU^R01"
10	20	ST	R	Message Control ID	
11	3	PT	R	Processing ID	
12	60	VID	R	Version ID	

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
13	15	NM	O	Sequence Number	
14	180	ST	O	Continuation Pointer	
15	2	ID	O	Accept Acknowledgment Type	
16	2	ID	O	Application Acknowledgment Type	
17	2	ID	O	Country Code	
18	16	ID	O	Character Set	
19	60	CE	O	Principal Language of Message	
20	20	ID	O	Alternate Character Set Handling Scheme	

Field MSH-18 Character Set shall only be valued if the message utilizes character sets other than ISO IR-6, also known as ASCII.

4.1.1.2 MSA Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	2	ID	R	Acknowledgment Code	Not sent.
2	20	ST	R	Message Control ID	Not sent.
3	80	ST	O	Text Message	Not sent.
4	15	NM	O	Expected Sequence Number	Not sent.
5	1	ID	O	Delayed Acknowledgment Type	Not sent.
6	100	CE	O	Error Condition	Not sent.

Field MSA-2 Message Control ID shall contain the Message ID from the MSH-10 Message Control ID of the incoming message for which this acknowledgement is sent.

4.1.1.3 PID Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	4	SI	O	Set ID – Patient ID	Not sent.
2	20	CX	O	Patient ID	
3	20	CX	R	Patient Identifier List	• PID-3.1.1 is Patient ID • PID-3.1.4.1 is Patient Identifier Domain/Assigning Authority • PID-3.1.4.2 Assigning Authority Universal Id – if available • PID-3.1.4.3 Assigning Authority Universal Id type – If available Note: The patient identifier domain provided is the one used in the related examination.
4	20	CX	O	Alternate Patient ID	Not sent.
5	48	XPN	R	Patient Name	• Last Name in PID-5.1.1.1 • First Name in PID-5.1.2 • Middle Name in PID-5.1.3 • Suffix in PID-5.1.4 • Prefix in PID-5.1.5
6	48	XPN	O	Mother's Maiden Name	Not sent.
7	26	TS	R2	Date/Time of Birth	PID-7.1 is Date of birth, the format used is YYYYMMDD
8	1	IS	R	Sex	PID-8 is Sex code DoseWatch can send all values specified in the standard: • F - "Female" • M - "Male" • U - "Unknown"

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
					• A – "Ambiguous" • N – "Not applicable" • O - "Other"
9	48	XPN	O	Patient Alias	Not sent.
10	80	CE	R2	Race	Not sent.
11	106	XAD	R2	Patient Address	Not sent.
12	4	IS	O	Country Code	Not sent.
13	40	XTN	O	Phone Number – Home	Not sent.
14	40	XTN	O	Phone Number – Business	Not sent.
15	60	CE	O	Primary Language	Not sent.
16	1	IS	O	Marital Status	Not sent.
17	80	CE	O	Religion	Not sent.
18	20	CX	C	Patient Account Number	Not sent.
19	16	ST	O	SSN Number – Patient	Not sent.
20	25	DLN	O	Driver's License Number – Patient	Not sent.
21	20	CX	O	Mother's Identifier	Not sent.
22	80	CE	O	Ethnic Group	Not sent.
23	60	ST	O	Birth Place	Not sent.
2	1	ID	O	Multiple Birth Indicator	Not sent.
25	2	NM	O	Birth Order	Not sent.
26	80	CE	O	Citizenship	Not sent.
27	60	CE	O	Veterans Military Status	Not sent.
28	80	CE	O	Nationality	Not sent.

4.1.1.4 PV1 Segment

The PV1 Segment is not used by DoseWatch in outbound interface.

4.1.1.5 ORC Segment

The ORC Segment is provided by DoseWatch. Only one field is filled, the ORC.3 – Filler Order Number: the accession number.

4.1.1.6 OBR Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	4	SI	O	Set ID – OBR	Not sent.
2	75	EI	C	Placer Order Number	Not sent.
3	75	EI	O	Filler Order Number	Imaging Service Request (a.k.a Accession Number) also provided in OBR-18.
4	200	CE	R	Universal Service ID	When data is available in DoseWatch database: • OBR-4.1 is Study Code • OBR-4.2 is Study Description
5	2	ID	B	Priority	Not sent.
6	26	TS	B	Requested Date/Time	Not sent.
7	26	TS	C	Observation Date/Time	Study DateTime
8	26	TS	O	Observation End Date/Time	Not sent.
9	20	CQ	O	Collection Volume	Not sent.
10	60	XCN	O	Collector Identifier	Not sent.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
11	1	ID	O	Specimen Action Code	Not sent.
12	60	CE	O	Danger Code	Not sent.
13	300	ST	O	Relevant Clinical Info	Relevant Radiation Information
14	26	TS	B	Specimen Received Date/Time	Not sent.
15	300	CM	C	Specimen Source	Not sent.
16	80	XCN	R	Ordering Provider	Not sent.
17	40	XTN	O	Order Callback Phone Number	Not sent.
18	60	ST	O	Placer Field 1	Accession Number (a.k.a Imaging Service Request)
19	60	ST	O	Placer Field 2	Study ID (a.k.a Requested Procedure ID)
20	60	ST	O	Filler Field 1	Not sent.
21	60	ST	O	Filler Field 2	Not sent.
22	26	TS	O	Results Rpt/Status Chng – Date/Time	Study DateTime
23	40	CM	O	Charge to Practice	Not sent.
24	10	ID	O	Diagnostic Serv Sect ID	Not sent.
25	1	ID	O	Result Status	Not sent.
26	400	CM	O	Parent Result	Not sent.
27	200	TQ	R	Quantity/Timing	Not sent.
28	150	XCN	O	Results Copies To	Not sent.
29	150	CM	C	Parent	Not sent.
30	20	ID	R2	Transportation Mode	Not sent.
31	300	CE	R2	Reason for Study	Not sent.
32	200	CM	O	Principal Result Interpreter	Not sent.
33	200	CM	O	Assistant Result Interpreter	Not sent.
34	200	CM	O	Technician	Not sent.
35	200	CM	O	Transcriptionist	Not sent.
36	26	TS	O	Scheduled Date/Time	Not sent.
37	4	NM	O	Number of Sample Containers	Not sent.
38	60	CE	O	Transport Logistics of Collected Sample	Not sent.
39	200	CE	O	Collector's Comment	Not sent.
40	60	CE	O	Transport Arrangement Responsibility	Not sent.
41	30	ID	R2	Transport Arranged	Not sent.
42	1	ID	O	Escort Required	Not sent.
43	200	CE	O	Planned Patient Transport Comment	Not sent.
44	80	CE	O	Procedure Code	Not sent.
45	80	CE	O	Procedure Code Modifier	Not sent.

4.1.1.7 ZDS Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	200	RP	R	Study Instance UID	ZDS-1.1 is Study Instance UID

Z Segment Study Instance UID Element Components

Component Number	Component Name	Contains
1	Reference Pointer	DICOM compliant Study Instance UID value
2	Application ID	Implementation specific (e.g., name of the sending application).
3	Type of Data	“Application”
4	Subtype	“DICOM”

4.1.2 Outbound ORM messages

When DoseWatch uses outbound ORM messages, the examination dose report can be provided using NTE segments.

This section specifies the additional segments which compose the outbound ORM message with the common segments described previously.

4.1.2.1 ORM^O01 Message Semantic

The DoseWatch outbound HL7 ORM message is: MSH PID OBR ORC ZDS.

ORM^O01 message sent by DoseWatch have the follow this semantic:

Segment	Description
MSH	Message Header
PID	Patient
ORC	Common Order
OBR	Observation Request
ZDS	Z Segment Study Instance UID

The different segments used by ORM^O01 are already described in the section “Common Segments”.

4.1.2.2 OBR segment

The OBR segment contains most of the useful information.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
3	75	EI	O	Filler Order Number	Imaging Service Request (a.k.a Accession Number) also provided in OBR-18.
4	200	CE	R	Universal Service ID	When data is available in DoseWatch database: • OBR-4.1 is empty • OBR-4.2 is Study Description
7	26	TS	C	Observation Date/Time	Study DateTime
13	300	ST	O	Relevant Clinical Info	Relevant Radiation Information
18	60	ST	O	Placer Field 1	Accession Number (a.k.a Imaging Service Request)
22	26	TS	O	Results Rpt/Status Chng – Date/Time	Study DateTime

4.1.2.3 ORM^O01 Message Example

```
MSH|^~\&|DoseWatch|DEFAULT_FACILITY|RecApp|RecFac|20220901135155||ORM^O01|22|P|2.4||||||8859/1||||
PID|1|PatientID_GE|PatientID_GE^^^||PatientName_GE^^||20000101|M|PatientName_GE^|||||||||||||||||||||||202209010
151|DEFAULT_FACILITY|||||
ORC|SC||AccessionNumber_GE|||||||||||||||||||||
OBR|||AccessionNumber_GE|^CORONAROGRAPHIE /- CONTROLE PONTAGE^|||20170911113951|||||| CORONAROGRAPHIE /-
CONTROLE PONTAGE:~~DAP Total: 2786.3999999999996 dGy.cm^2~Kair: 3885.3 mGy~Total time of fluoro: 5346
s|||||AccessionNumber_GE|AccessionNumber_GE|AccessionNumber_GE||201709111139|||||||||||||||||||||||||
ZDS|1.2.840.113619.2.326.0.0001.940809305^DoseWatch^Application^DICOM|
```

4.1.3 Outbound ORU messages

When DoseWatch uses outbound ORU messages, the examination dose report can be provided using OBX segments.

This section specifies the additional segments which compose the outbound ORU message with the common segments described previously.

4.1.3.1 ORU^R01 Message Semantic

The DoseWatch outbound HL7 ORU message is: MSH PID OBR {OBX} ZDS.

ORM^O01 message sent by DoseWatch have the follow this semantic:

Segment	Description
MSH	Message Header
PID	Patient
OBR	Observation Request
{OBX}	Observation/Result
ZDS	Z Segment Study Instance UID

The different segments used by ORM^O01 are already described in the section “Common Segments”.

4.1.3.2 OBX Segment

DoseWatch provides the examination dose report (see example in 3.4.2) within OBX segments. OBX segments are repeated to provide one line of the dose report by individual NTE segment.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	4	SI	R	Set ID – OBX	Number of the dose report line, starting from 1.
2	3	ID	R	Value Type	“TX”
3	80	CE	R	Observation Identifier	“DoseWatch”
4	20	ST	C	Observation Sub-ID	Not sent.
5	2000		R	Observation value	Contains the examination dose report. One line of the dose report is provided within each repeated OBX segment

4.1.3.2.1 OBX segment example

OBX|1|TX|DoseWatch||Exam dose summary for “<study description>” on <Study Date> <Study Time>:|

OBX|2|TX|DoseWatch||Total number of exposures : <number>|

OBX|3|TX|DoseWatch||Topogram: kV=120 mAs=98|

OBX|4|TX|DoseWatch||HYPO SI: kV=120 mAs=1503 CTDIvol=52.23 DLP=298|

OBX|5|TX|DoseWatch||HYPO ART: kV=120 mAs=1594 CTDIvol=61.81 DLP=316|

OBX|7|TX|DoseWatch||CRANE Tardif: kV=120 mAs=5363 CTDIvol=59.58 DLP=1092|

OBX|8|TX|DoseWatch||End of exam dose summary.|

4.1.3.3 Example of ORU^R01 message

MSH|^~\&|DW|DW|DST|DST|20220901160626||ORU^R01|12|P|2.4|||||8859/1||||
PID|||PatientID_GE^^^||PatientName_GE^^||20000101|M|PatientName_GE^|||||||||||||||||||||||202209010406|DEFAULT_FACILITY|||||
OBR||AccessionNumber_GE|AccessionNumber_GE|DoseWatch^Dose Report from DoseWatch:CORONAROGRAPHIE /- CONTROLE PONTAGE^DoseWatch|||20170911113951|20220901160626|||||||||||||20220901160626|||F|||||||||||||||||||||
OBX|1|TX|DoseWatch1||Exam dose summary for CORONAROGRAPHIE /- CONTROLE PONTAGE at 20170911113951||||||F|||||||||

```
OBX|2|TX|DoseWatch2||Total number of exposures : 7 ||||||F|||||||||
OBX|3|TX|DoseWatch3|| Total DAP : 3715.20 dGy.cm^2 ||||||F|||||||||
OBX|4|TX|DoseWatch4||1 Cardiac Faible dose DYNAMIC : DAP series = 1.80 dGy.cm^2Entrance Dose series = 2.44
mGy||||||F|||||||||
OBX|5|TX|DoseWatch5||1 Cardiac Faible dose FLUORO : DAP series = 3.50 dGy.cm^2Entrance Dose series = 4.62
mGy||||||F|||||||||
ZDS|1.2.840.113619.2.326.0.0001.940809305^DoseWatch^Application^DICOM|
```

4.1.4 Outbound Radiation Dose Summary resources

DoseWatch can share radiation information summary FHIR® resources as defined by HL7® implementation guide available at: http://hl7.org/fhir/uv/radiation-dose-summary/2022Jan/. In order to share Radiation Summary resources, DoseWatch act as a Radiation Dose Summary Producer actor, and follow the capability statement defined under the implementation guide: http://hl7.org/fhir/uv/radiation-dose-summary/2022Jan/CapabilityStatement-RDSP.html. DoseWatch is capable of participating in the workflow defined in use case 1 of the IG: Imaging Report Construction, and can make all the needed queries to the FHIR® server in order to collect the right resources identifier, and to construct to corresponding Bundle, as described in the section Actors communication from the IG.

The following table is a summary of the capability statement for this functionality:

Mode	CLIENT
Transaction	yes
System History	
System Search	yes

Resource Type	Profile	Read	Search	Update	Create
Patient		yes	yes		yes
Practitioner		yes	yes		yes
ImagingStudy		yes	yes		yes
Device		yes	yes		yes
Observation		yes	yes		yes

This capability was tested successfully during the HL7® FHIR® Connectathon N°28 (September 2021) and N°29 (January 2022).

5 Messages for Patient Identification Cross-Referencing (PIX)

5.1 PIX Query

The PIX query is a synchronous query as it is defined in the IHE IT Infrastructure Technical Framework, under https://profiles.ihe.net/ITI/TF/Volume1/ch-5.html. The goal is to query synchronously a PIX manager or MPI server with a patient ID and domain information as entry parameter and get back the list of patient IDs linked together in the PID-3 field.

5.1.1 QBP^Q23 Message Specification

5.1.1.1 Message semantics

The message sent by DoseWatch to the PIX manager contains the following segments:

Segment	Description	DoseWatch behavior
MSH	Message Header	Used
QPD	Query Parameter Definition	Used
RCP	Response Control Parameter	Used
[DSC]	Continuation Pointer	Not Used

5.1.1.2 QPD segment

The QPD contains all elements necessary for the query.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	250	CE	R	Message Query Name	e.g., IHE PIX Query
2	32	ST	R+	Query Tag	e.g., Q20140408132438354
3	250	CX	R	Person Identifier	i.e., <Patient_id>^^^<Assigning_authority>&<Universal_id>&<Universal_Id_type>
4	250	CX	O	What Domains Returned	i.e., ^^^<Assigning_authority>&<Universal_id>&<Universal_Id_type> Note: Usually Dosewatch doesn't use this parameter and ask the PIX manager all identifiers known.

5.1.2 Example of PIX Query message

```
MSH|^~\&|DOSEWATCH|GE|PIX_X_REF_MGR_Acuo_6|Acuo|20140408132438||QBP^Q23^QBP_Q21|DW131200140221|P|2.5
QPD|IHE PIX Query|Q20140408132438354|IHEFACILITY-1034^^^IHEFACILITY&1.3.6.1.4.1.21367.3000.1.6&ISO
RCP|I
```

5.2 PIX Query Results

5.2.1 RSP^K23 Message Specification

The PIX manager shall return the following message: K23 – Corresponding patient identifiers

5.2.1.1 Message semantics

The message returned by the PIX manager shall contain the following segments:

Segment	Description	DoseWatch behavior
MSH	Message Header	Used
MSA	Message Acknowledgement	Used
[{ERR}]	Error segment	Used
QAK	Query Acknowledgment	Used
QPD	Query Parameter Definition	Used
[PID]	Patient Identification	Used

The other segments can be received by DoseWatch, but they will be ignored.

5.2.1.2 PID segment

The PID segment read by DoseWatch shall be formatted like:

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	4	SI	O	Set ID – Patient ID	Not stored.
2	20	CX	O	Patient ID	
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1.1 • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1 • UniversalId is read from PID-3.1.4.2 • UniversalIdType is read from PID-3.1.4.3 Each element of the list must be separated by the '~' character.
5	48	XPN	O	Patient Name	• Last Name is read from PID-5.1.1.1 • First Name is read from PID-5.1.2 • Middle Name is read from PID-5.1.3 • Suffix is read from PID-5.1.4 • Prefix is read from PID-5.1.5
7	26	TS	O	Date/Time Of Birth	The format should be • YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][+/-ZZZZ]^<degree of precision> Usually, DoseWatch receives date formatted this way YYYYMMDD
8	1	IS	O	Administrative Sex	Sex code is read from PID-8. DoseWatch manages all values specified in the standard: • F converted to "Female" • M converted to "Male" • U converted to "Unknown" (default if nothing specified) • A converted to "Ambig" for ambiguous • N converted to "Not_app" for not applicable • O converted to "Other"

Note about the PID-5 element in a PIX response: IHE says "To eliminate the issue of conflicting name values between Patient Identifier Domains, the Patient Identifier Cross-reference Manager Actor shall return in an empty (not present)

value in the first repetition of field PID-5-Patient Name, and shall return a second repetition of field *PID-5-Patient Name* in which the only populated component is Component 7 (Name Type Code). Component 7 of repetition 2 shall contain a value of S (Coded Pseudo-name to assure anonymity). All other components of repetition 2 shall be empty (not present).” However, DoseWatch can read the PID-5 if presents. It allows facilities having only a MPI server communicating with DoseWatch to synchronize patient name with DoseWatch.

5.2.1.2.1 Example of PID -3 element:

<Patient_id_1>^^^<Assigning_autorithy_1>&<Universal_id_1>&<Universal_id_type-1>~
<Patient_id_2>^^^<Assigning_autorithy_2>&<Universal_id_2>&<Universal_id_type-2>~
<Patient_id_3>^^^<Assigning_autorithy_3>&<Universal_id_3>&<Universal_id_type-3>…

5.2.2 Example of RSP^K23 message

```
MSH|^~\&|EHR_ITH-ICOSERVE_sen|ITH-ICOSERVE|DOSEWATCH|GE|20140408120314||RSP^K23^RSP_K23|1396951394498115|P|2.5
MSA|AA|DW131200140221
QAK|Q20140408120314304|OK|IHE PIX Query|13
QPD|IHE PIX Query|Q20140408120314304|IHEFACILITY-1034^^^IHEFACILITY&1.3.6.1.4.1.21367.3000.1.6&ISO|^^^IHERED&1.3.6.1.4.1.21367.13.20.1000&ISO
PID|||26f12c02-197d-472a-81fc-fb2bcf75086f^^^XDS Affinity Domain 1&1.1.1&ISO^GPI~DDS-1034^^^DDS&1.3.6.1.4.1.12559.11.1.4.1.2&ISO^PI~ICO001^^^TIEH&1.3.6.1.4.1.21367.2011.2.5.5384&ISO^PI~IHEFACILITY-1034^^^IHE-FACILITY&1.3.6.1.4.1.21367.3000.1.6&ISO^PI~IHEBLUE-1034^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO^PI~IHEBLUE-997^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO^PI~IHEGREEN-1034^^^IHEGREEN&1.3.6.1.4.1.21367.13.20.2000&ISO^PI~IHEGREEN-997^^^IHEGREEN&1.3.6.1.4.1.21367.13.20.2000&ISO^PI~IHERED-1034^^^IHERED&1.3.6.1.4.1.21367.13.20.1000&ISO^PI~IHERED-997^^^IHERED&1.3.6.1.4.1.21367.13.20.1000&ISO^PI~12345^^^ADT_Avintis_WSO2&1.3.6.1.4.1.21367.2011.2.5.5387&ISO^PI~XT-1^^^&1.3.6.1.4.1.21367.2011.2.5.5401&ISO^PI~1^^^&1.3.6.1.4.1.21367.2011.2.5.5394&ISO^PI||~^^^^^^S
```

5.3 PIX Update Notification – Message ADT^31

DoseWatch can link/unlink patient identifiers based on unsolicited ADT^31 messages from the PIX Manager.

5.3.1 ADT^A31 Message Specification

The message received by DoseWatch from the PIX manager should contain the segments described by the section "ADT Messages Semantic".

5.3.1.1 PID Segment

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
3	20	CX	R	Patient Identifier List	• Patient ID is read from PID-3.1.1 • Patient Identifier Domain/Assigning Authority is read from PID-3.1.4.1 • UniversalId is read from PID-3.1.4.2 • UniversalIdType is read from PID-3.1.4.3 Each element of the list must be separated by the '~' character. All identifiers from the list are read
5	48	XPN	R	Patient Name	• Last Name is read from PID-5.1.1.1 • First Name is read from PID-5.1.2 • Middle Name is read from PID-5.1.3 • Suffix is read from PID-5.1.4 • Prefix is read from PID-5.1.5
7	26	TS	O	Date/Time Of Birth	The format should be • YYYY[MM[DD[HHMM[SS[.S[S[S[S]]]]]]]][+/-ZZZZ]^<degree of precision> Usually, DoseWatch receives date formatted this way YYYYMMDD
8	1	IS	O	Administrative Sex	Sex code is read from PID-8. DoseWatch manages all values specified in the standard: • F converted to "Female" • M converted to "Male" • U converted to "Unknown" (default if nothing specified) • A converted to "Ambig" for ambiguous • N converted to "Not_app" for not applicable • O converted to "Other"

Other elements are optional and not read by DoseWatch.

The list of cross-referenced patient IDs shall be contained in the PID-3 Patient Identifier List.

Here is an example of the format of PID-3 for three patient identifiers in three different domains:

<Patient_id_1>^^^<Assigning_autorithy_1>&<Universal_id_1>&<Universal_id_type-1>~
<Patient_id_2>^^^<Assigning_autorithy_2>&<Universal_id_2>&<Universal_id_type-2>~
<Patient_id_3>^^^<Assigning_autorithy_3>&<Universal_id_3>&<Universal_id_type-3>

5.3.2 Example of ADT^A31 message

```
MSH|^~\&|SendApp|SendFac|DoseWatch|GE|20180419162825||ADT^A31^ADT_A05|3VJTJNFBKUO|P^T|2.5||232445234 |AL
EVN|A31|20180419162825
PID|||IHEBLUE-997^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO~IHEFACILITY-
997^^^IHEFACILITY&1.3.6.1.4.1.21367.3000.1.6&ISO~IHEGREEN-997^^^IHEGREEN&1.3.6.1.4.1.21367.13.20.2000&ISO~IHERED-
997^^^IHERED&1.3.6.1.4.1.21367.13.20.1000&ISO~Tiani-12345^^^TIE5&1.3.6.1.4.1.21367.2011.2.5.5491&ISO||
PV1||N
```

5.4 DoseWatch behavior upon the reception of a PIX message (RSP^K23 or ADT^A31)

5.4.1 Link patients

When DoseWatch receives a PIX response or a PIX Update message DoseWatch will link identifiers returned in the query. The first step that DoseWatch will do is to identify the Assigning Authority sent with patients Id. Only Assigning Authorities configured in DoseWatch will be considered, other will be ignored. Then an existing patient in database will be searched within the list of identifiers returned (with the patient Id and its Assigning Authority) to link all identifiers to this existing patient. If no existing patient is identified, DoseWatch won't do anything as we don't want to store patients without examination.

5.4.2 Unlink patients

Two cases can be configured to unlink patient.

In the following example, DoseWatch will receive three patient identifiers A, B, C to link. In database, we will create these links. In a second call to the PIX manager, it will send only A and B patient identifiers. By default, if DoseWatch will link patient identifiers A and B and unlink the patient C. However, it is possible to deactivate this behavior and to keep these three identifiers linked. This is useful for example if a domain is de-activated in the PIX manager and we want to keep information about the domain deleted.

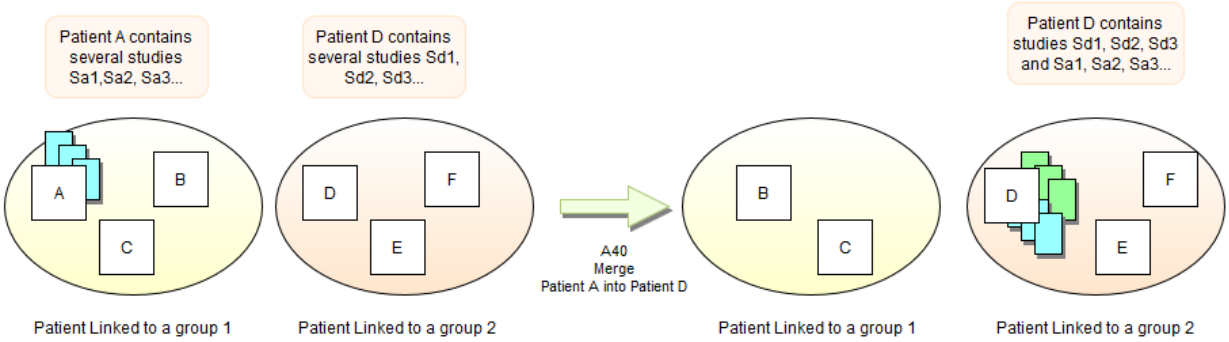
5.4.3 DoseWatch behavior after a Merge patients (ADT^A40 when patients are linked)

Two cases can be configured in DoseWatch when an A40 message is received when patient IDs are linked together:

Case 1:

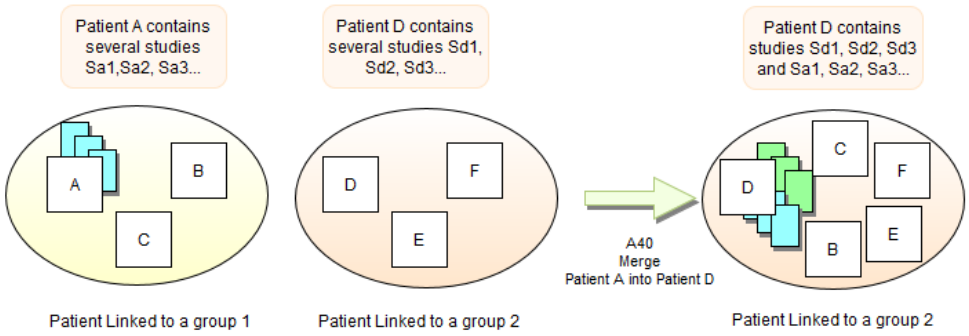
In the case described in the schema below, we have six patient identifiers A, B and C linked together and D, E and F forming another group.

When a merge happens, asking the merge of the patient A into the patient D, patient A is deleted, and all studies attached to this patient are assigned to the patient D. The patient B and C are still linked together and D, E, F also.



Case 2:

In this case, all patients attached to the patient A are moved to group of patient D. This case can be configured when a merge at “physical” patient level is needed and not only a patient id merge. It will result that the patient A is merge into the patient D, all studies from the patient A are moved into the patient D. Then patient Identifiers B, C, D, E and F are linked together.



5.5 Demographic information read in RSP^K23

As described in “RSP^K23 Message Specification” demographic shall not be present in the PIX response to keep the query anonymous. However, DoseWatch can read demographic if present. A specific option gives the ability to DoseWatch to synchronize demographics on all patients linked in the message. As we consider that in some case the PIX manager would contain the most up-to-date information on the patient, demographics a read and updated in the system.

5.6 PIX-m on FHIR capability

DoseWatch supports PIX using standard HL7® FHIR® R4. The workflow is the same as specified in the previous subchapter, but a HTTP request is generated instead of an LLP query. DoseWatch supports both XML and JSON format.

5.6.1 PIX-m on FHIR using JSON format

- PIX-m Consumer queries PIX Manager with a local ID for a patient without specifying targetSystem (domain)

Example of request:

```
DefaultHttpRequest(chunked: false)
GET /PIXFhir/r4/Patient/$ihe-pix?sourceIdentifier=urn:oid:1.3.6.1.4.1.21367.3000.1.6|IHEFACILITY-998&_format=json HTTP/1.1
Host: 172.16.0.13:11945
Accept: */*
Content-Type: application/fhir+json
```

Example of response that contains all targetSystems

```
{
   "resourceType":"Parameters",
   "parameter":[
      {
         "name":"targetIdentifier",
         "valueIdentifier":{
            "system":"urn:oid:1.3.6.1.4.1.21367.13.20.3000",
            "value":"IHEBLUE-998"
```

```
         }
      },
      {
         "name":"targetIdentifier",
         "valueIdentifier":{
            "system":"urn:oid:1.3.6.1.4.1.21367.13.20.2000",
            "value":"IHEGREEN-998"
         }
      },
      {
         "name":"targetIdentifier",
         "valueIdentifier":{
            "system":"urn:oid:1.3.6.1.4.1.21367.13.20.1000",
            "value":"IHERED-998"
         }
      },
      {
         "name":"targetIdentifier",
         "valueIdentifier":{
            "system":"urn:oid:1.3.6.1.4.1.21367.2011.2.5.5492",
            "value":"VTLYPX-1"
         }
      },
      {
         "name":"targetId",
         "valueReference":{
            "reference":"Patient/REG.1I0LKL9KB8"
         }
      }
   ]
}
```

- PIX-m Consumer queries PIX Manager with a local ID for a patient specifying targetSystem (domain)

Request:

```
DefaultHttpRequest(chunked: false)
GET /PIXFhir/r4/Patient/$ihe-pix?sourceIdentifier=urn:oid:1.3.6.1.4.1.21367.3000.1.6|IHEFACILITY-
998&targetSystem=urn:oid:1.3.6.1.4.1.21367.13.20.1000&_format=json HTTP/1.1
Host: 172.16.0.13:11945
Accept: */*
Content-Type: application/fhir+json
```

Response for the requested targetSystem

```
{
   "resourceType":"Parameters",
   "parameter":[
      {
         "name":"targetIdentifier",
         "valueIdentifier":{
            "system":"urn:oid:1.3.6.1.4.1.21367.13.20.1000",
            "value":"IHERED-998"
         }
      }
   ]
}
```

- PIX-m Consumer queries PIX Manager with a local ID for a patient but with no match on the PIX Manager. The HTTP response shall be with the code 404 and the JSON response shall be:

```
{
   "resourceType":"OperationOutcome",
   "issue":[
      {
         "severity":"error",
         "code":"not-found",
         "details":{
            "coding":[
               {
                  "system":"http://hl7.org/fhir/issue-type",
                  "code":"not-found"
               }
            ]
         },
         "diagnostics":"sourceIdentifier Patient Identifier not found"
      }
   ]
}
```

5.6.2 PIX-m on FHIR using XML format

- PIX-m Consumer queries PIX Manager with a local ID for a patient without specifying targetSystem (domain)

Request:

```
DefaultHttpRequest(chunked: false)
GET /PIXFhir/r4/Patient/$ihe-pix?sourceIdentifier=urn:oid:1.3.6.1.4.1.21367.3000.1.6|IHEFACILITY-998&_format=xml HTTP/1.1
Host: 172.16.0.13:11945
Accept: */*
Content-Type: application/fhir+xml
```

Response:

- PIX-m Consumer queries PIX Manager with a local ID for a patient specifying targetSystem (domain)

Request:

```
DefaultHttpRequest(chunked: false)
GET /PIXFhir/r4/Patient/$ihe-pix?sourceIdentifier=urn:oid:1.3.6.1.4.1.21367.3000.1.6|IHEFACILITY-998&targetSystem=urn:oid:1.3.6.1.4.1.21367.13.20.1000&_format=xml HTTP/1.1
Host: 172.16.0.13:11945
Accept: */*
Content-Type: application/fhir+xml
```

Response:

```
<?xml version="1.0" encoding="UTF-8"?><Parameters xmlns="http://hl7.org/fhir">
  <parameter>
    <name value="targetIdentifier"/>
    <valueIdentifier>
      <system value="urn:oid:1.3.6.1.4.1.21367.13.20.1000"/>
      <value value="IHERED-998"/>
    </valueIdentifier>
  </parameter>
</Parameters>
```

6 Patient Demographics Query (PDQ)

6.1 PDQ Query

The PDQ query is a synchronous query as it is defined in the IHE IT Infrastructure Technical Framework, under the link: https://profiles.ihe.net/ITI/TF/Volume2/ITI-21.html#3.21. The goal is to query synchronously a PDS (Patient Demographic Supplier) with a patient ID and a domain information as entry parameter and get back the patient demographic information under the PID segment.

6.1.1 QBP^Q22 Message Specification

6.1.1.1 Message semantics

The message sent by DoseWatch to the PDS contains the following segments:

Segment	Definition
MSH	Message Header
QPD	Query Parameter Definition
RCP	Response Control Parameter

6.1.1.2 MSH Segment

The HL7 Version used (MSH-12) is 2.5.

The Field MSH-9-Message Type contains the value “QBP^Q22^QBP_Q21”.

The sending application, sending facility, receiving application, and receiving facility are configurable.

6.1.1.3 QPD Segment

The QPD segment contains all the elements necessary for the query.

SEQ	LEN	DT	OPT	ELEMENT NAME	COMMENTS
1	250	CE	R	Message Query Name	e.g., GE DoseWatch
2	32	ST	R+	Query Tag	e.g., DW_20220726190445515
3	250	CX	R	Demographics Fields	Contains the list of key/values of (segment field name, values). E.g., @PID.3.1^IHERED-998~@PID.3.4.1^IHERED~@PID.3.4.2^1.3.6.1.4.1.21367.13.20.1000

6.1.1.4 Example of PDQ Query message

```
MSH|^~\&|DoseWatch|GE|PDQPDS|IHE|20220726190445||QBP^Q22^QBP_Q21|DW_20220726190445515|P|2.5
QPD|GEDoseWatch|DW_20220726190445515|@PID.3.1^IHERED998~@PID.3.4.1^IHERED~@PID.3.4.2^1.3.6.1.4.1.21367.13.20.1000
RCP|I
```

6.2 PDQ Query Results

6.2.1 RSP^K22 Message Specification

The PDS shall return the following message: K22 – Corresponding patients found with their demographic information.

6.2.1.1 Message semantics

The message returned by the PDS shall contain the following segments:

Segment	Description
MSH	Message Header

MSA	Message Acknowledgement
[{ERR}]	Error segment
QAK	Query Acknowledgment
QPD	Query Parameter Definition
[{PID}]	Patient Identification

6.2.1.2 PID segment

If multiple PID segments are received, the whole HL7 response is ignored.

The PID segment read by DoseWatch shall be formatted the same way as described in the paragraph “PID segment” from PIX chapter.

6.2.2 Example of RSP^K22 Message

```
MSH|^~\&|SendingApp|SendingFac|DoseWatch|GE|20210616200418||RSP^K22^RSP_K21|CBUFZTCC58OSJ59R8R|P^T|2.5|||NE|
||UNICODE UTF-8
MSA|AA|DW_20210616200415978
QAK|DW_20210616200415978|OK||1|1|0
QPD|GEDoseWatch|DW_20210616200415978|@PID.3.1^IHERED992~@PID.3.4.1^IHERED~@PID.3.4.2^1.3.6.1.4.1.21367.13.20.1000
PID|||IHERED992^^^IHERED&1.3.6.1.4.1.21367.13.20.1000&ISO~IHEBLUE992^^^IHEBLUE&1.3.6.1.4.1.21367.13.20.3000&ISO
||MOORE^CHIP^^^^^L||19380223|M|||10
PINETREE^^WEBSTER^MO^63119^USA||||||||||||||||||||20210613233358.333+0200
```

The fields marked in grey are the fields read and stored in the DoseWatch database following the PDQ query.

6.3 DoseWatch behavior upon the reception of a PDQ message (RSP^K22)

6.3.1 Link patients

When DoseWatch receives a PDQ response, DoseWatch will link identifiers returned in the query. The first step that DoseWatch will do is to identify the Assigning Authority sent with patients Id. Only Assigning Authorities configured in DoseWatch will be considered, other will be ignored. Then an existing patient in database will be searched within the list of identifiers returned (with the patient Id and its Assigning Authority) to link all identifiers to this existing patient. If no existing patient is identified, DoseWatch won’t do anything as we don’t want to store patients without examination.

6.4 Demographic information read in RSP^K22

DoseWatch reads demographic information if present. The selected information that DoseWatch use to update patient information are the patient’s name (first name, last name, and middle name), the patient sex, and the patient date of birth.

6.5 PDQm on FHIR capability

DoseWatch supports PDQm using standard HL7® FHIR® R4. The workflow is the same as specified in the previous subchapter, but a HTTP request is generated instead of an LLP query. DoseWatch supports both XML and JSON format. With FHIR®, we use the Patient resource in order to perform the query to the FHIR server, following the specification of IHE® PDQm profile.

6.5.1 PDQm on FHIR using JSON format

Here is an example of the query performed:

```
https://gazelle.ihe.net/PatientManager/fhir/Patient?identifier=urn:oid:1.3.6.1.4.1.21367.13.20.1000|IHERED-998&_format=json
```

Here is an example of the response:


```
{
  "resourceType": "Bundle",
  "id": "d9235550-1b99-427e-a6be-0c01866ec310",
  "meta": {
    "lastUpdated": "2022-08-31T11:41:57.366+02:00"
  },
  "type": "searchset",
  "total": 1,
  "link": [
    {
      "relation": "self",
      "url":
"https://gazelle.ihe.net/PatientManager/fhir/Patient?_format=application%2Ffhir%20json&identifier=urn%3Aoid%3A1.3.6.1.4.1.21367.13.20.1000%7CIHERED-998"
    }
  ],
  "entry": [
    {
      "fullUrl": "https://gazelle.ihe.net/PatientManager/fhir/Patient/8335",
      "resource": {
        "resourceType": "Patient",
        "id": "8335",
        "meta": {
          "profile": [    "http://ihe.net/fhir/StructureDefinition/IHE.PDQm.PatientResource"
          ]
        },
        "identifier": [
          {
            "system": "urn:oid:1.3.6.1.4.1.21367.13.20.1000",
            "value": "IHERED-998"
          },
          {
            "system": "urn:oid:1.3.6.1.4.1.21367.13.20.2000",
            "value": "IHEGREEN-998"
          }
        ],
        "active": true,
        "name": [
          {
            "use": "official",
            "family": "WALTERS",
            "given": [
              "WILLIAM"
            ]
          }
        ],
        "gender": "male",
        "birthDate": "1955-05-04",
        "address": [
          {
            "use": "home",
            "line": [
              "3900 FLORA PL"
```

```
            ],
            "city": "ST. LOUIS",
            "state": "MO",
            "postalCode": "63110",
            "country": "USA"
          }
        ]
      }
    }
  ]
}
```


The fields marked in grey are the fields read and stored in the DoseWatch database following the PDQm query.

6.5.2 PDQm on FHIR using XML format

Here is an example of the query performed:

```
https://gazelle.ihe.net/PatientManager/fhir/Patient?identifier=urn:oid:1.3.6.1.4.1.21367.13.20.1000|IHERED-998&_format=xml
```

Here is an example of the response:


```
<Bundle xmlns="http://hl7.org/fhir">
  <id value="70320b06-538a-4459-97d9-e5ebf5bc3c0f"/>
  <meta>
    <lastUpdated value="2022-08-31T11:47:13.333+02:00"/>
  </meta>
  <type value="searchset"/>
  <total value="1"/>
  <link>
    <relation value="self"/>
    <url
value="https://gazelle.ihe.net/PatientManager/fhir/Patient?_format=xml&amp;identifier=urn%3Aoid%3A1.3.6.1.4.1.21367.13.20.1000%7CIHERED-998"/>
  </link>
  <entry>
    <fullUrl value="https://gazelle.ihe.net/PatientManager/fhir/Patient/8335"/>
    <resource>
      <Patient xmlns="http://hl7.org/fhir">
        <id value="8335"/>
        <meta>
          <profile value="http://ihe.net/fhir/StructureDefinition/IHE.PDQm.PatientResource"/>
        </meta>
        <identifier>
          <system value="urn:oid:1.3.6.1.4.1.21367.13.20.1000"/>
          <value value="IHERED-998"/>
        </identifier>
        <identifier>
          <system value="urn:oid:1.3.6.1.4.1.21367.13.20.2000"/>
          <value value="IHEGREEN-998"/>
        </identifier>
        <active value="true"/>
        <name>
          <use value="official"/>
          <family value="WALTERS"/>
          <given value="WILLIAM"/>
```

```
        </name>
        <gender value="male"/>
        <birthDate value="1955-05-04"/>
        <address>
          <use value="home"/>
          <line value="3900 FLORA PL"/>
          <city value="ST. LOUIS"/>
          <state value="MO"/>
          <postalCode value="63110"/>
          <country value="USA"/>
        </address>
      </Patient>
    </resource>
  </entry>
</Bundle>
```

The fields marked in grey are the fields read and stored in the DoseWatch database following the PDQm query.

7 Security

The product supports communication through secure HL7 channels.

7.1 Supported Protocols

The product supports the following TLS protocols, for both client and server communications: SSLv3, TLSv1.0, TLSv1.1, and TLSv1.2. The default supported protocols are TLSv1.1 and TLSv1.2.

7.2 Supported Cipher suites

The table below describes the list of supported cipher suites, and the corresponding TLS protocols.

Ciphers	SSLv3	TLS1.0	TLS1.1	TLS1.2
AES128-GCM-SHA256	NO	NO	NO	YES
AES128-SHA	YES	YES	YES	YES
AES128-SHA256	NO	NO	NO	YES
AES256-GCM-SHA384	NO	NO	NO	YES
AES256-SHA	YES	YES	YES	YES
AES256-SHA256	NO	NO	NO	YES
CAMELLIA128-SHA	YES	YES	YES	YES
CAMELLIA256-SHA	YES	YES	YES	YES
DES-CBC3-SHA	YES	YES	YES	YES
ECDHE-RSA-AES128-GCM-SHA256	NO	NO	NO	YES
ECDHE-RSA-AES128-SHA	NO	YES	YES	YES
ECDHE-RSA-AES128-SHA256	NO	NO	NO	YES
ECDHE-RSA-AES256-GCM-SHA384	NO	NO	NO	YES
ECDHE-RSA-AES256-SHA	NO	YES	YES	YES
ECDHE-RSA-AES256-SHA384	NO	NO	NO	YES
ECDHE-RSA-DES-CBC3-SHA	NO	YES	YES	YES
SEED-SHA	YES	YES	YES	YES

TLS1.1 and TLS1.2 are supported by default; extra configuration is needed to support SSLv3 and TLS1.0.

The ciphers in gray are supported following extra configuration (they are not supported by default). Other ciphers can be supported, but they are not tested.

7.3 Security considerations

It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- Firewall or router protections to ensure that only approved external hosts have network access to the product.
- Firewall or router protections to ensure that the product only has network access to approved external hosts and services.
- Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN)).

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