Integrating the Healthcare Enterprise

IHE IT Infrastructure
Technical Framework Supplement

Patient Identifier Cross-reference PIX for Mobile (PIXm)

Draft for Public Comment

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Author: IHE ITI Technical Committee

Email: iti@ihe.net

Please verify you have the most recent version of this document. See here for Trial Implementation and Final Text versions and here for Public Comment versions.

Foreword

This is a supplement to the IHE IT Infrastructure Technical Framework V11.0. Each supplement undergoes a process of public comment and trial implementation before being incorporated into the volumes of the Technical Frameworks.

This supplement is published on June 8, 2015 for public comment. Comments are invited and can be submitted at http://www.ihe.net/ITI_Public_Comments. In order to be considered in development of the trial implementation version of the supplement, comments must be received by July 8, 2015.

This supplement describes changes to the existing technical framework documents.

"Boxed" instructions like the sample below indicate to the Volume Editor how to integrate the relevant section(s) into the relevant Technical Framework volume.

Amend Section X.X by the following:

Where the amendment adds text, make the added text **bold underline**. Where the amendment removes text, make the removed text ~~**bold strikethrough**~~. When entire new sections are added, introduce with editor's instructions to "add new text" or similar, which for readability are not bolded or underlined.

General information about IHE can be found at: http://ihe.net.

Information about the IHE IT Infrastructure domain can be found at: http://ihe.net/IHE_Domains.

Information about the organization of IHE Technical Frameworks and Supplements and the process used to create them can be found at: http://ihe.net/IHE_Process and http://ihe.net/Profiles.

The current version of the IHE IT Infrastructure Technical Framework can be found at: http://ihe.net/Resources/Technical_Frameworks.

CONTENTS

Introduction to this Supplement

The Patient Identifier Cross-reference for Mobile (PIXm) Profile defines a lightweight RESTful interface to a Patient Identifier Cross-reference Manager, leveraging technologies readily available to mobile applications and lightweight browser based applications.

The functionality is partially identical to the PIX Profile described in the ITI TF-1:5. The differences are transport and messaging format of messages and queries. The profile leverages HTTP transport, and the JavaScript Object Notation (JSON), Simple-XML, and Representational State Transfer (REST). The payload format is defined by the HL7 Fast Health Interoperable Resources (FHIR) draft standard. It is important to note that PIXm Profile does not currently support the transmission of patient identity information from a Patient Identity Source to the Patient Identifier Cross-reference Manager.

The PIXm Profile exposes the functionality of a Patient Identifier Cross-reference Manager to mobile applications and lightweight browser applications.

This supplement is intended to be fully compliant with the HL7 FHIR specification, providing only use-case driven constraints to aid with interoperability, deterministic results, and compatibility with existing PIX and PIXv3 Profiles.

Currently the HL7 FHIR standard is in "Draft Standard for Test Use" (DSTU) and may experience a large amount of change during this phase. Readers are advised that, while the profiled components in this supplement may not accurately reflect the most recent version of the FHIR standard, implementations of PIXm will be tested as specified in this supplement. Changes to the FHIR DSTU will be integrated into this supplement via the formal IHE Change Proposal (CP) process.

Open Issues and Questions

PIXm_004: There are several viable query messages:

- Profile and constrain the FHIR Patient resource
- Use of FHIR Operations to constrain returned values
- Create an IHE resource modeled on the FHIR patient resource

We will look at which one is preferred by FHIR experts and which is feasible for existing PIX managers

Sections 3.Y. 4 is the detailed approach using Operations, we invite comment to help describe it correctly or describe a better alternative.

We are trying to accomplish the same functionality as specified in ITI TF-2a: 3.9.4.1

PIXm_007

PIXm Query response <assigner> resource will be required, for cases where the Assigning authority is not an OID or UUID or URI

Do we want to use Assigner as an alternative field?

PIXm_008

Should Query response use http accept header as well as `_format` parameter?

PIXm_09

Should we document inherited FHIR behaviors (such as paging capacity)?

PIXm_10

Is using FHIR Operations the right approach for this profile? If it is correct, did we document it properly?

Closed Issues

PIXm_001: Should we include the Pediatric options?

A: No, as for the moment the feed is not supported and no pediatric demographics are involved in PIX query. This should be revisited when / if we add support for REST Patient Identity Feed.

PIXm_002 :We will not include Update Notification for the moment

PIXm_003: We will not include RESTful Patient Identity feed for the moment

PIXm_005: Do we want the Server to filter by assigning authority as in HL7V3 or the HL7V2 functionality? Use the HL7V2 style of functionality.

We have decided to include filtering optional parameter this in the profile.

PIXm_006: How will we distinguish the type of query we are attempting on the FHIR servers?

- Use of parameter to distinguish between PDQm and PIXm; this method is not well supported by FHIR. FHIR does not specify how to manage additional parameters, unless FHIR explicitly dictates behavior, this is not a reliable method. We would have to rely on correct IHE profile implementation.
- Use a new FHIR resource (such PIXID) to query

We solved this by using a FHIR operation.

General Introduction

Update the following Appendices to the General Introduction as indicated below. Note that these are not appendices to Volume 1.

Appendix A - Actor Summary Definitions

Add the following actors to the IHE Technical Frameworks General Introduction list of Actors:

No change to Appendix A as no new actors.

Appendix B - Transaction Summary Definitions

Add the following transactions to the IHE Technical Frameworks General Introduction list of Transactions:

Transaction	Definition
PIXm Query	Performs a query against a patient identifier cross-reference manager using HTTP, REST, and JSON/XML message encoding.

Glossary

Add the following glossary terms to the IHE Technical Frameworks General Introduction Glossary:

Note: Glossary terms are borrowed from the existing Glossary and are included here only to facilitate the reading of the current supplement.

Glossary Term	Definition
FHIR	Fast Health Interoperable Resources ™– A resource based draft standard currently being developed by HL7
JSON	JavaScript Object Notation – A textual representation of a serialized object from the JavaScript language.
REST	Representational State Transfer – An integration paradigm whereby data is exchanged with remote hosts by operating on HTTP resources using HTTP verbs such as GET, PUT, POST, etc.

Volume 1 – Profiles

Copyright Licenses

The FHIR License can be found at http://hl7.org/implement/standards/fhir/license.html.

Add the following to the IHE Technical Frameworks General Introduction Copyright section:

Add to Section as 5.5

5.5 PIXm Cross Profile Considerations

There are two additional profiles: PIXv3 (Patient Identifier Cross-reference HL7 V3) and PIXm (Patient Identifier Cross-reference for Mobile), which provide similar functionality to Patient Identifier Cross-reference Query. These profiles adapt the Patient Identifier Cross-reference Query transaction of the Patient Identifier Cross-reference Manager and Patient Identifier Cross-reference Consumer actors for HL7v3 and HL7 FHIR. ITI TF-2x: Appendix M.4 provides additional details about these Patient Identifier Cross-reference Query profiles and their relationship with one another.

A PIX Cross-Reference Manager may choose to group with the PIXm Cross-Reference Manager to provide an HTTP RESTful query method.

Add the following section as 23.7

23.7 PIXv3 Cross Profile Considerations

There are two additional profiles: PIX (Patient Identifier Cross-reference) and PIXm (Patient Identifier Cross-reference for Mobile), which provide similar functionality to Patient Identifier Cross-reference Query. These profiles adapt the Patient Identifier Cross-reference Query transaction of the Patient Identifier Cross-reference Manager and Patient Identifier Cross-reference Consumer actors for HL7v2 and HL7 FHIR. ITI TF-2x: Appendix M.4 provides additional details about these Patient Identifier Cross-reference Query profiles and their relationship with one another.

Add Section X

X Patient Identifier Cross-reference for Mobile Profile (PIXm)

The **Patient Identifier Cross-reference Mobile Integration Profile (PIXm)** Profile provides a transaction for mobile and lightweight browser based applications to query a Patient Identifier Cross-reference Manager for a list of patient identifiers based on the patient Identifier in a different domain and retrieve a patient's cross-domain identifiers information into the application.

This profile provides a lightweight alternative to [ITI-9] or [ITI-45] using a HTTP RESTful Query. This profile depends upon the implementation of the PIX or PIXV3 Profile or equivalent for the Identity feeds and cross-reference manager operations.

This profile does not assume the availability of a full FHIR server and could be used to provide a RESTful interface to a PIX or PIXv3 Patient Identifier Cross-reference Manager.

X.1 PIXm Actors, Transactions, and Content Modules

Figure X.1-1 shows the actors directly involved in the Patient Identifier Cross-reference for Mobile (PIXm) Profile and the relevant transactions between them. Note that the actors in this profile are a subset of the actors defined in the PIX Profile (ITI TF-1: 5.1).

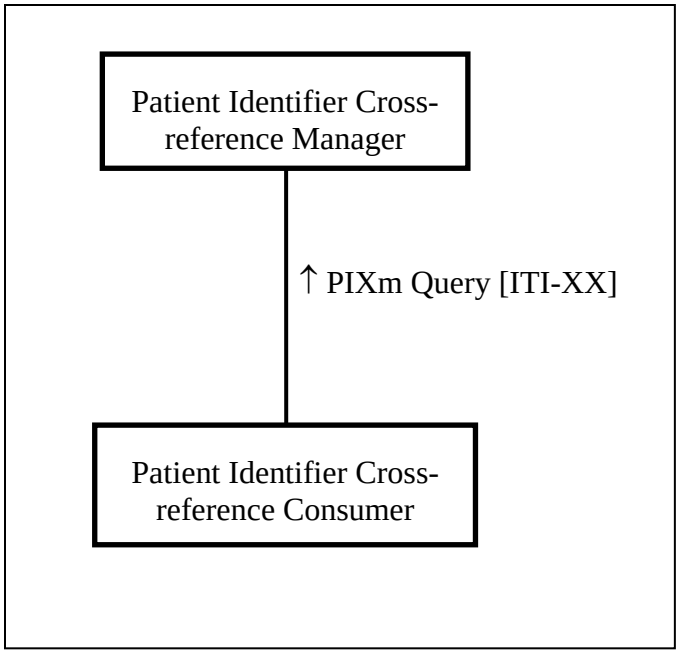


Figure X.1-1: PIXm Actor Diagram

Table X.1-1 lists the transactions for each actor directly involved in the PIXm Profile. To claim compliance with this Profile, an actor shall support all required transactions (labeled "R") and may support the optional transactions (labeled "O").

Table X.1-1: PIXm Profile - Actors and Transactions

Actors	Transactions	Optionality	Reference
Patient Identifier Cross-reference Consumer	PIXm Query [ITI-XX]	R	ITI TF-2c: 3.Y
Patient Identifier Cross-reference Manager	PIXm Query [ITI-XX]	R	ITI TF-2c: 3.Y

The transaction defined in this profile corresponds to one of the transactions used in the PIX Profile (ITI TF-1: 5) and provides similar functionality. Note that there are no equivalent transactions that correspond to the PIX Update Notification ([ITI-10] and [ITI-46]) or Patient Identity Feed ([ITI-8] or [ITI-44]) transactions in the PIX and PIXV3 Profiles.

X.1.1 Actor Descriptions and Actor Profile Requirements

Most requirements are documented in Transactions (Volume 2) and Content Modules (Volume 3). This section documents any additional requirements on profile's actors.

X.2 PIXm Actor Options

Options that may be selected for each actor in this profile, if any, are listed in the Table X.2-1. Dependencies between options when applicable are specified in notes.

Table X.2-1: PIXm- Actors and Options

Actor	Option Name	Reference
Patient Identifier Cross-reference Consumer	No options defined	--
Patient Identifier Cross-reference Manager	No options defined	--

X.3 PIXm Required Actor Groupings

Table X.3-1: Patient Identifier Cross-reference PIX for Mobile - Required Actor Groupings

PIXm Actor	Actor to be grouped with	Reference	Content Bindings Reference
Patient Identifier Cross-reference Consumer	None		
Patient Identifier Cross-reference Manager	None		

X.4 PIXm Overview

The ***Patient Identifier Cross-reference for Mobile Profile (PIXm)*** is intended of lightweight applications and mobile devices used in healthcare enterprises in broad range of sizes (hospital, a clinic, a physician office, etc.). It supports the Cross-reference query of patient identifiers from multiple Patient Identifier Domains via the following interaction:

- The ability to access the list(s) of cross-referenced patient identifiers via a query/ response.

The PIXm Profile can works in combination with the PIX or PIXV3 Profile, described in ITI TF-1:5. PIXm enables the alternative of using the RESTful PIXm Query PIX query [ITI-XX] instead of the PIX Query [ITI-9], by replacing the PIX Patient Identifier Cross-reference Consumer with the RESTful PIXm Patient Identifier Cross-reference Consumer. The other actors and transactions described in ITI TF-1:5 must also be present for full functioning.

The following use case and descriptions assume familiarity with the profile in ITI TF-1:5, and only describe the alternative RESTful actor and transaction.

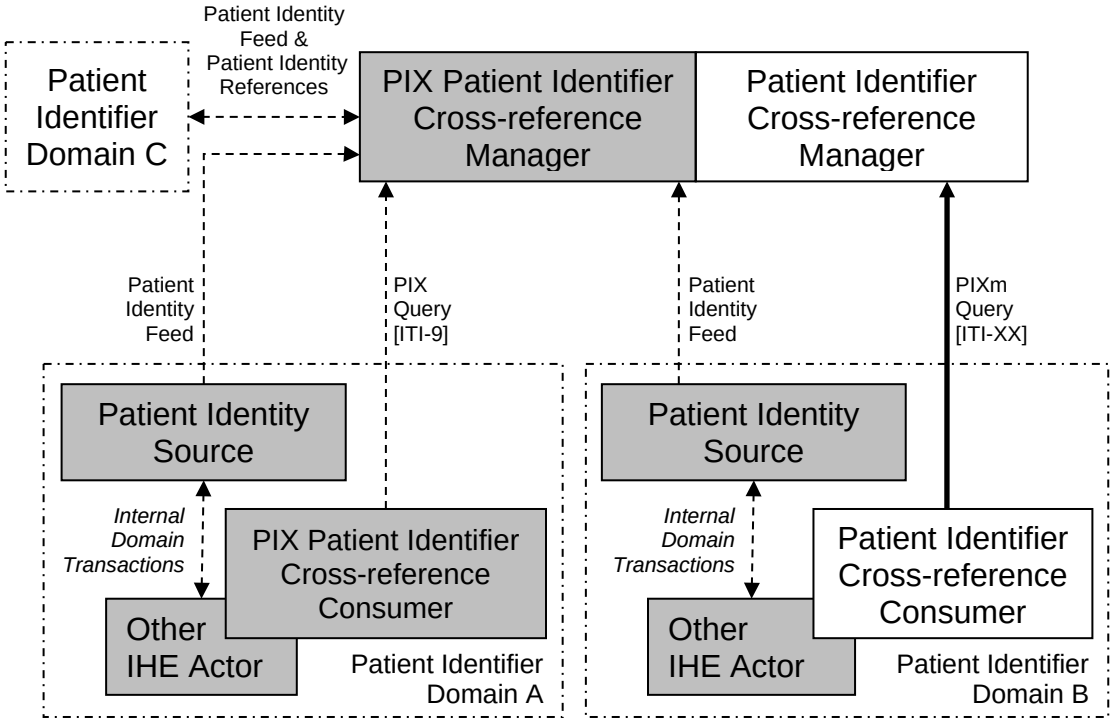


Figure X.4-1: Process Flow with PIXm

X.4.1 Concepts

The RESTful Patient Identifier Cross-reference Consumer fits into the combination of actors and transactions defined for PIX, see ITI TF-1: 5. It adds the alternative of using the RESTful PIX query instead of the PIX Query [ITI-9], or PIXv3 Query [ITI-45].

The RESTful Patient Identifier Cross-reference Consumer uses a query for sets of cross-reference patient identifiers.

For a discussion of the relationship between this Integration Profile and an enterprise master patient index (eMPI) see ITI TF-1: 5.4.

X.4.2 Use Cases

X.4.2.1 Use Case: Multiple Identifier Domains within a Single Facility/ Enterprise

X.4.2.1.1 Multiple Identifier Domains with a Single Facility/ Enterprise Use Case Description

A patient is in an ambulance on his way to the hospital after an accident. The mobile Care system in the ambulance wants to get allergy information (e.g., MHD Profile) associated with a patient that the mobile Care system knows the patient's driver's license as patient ID = 'E-123'. Before requesting the allergy information from the hospital, it must translate the known patient identity (driver's license) to the patient's identity known by the hospital (MRN). To achieve this correlation, the mobile Care system issues a PIXm query to the Patient Identifier Cross-reference Manager and retrieves the corresponding patient identity. It requests a list of patient ID aliases corresponding to patient ID = 'E-123' (within the "mobile Care domain") from the Patient Identifier Cross-reference Manager. Having linked this patient with a patient known by medical record number = '007' in the 'ADT Domain', the Patient Identifier Cross-reference Manger returns this list to the mobile Care system so that it may retrieve the allergies information for the desired patient.

The mobile Care system can now requests the allergy information from the hospital allergy system using its own patient ID (MRN-007) including the domain identifier/ assigning authority.

In this scenario, the hospital's main ADT system (acting as a Patient Identity Source) would provide a Patient Identity Feed (using the patient's MRN as the identifier) to the Patient Identifier Cross-reference Manager. Similarly, the mobile Care system or the external assigning authority would also provide a Patient Identity Feed to the Patient Identifier Cross-reference Manager using the internally generated patient ID as the patient identifier and providing its own unique identifier domain identifier.

X.4.2.1.2 Multiple Identifier Domains with a Single Facility/ Enterprise Process Flow

The PIXm Profile is intended to provide a different transport mechanism for the cross identity Query transaction described in the PIX Profile. Hence, the RESTFul PIX query transaction can be used where the [ITI-9] (or equivalent) transaction is used. The following diagram describes is inspired from the PIX Profile, and describes how the PIXm Query [ITI-XX] transaction integrates in a multiple identifier workflow.

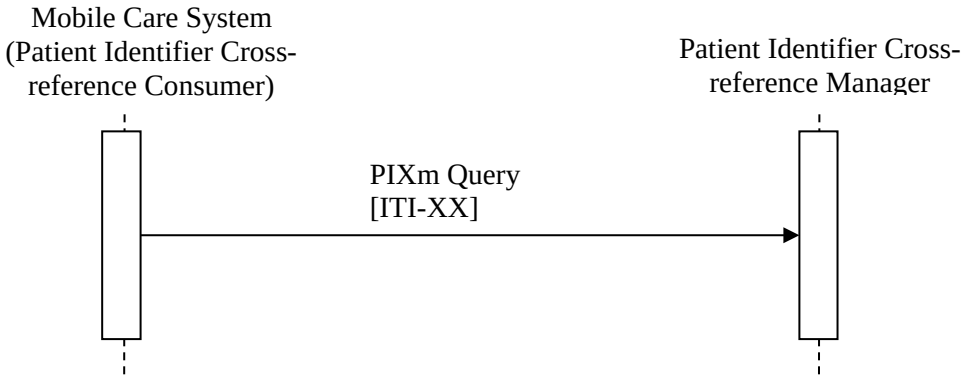


Figure X.4.2.1.2-1: Basic Process Flow in Multiple ID Domains in a Single Facility Process Flow in PIXm Profile

X.5 PIXm Security Considerations

The challenges of security and privacy controls within a mobile environment are unique, simply because the devices are harder to physically control. In other uses of the HTTP/REST pattern, applications are accessing far less sensitive information than patient identifiers. The PIXm Profile provides access to the patient identifiers managed in healthcare. These factors present a unique and difficult challenge for the security model. It is recommended that application developers utilize a Risk Assessment in the design of the applications, and that the operational environment utilize a Risk Assessment in the design and deployment of the operational environment.

There are many reasonable methods of security for interoperability transactions, which can be implemented without modifying the characteristics of the PIXm Profile transactions. The use of TLS is encouraged, as is the use of the ATNA Profile (see ITI TF-1:9).

User authentication on mobile devices and browsers is typically handled by more lightweight authentication schemes such as HTTP Authentication, OAuth, or OpenID Connect. IHE has a set of profiles for user authentication including: Enterprise User Authentication (EUA) on HTTP-based devices and Internet User Authentication (IUA) for REST-based authentication. In all of these cases, the network communication security, and user authentication are layered in the HTTP transport layer and do not modify the interoperability characteristics defined in the PIXm Profile. The use of strong trust keys is encouraged to prevent Patient Identifier Cross-reference Manager Actor to be falsely represented and therefor propagate false authorities relationships. This could potentially link wrong patients together thus creating potentially dangerous situations.

PIXm should the use of the Security Audit logging (ATNA) Profile. Support for ATNA-based audit logging on mobile devices and lightweight browser applications may be beyond the ability

of the constrained environment. This would mean that the operational environment must choose how to mitigate the risk of relying only on the service side audit logging. It is recommended that Mobile Patient Identifier Cross-reference Actors implement the Internet User Authentication (IUA) Profile, incorporating the `subject` of the IUA token in audit messages.

The Resource URL pattern defined in this profile means many requests will include Patient ID parameters for query. The advantage of this pattern is ease of implementation and clear distinction of a patient's identity. The URL pattern does present a risk when using typical web server audit logging of URL requests and browser history. In both of these cases the URL with the Patient ID query parameters is clearly visible. These risks need to be mitigated in system or operational design.

The Patient Identifier Cross-reference Manager service exposed also presents a risk of revealing patient cross identification relationships to malicious processes poling patient identifiers. This must also be mitigated especially when a high volume of unknown patient queries are being issued.

X.6 PIXm Cross Profile Considerations

PIX - Patient Identifier Cross-reference Integration Profile

Two example alternatives are presented:

The PIX managers from both PIX and PIXm can be grouped.

- The PIXm Manager can be grouped with a PIX Consumer so that a PIXm Query can be proxied to the PIX manager and the results returned.

Volume 2 – Transactions

Add Section 3.Y

3.Y PIXm Query [ITI-XX]

This section corresponds to Transaction ITI-XX of the IHE IT Infrastructure Technical Framework. Transaction ITI-XX is used by the Patient Identifier Cross-reference Consumer and Patient Identifier Cross-reference Manager Actors.

3.Y.1 Scope

This transaction is used by the Patient Identifier Cross-reference Consumer to solicit information about patients whose Patient Identifiers data cross-match Patient Identifiers provided in the query parameters on the request message. The request is received by the Patient Identifier Cross-reference Manager. The Patient Identifier Cross-reference Manager processes the request and returns a response in the form of Patient Identifiers for the matching patients.

3.Y.2 Actor Roles

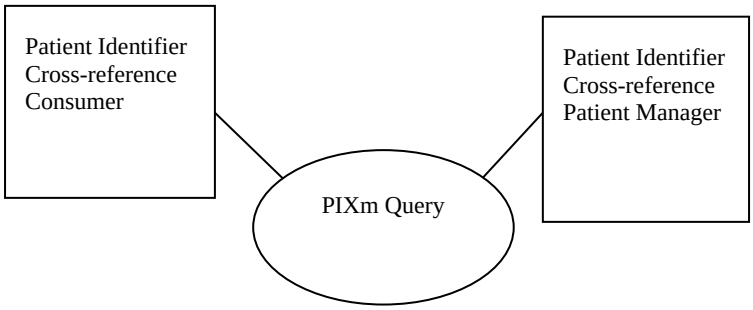


Figure 3.Y.2-1: Use Case Diagram

Table 3.Y.2-1: Actor Roles

Actor:	Patient Identifier Cross-reference Consumer
Role:	Requests a list of patient identifiers matching the supplied Patient Identifier from the Patient Identifier Cross-reference Manager Actor. The Patient Identifier Cross-reference Consumer populates its attribute the known Patient Identifier.
Actor:	Patient Identifier Cross-reference Manager

Role:	Returns Cross-referenced Patient Identifiers for the patient that cross-matches the Patient Identifier criteria provided by the Patient Identifier Cross-reference Consumer.

3.Y.3 Referenced Standards

HL7*:* HL7 Fast Healthcare Information Resources (FHIR) DSTU 2.0 Draft for Ballot

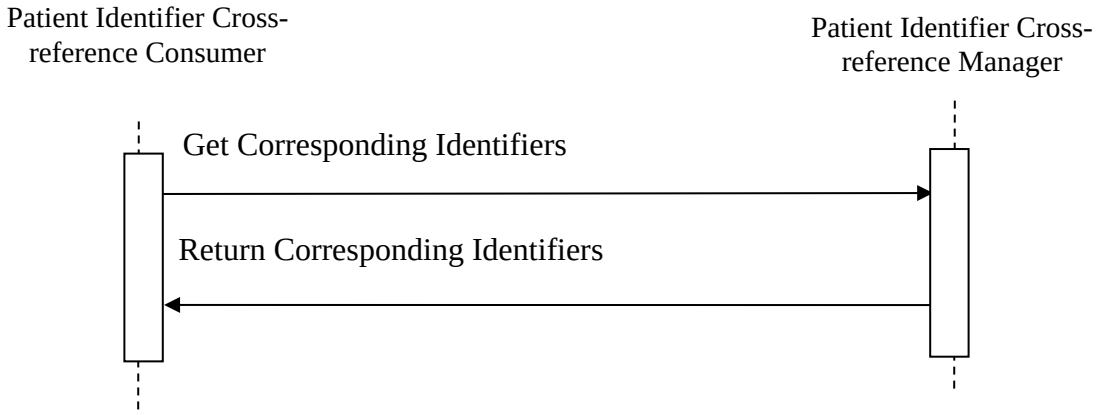
RFC 2616: IETF Hypertext Transfer Protocol – HTTP/1.1

RFC 4627: The application/json Media Type for JavaScript Object Notation

RFC 3968: Uniform Resource Identifier (URI) Generic Syntax

OpenSearch Relevance 1.0 Draft 1

3.Y.4 Interaction Diagram



3.Y.4.1 Get Corresponding Identifiers message

This message represents an HTTP GET operation from the Patient Identifier Cross-reference Consumer to the Patient Identifier Cross-reference Manager. It is implemented through the FHIR $ihe-pix operation described in Section 3.Y.4.1.2 Message Semantics

3.Y.4.1.1 Trigger Events

A Patient Identifier Cross-reference Consumer needs to obtain, or determine the existence of, alternate patient identifiers.

3.Y.4.1.2 Message Semantics

The message is a FHIR operation with the input and output parameters shown in Table 3.Y.4.1.2-1. The name of the operation is $ihe-pix, and it is applied to Patient FHIR resource type. The Get Corresponding Identifiers message is conducted by the Patient Identifier Cross-reference Consumer by executing an HTTP GET against the Patient Identifier Cross-reference Manager's Patient Resource URL.

The URL for this operation is: [base]/Patient/$ihe-pix

Where [base] is the URL of Patient Identifier Cross-reference Manager Service provider.

Table 3.Y.4.1.2-1: $ihe-pix Message Parameters

Parameter	Card.	Data Type	Description
Input Parameters			
sourceidentifier	1..1	Identifier	The Patient identifier that will be used by the Patient Identifier Cross-reference Manager to find cross matching identifiers associated with the Patient resource. See Section 3.Y.4.1.2.1.
targetsystem	0..*	uri	The target Patient Identifier Assigning Authority from which the returned identifiers should be selected. See Section 3.Y.4.1.2.2.
Output Parameters			
targetIdentifier	0..*	Identifier	The collection of identifiers found
targetId	0..*	id	The Patient Resource FHIR resource id

3.Y.4.1.2.1 Patient Search Parameter

This required, parameter `sourceidentifier` of type `token`, specifies an identifier associated with the patient whose information is being queried (e.g., a local identifier, account identifier, etc.). Please see ITI TF-2x: Appendix Z.2.2 (currently in the PDQm Trial Implementation Supplement) for use of the `token` data type for patient identifiers.

Only one (1) instance of this parameter shall be provided in the query.

`sourceidentifer.identifier.value and sourceidentifer.identifier.system` portion of the identifier parameter shall be specified, all other fields shall be ignored.

For example, a query searching for patients having identifier NA5404 assigned by authority "1.3.6.1.4.1.21367.2010.1.2.300&ISO" would be represented as:

[base]/Patient/**$ihe-pix?sourceidentifier= urn:oid:1.3.6.1.4.1.21367.2010.1.2.300|NA5404**

3.Y.4.1.2.2 Populating Which Domains are Returned

The Patient Identifier Cross-reference Consumer may constrain the domains from which patient identifiers are returned from the Patient Identifier Cross-reference Manager in the resulting response. The Patient Identifier Cross-reference Consumer shall convey this by specifying the patient identity domains only in the repeating `targetsystem` parameters using this format:

&targetsystem=<patient ID domain>

For example, a Patient Identifier Cross-reference Consumer wishing to filter for patients with Identifier NA5404^^^1.3.6.1.4.1.21367.2010.1.2.300&ISO having identifiers from an identity domain with OID 1.3.6.1.4.1.21367.2010.1.2.100&ISO would convey this search as:

[base]/Patient/$ihe-pix?sourceidentifier=urn:oid1.3.6.1.4.1.21367.2010.1.2.300|NA5404**&targesystem=urn:oid1.3.6.1.4.1.21367.2010.1.2.100**

The Identifier Cross-reference Consumer shall populate the `targetsystem` of the token with values described in ITI TF-2x: Appendix E.3.

3.Y.4.1.3 Expected Actions

The Patient Identifier Cross-reference Manager shall return all Patient Identifiers that are associated with the identifier provided by the Patient Identifier Cross-reference Consumer.

The Patient Identifier Cross-reference Manager Actor shall respond to the query request as described by the following cases with a Query Patient Resource Response message described in Section 3.Y.4.2, and shall behave according to the cases listed below:

Case 1: The Patient Identifier Cross-reference Manager Actor recognizes the specified *sourceidentifier* sent by the Patient Identifier Cross-reference Consumer and corresponding identifiers exist in at least one other domain.

HTTP 200 (OK) is returned as the HTTP status code.

A *$ihe-pix Parameter* is returned representing the result set.

Case 2: The Patient Identifier Cross-reference Manager Actor recognizes the specified *sourceidentifier* sent by the Patient Identifier Cross-reference Consumer, but no identifier exists for that patient in any of the other domains.

HTTP 200 (OK) is returned as the HTTP status code.

A *$ihe-pix Parameter* is returned representing the result set with the empty set.

Case 3: The Patient Identifier Cross-reference Manager Actor recognizes the specified domain in `sourceidentifer.identifier.system` sent by the Patient Identifier Cross-reference Consumer, but the identifier sent in `sourceidentifer.identifier.value` for that patient does not exist.

HTTP 400 (Bad Request) is returned as the HTTP status code.

An OperationOutcome Resource is returned indicating that the patient identity domain is not recognized in an `issue` having:

Attribute	Value
severity	Error
type	{http://hl7.org/fhir/vs/issue-type}value

Case 4: The Patient Identifier Cross-reference Manager Actor does not recognize the specified domain `sourceidentifer.identifier.system` sent by the Patient Identifier Cross-reference Consumer.

HTTP 400 (Bad Request) is returned as the HTTP status code.

An OperationOutcome Resource is returned indicating that the patient identity domain is not recognized in an `issue` having:

Attribute	Value
severity	Error
type	{http://hl7.org/fhir/vs/issue-type} not-supported

Case 5: The Patient Identifier Cross-reference Manager Actor does not recognize the specified *targetsystem* sent by the Patient Identifier Cross-reference Consumer.

HTTP 400 (Bad Request) is returned as the HTTP status code.

An OperationOutcome Resource is returned indicating that the patient identity domain is not recognized in an `issue` having:

Attribute	Value
severity	Error
type	{http://hl7.org/fhir/vs/issue-type} unknown-key-identifier

Case 6: The Patient Identifier Cross-reference Manager Actor recognizes the specified *sourceidentifier* and *targetsystem* sent by the Patient Identifier Cross-reference Consumer and lease one corresponding identifier exist.

HTTP 200 (OK) is returned as the HTTP status code.

A *$ihe-pix Parameter* is returned representing the result set.

The Patient Identifier Cross-reference Manager may be capable of servicing requests for response formats not listed in Section 3.Y.4.1.2.5, but shall, at minimum, be capable of producing XML and JSON encodings. If the Patient Identifier Cross-reference Consumer provided multiple values in the `_format` parameter, the Patient Identifier Cross-reference Manager may choose any of the response formats for the encoding of the response message.

The Patient Identifier Cross-reference Manager may return other HTTP status codes to represent specific error conditions. When HTTP error status codes are returned by the Patient Identifier Cross-reference Manager, they shall conform to the HTTP standard RFC 2616. Their use is not further constrained or specified by this transaction.

3.Y.4.2 Query Patient Resource Response message

3.Y.4.2.1 Trigger Events

The Patient Identifier Cross-reference Manager received a Query Patient Resource Request from the Patient Identifier Cross-reference Consumer as a result of a Query Patient Resource Request.

3.Y.4.2.2 Message Semantics

The Query Patient $ihe-pix Parameters Resource Response is sent from the Patient Identifier Cross-reference Manager Actor to the Patient Identifier Cross-reference Consumer Actor.

Table 3.Y.4.2.2-1: $ihe-pix Message Parameters

Parameter	Card.	Data Type	Description
Output Parameters			
targetIdentifier	0..*	Identifier	The collection of identifiers found
targetId	0..*	id	The Patient Resource id

The "content-type" of the response will depend upon the requested response format indicated by the Patient Identifier Cross-reference Consumer Actor via the _format parameter.

Table 3.Y.4.2.2-2 outlines the format of a response based on the values specified in the format parameter.

Table 3.Y.4.2.2-2: Response Message Format

_format Parameter	Content Type
json *or* application/json+fhir	application/json+fhir; charset=UTF-8
xml *or* application/xml+fhir	application/xml+fhir; charset=UTF-8

The Patient Identifier Cross-reference Manager shall use a character encoding of UTF-8. Both XML and JSON encodings of the response shall adhere to the FHIR bundle constraints profiled in ITI TF-2x: Appendix Z.1.

3.Y.5 Security Considerations

See the general Security Consideration in ITI TF-1:X.5

3.Y.5.1 Security Audit Considerations

The Security audit criteria are similar to those for the PIX Query [ITI-45] as this transaction discloses the same type of patient information. The PIXm Query is a Query Information event as defined in Table 3.20.6-1 (see ITI TF-2a:3.20.6). The Patient Identifier Cross-reference Manager shall record audit events according to the following:

3.Y.5.1.1 Patient Identifier Cross-reference Consumer audit message:

	Field Name	Opt	Value Constraints
Event AuditMessage/ EventIdentification	EventID	M	EV(110112, DCM, "Query")
	EventActionCode	M	"E" (Execute)
	EventDateTime	*M*	*not specialized*
	EventOutcomeIndicator	*M*	*not specialized*
	EventTypeCode	M	EV("ITI-XX", "IHE Transactions", "PIXm Query")
Source (Patient Identifier Cross-reference Consumer) (1)			
Human Requestor (0..n)			
Destination (Patient Identifier Cross-reference Manager(1)			
Audit Source (Patient Identifier Cross-reference Consumer) (1)			
Patient (0..n)			
Query Parameters(1)			

Where:

Source AuditMessage/ ActiveParticipant	*UserID*	*M*	*not specialized*
	AlternativeUserID	M	The process ID as used within the local operating system logs.
	UserName	*U*	*not specialized*
	UserIsRequestor	*U*	*not specialized*
	RoleIDCode	M	EV(110153, DCM, "Source")
	NetworkAccessPointTypeCode	M	"1" for machine (DNS) name, "2" for IP address
	NetworkAccessPointID	M	The machine name or IP address, as specified in DICOM PS 3.15.
Human Requestor (if known) AuditMessage/ ActiveParticipant	UserID	M	Identity of the human that initiated the transaction
	AlternativeUserID	U	The process ID as used within the local operating system logs.
	UserName	*U*	*not specialized*
	UserIsRequestor	M	"true"
	RoleIDCode	M	Access Control role(s) the user holds that allows this transaction
	NetworkAccessPointTypeCode	*NA*	
	NetworkAccessPointID	*NA*	

Destination AuditMessage/ ActiveParticipant	UserID	M	HTTP endpoint of the request excluding query string.
	AlternativeUserID	*U*	*not specialized*
	UserName	*U*	*not specialized*
	UserIsRequestor	M	"false"
	RoleIDCode	M	EV(110152, DCM, "Destination")
	NetworkAccessPointTypeCode	M	"1" for machine (DNS) name, "2" for IP address, "5" for URI
	NetworkAccessPointID	M	The HTTP endpoint of the request, the machine name or IP address, as specified in DICOM PS 3.15.

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Audit Source AuditMessage/ AuditSourceIdentification	*AuditSourceID*	*U*	*not specialized.*
	AuditEnterpriseSiteID	*U*	*not specialized*
	AuditSourceTypeCode	*U*	*not specialized*

Query Parameters (AuditMessage/ ParticipantObject Identification)	ParticipantObjectTypeCode	M	"2" (system object)
	ParticipantObjectTypeCodeRole	M	"24" (query)
	ParticipantObjectDataLifeCycle	*U*	*not specialized*
	ParticipantObjectIDTypeCode	M	EV("ITI-XX", "IHE Transactions", "PIXm Query")
	ParticipantObjectSensitivity	*U*	*not specialized*
	ParticipantObjectID	M	"PIXmQuery"
	ParticipantObjectName	*U*	*not specialized*
	ParticipantObjectQuery	M	Request query string
	ParticipantObjectDetail	M	HTTP Request Headers contained in the query

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3.Y.5.1.2 Patient Identifier Cross-reference Manager audit message:

	Field Name	Opt	Value Constraints
Event AuditMessage/ EventIdentification	EventID	M	EV(110112, DCM, "Query")
	EventActionCode	M	"E" (Execute)
	EventDateTime	*M*	*not specialized*
	EventOutcomeIndicator	*M*	*not specialized*
	EventTypeCode	M	EV("ITI-XX", "IHE Transactions", "PIXm Query")
Source (Patient Identifier Cross-reference Consumer) (1)			
Destination (Patient Identifier Cross-reference Manager (1)			
Audit Source (Patient Identifier Cross-reference Manager) (1)			
Patient (0..n)			
Query Parameters(1)			

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Source AuditMessage/ ActiveParticipant	*UserID*	*M*	*not specialized*
	AlternativeUserID	*U*	*not specialized*
	UserName	*U*	*not specialized*
	UserIsRequestor	M	"true"
	RoleIDCode	M	EV(110153, DCM, "Source")
	NetworkAccessPointTypeCode	M	"1" for machine (DNS) name, "2" for IP address
	NetworkAccessPointID	M	The machine name or IP address, as specified in DICOM PS 3.15.

Destination AuditMessage/ ActiveParticipant	UserID	M	HTTP endpoint of the request excluding query string.
	AlternativeUserID	M	The process ID as used within the local operating system in the local system logs.
	UserName	*U*	*not specialized*
	UserIsRequestor	M	"false"
	RoleIDCode	M	EV(110152, DCM, "Destination")
	NetworkAccessPointTypeCode	M	"1" for machine (DNS) name, "2" for IP address, "5" for URI
	NetworkAccessPointID	M	The HTTP endpoint of the request, the machine name or IP address, as specified in DICOM PS 3.15.

Audit Source AuditMessage/ AuditSourceIdentification	*AuditSourceID*	*U*	*not specialized*
	AuditEnterpriseSiteID	*U*	*not specialized*
	AuditSourceTypeCode	*U*	*not specialized*

Query Parameters (AuditMessage/ ParticipantObjectIdentification)	ParticipantObjectTypeCode	M	"2" (system object)
	ParticipantObjectTypeCodeRole	M	"24" (query)
	ParticipantObjectDataLifeCycle	*U*	*not specialized*
	ParticipantObjectIDTypeCode	M	EV("ITI-XX", "IHE Transactions", "PIXm Query")
	ParticipantObjectSensitivity	*U*	*not specialized*
	ParticipantObjectID	M	"PIXmQuery"
	ParticipantObjectName	*U*	*not specialized*
	ParticipantObjectQuery	M	Request query string
	ParticipantObjectDetail	M	HTTP Request Headers contained in the query (Accept)

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