Integrating the Healthcare Enterprise

IHE IT Infrastructure
Technical Framework Supplement

Patient Identifier Cross-reference for Mobile (PIXm)

Trial Implementation

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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 August 7, 2015 for trial implementation and may be available for testing at subsequent IHE Connectathons. The supplement may be amended based on the results of testing. Following successful testing it will be incorporated into the IT Infrastructure Technical Framework. Comments are invited and may be submitted at http://www.ihe.net/ITI_Public_Comments.

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/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 based on the PIX Profile described in the ITI TF-1:5. The primary 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. Unlike the PIX Profile, this PIXm Profile does not 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.

The HL7 FHIR standard version referenced in this PIXm supplement is in “Draft Standard for Trial Use” (DSTU) and may experience a large amount of change during this phase. Readers are advised that the profiled components in this supplement may not reflect the most recent version of the FHIR standard. Changes to the FHIR DSTU that affect PIXm will be integrated into this supplement via the formal IHE Change Proposal (CP) process.

Open Issues and Questions

PIXm_007

Mobile Patient Identifier Cross-reference 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_10

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

PIXm 12

This profile is based on, and requires use of, FHIR DSTU 2 ballot, with the expectation that this supplement will be revised when DSTU 2 final is published

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.

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

Section 3.83.4 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_008

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

Yes, the _format parameter is optional

PIXm_09

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

Do not support paging. A well behaved PIX query should have a small response. If paging is needed there is a serious problem. An error is appropriate if there is too much response.

170 Not applicable

PIXm_11

We should provide an (informative?) Conformance, StructureDefinition, or OperationDefinition resource on the web-site, or in the profile

We could eventually include informative OperationDefinition on the ftp site.

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
[ITI-83] Mobile Patient Identifier Cross-reference 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 standard 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

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

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

Add the following as Section 5.5

5.5 Cross Profile Considerations

There are two other profiles, PIXv3 (Patient Identifier Cross-reference HL7 V3) and PIXm (Patient Identifier Cross-reference for Mobile), which provide similar functionality to the Patient Identifier Cross-reference Query transaction.

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

Add the following section as 23.7

23.7 Cross Profile Considerations

There are two other profiles, PIX (Patient Identifier Cross-reference) and PIXm (Patient Identifier Cross-reference for Mobile), which provide similar functionality to the PIXV3 Query transaction.

A PIXv3 Patient Identifier Cross-reference Manager may choose to group with the PIXm Patient Identifier Cross-reference Manager to provide an HTTP RESTful query method.

Add Section 41

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

The **Patient Identifier Cross-reference for Mobile Integration 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 PIX Query [ITI-9] or PIXv3 Query [ITI-45], using a HTTP RESTful Query. This profile depends upon the implementation of the PIX or PIXV3 Profile or equivalent for the patient identity feed and update notifications. Two example groupings are shown in TF-1: 41.5.

This profile does not assume Patient Identifier Cross-reference Manager has the ability to act as a full-fledged FHIR server, other than for the profiled transaction. The profile can be used to provide a RESTful interface to a PIX or PIXv3 Patient Identifier Cross-reference Manager without providing other FHIR services.

41.1 PIXm Actors, Transactions, and Content Modules

Figure 41.1-1 shows the actors directly involved in the Patient Identifier Cross-reference for Mobile (PIXm) Profile and the relevant transactions between them.

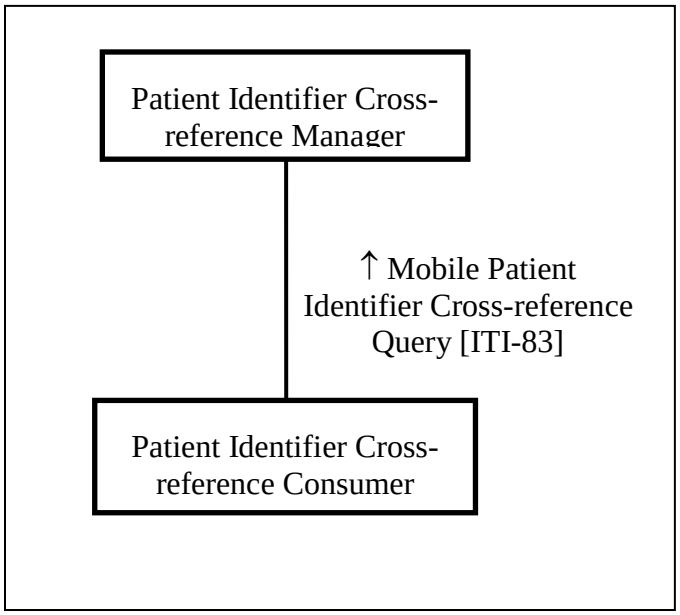


Figure 41.1-1: PIXm Actor Diagram

Table 41.1-1 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 41.1-1: PIXm Profile - Actors and Transactions

Actors	Transactions	Optionality	Reference
Patient Identifier Cross-reference Consumer	Mobile Patient Identifier Cross-Reference Query [ITI-83]	R	ITI TF-2c: 3.83
Patient Identifier Cross-reference Manager	Mobile Patient Identifier Cross-Reference Query [ITI-83]	R	ITI TF-2c: 3.83

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 equivalent transactions 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 are outside the scope of this profile.

41.1.1 Actor Descriptions and Actor Profile Requirements

No additional requirements above those in Volume 2 for the [ITI-83] transaction.

41.2 PIXm Actor Options

Options that may be selected for each actor in this profile, if any, are listed in the Table 41.2-1. Dependencies between options when applicable are specified in notes.

Table 41.2-1: PIXm Actors and Options

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

41.3 PIXm Required Actor Groupings

Table 41.3-1: PIXm - 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		

41.4 PIXm Overview

The ***Patient Identifier Cross-reference for Mobile Profile*** is intended to be used by lightweight applications and mobile devices present in healthcare enterprises of a 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 following use case and descriptions assume familiarity with the profiles in ITI TF-1:5 and ITI TF-1:23, and only describe the RESTful actors and transaction alternatives.

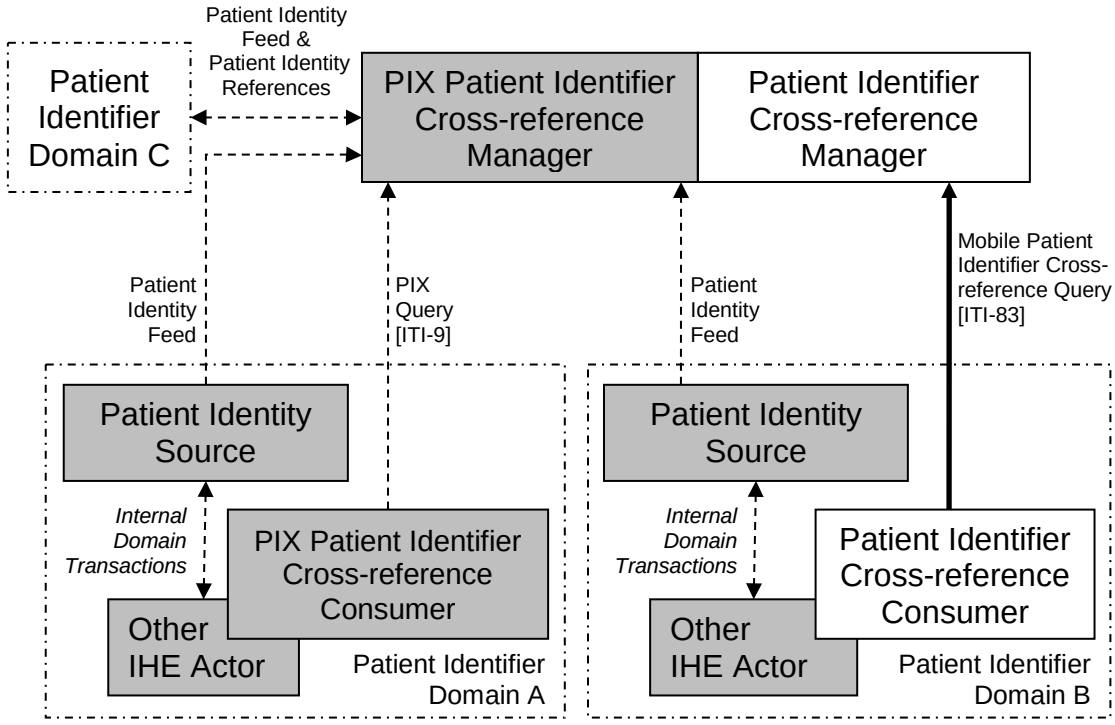


Figure 41.4-1: Process Flow with PIXm

This diagram shows how PIXm actors (in solid outlined, white boxes) can integrate into a PIX environment (gray boxes; described in ITI TF-1:5.2). For a discussion of the relationship between this Integration Profile and an enterprise master patient index (eMPI) see ITI TF-1: 5.4.

41.4.1 Concepts

The 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 Mobile Patient Identifier Cross-reference Query [ITI-83] instead of the PIX Query [ITI-9], or PIXv3 Query [ITI-45].

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

41.4.2 Use Cases

41.4.2.1 Use Case: Multiple Identifier Domains within a Single Facility/Enterprise

41.4.2.1.1 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) for the patient. The mobile Care system uses the patient's driver's license number 'E-123' as their patient ID. 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 Mobile Patient Identifier Cross-reference 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 Manager 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 request the allergy information from the hospital allergy system using the allergy system's 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.

41.4.2.1.2 Multiple Identifier Domains with a Single Facility/Enterprise Process Flow

The PIXm Profile is intended to provide a different transport mechanism for the cross-identifier Query functionality described in the PIX Profile. Hence, the Mobile Patient Identifier Cross-reference Query [ITI-83] transaction can be used where the PIX Query [ITI-9] (or equivalent) transaction is used. The following diagram describes only Patient Cross-Identity for Mobile Process Flow. Figure 5.3-1 shows Mobile Patient Identifier Cross-reference Query [ITI-83] transaction integration in a multiple identifier workflow.

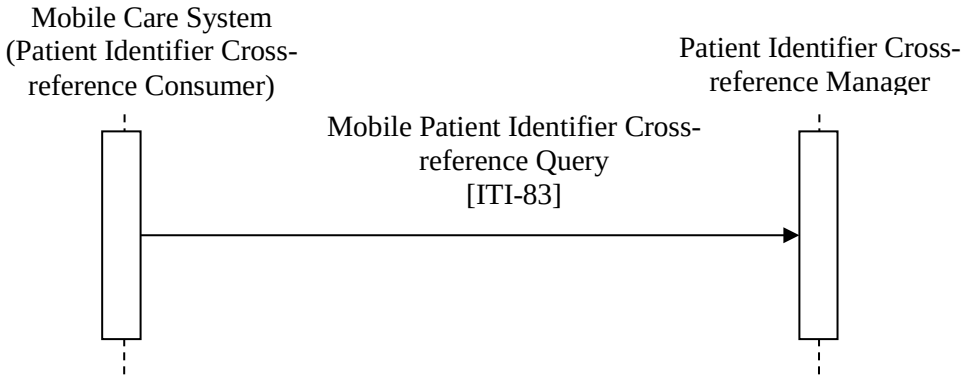


Figure 41.4.2.1.2-1: Basic Process Flow in Multiple ID Domains in a Single Facility Process Flow in PIXm Profile

41.5 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 many 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 devices using HTTP and Internet User Authorization (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 the Patient Identifier Cross-reference Manager Actors to be falsely represented and therefore propagate false authorities relationships. This could potentially link wrong patients together thus creating potentially dangerous situations.

Actors in the PIXm Profile should make use of the audit logging (ATNA) Profile. However, support for ATNA-based audit logging on mobile devices and lightweight browser applications may be beyond their ability. The operational environment must choose how to mitigate the risk of relying only on the service-side audit logging on the Patient Identifier Cross-manager. 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.

41.6 PIXm Cross Profile Considerations

41.6.1 Proxy Model

The Patient Identifier Cross-reference Manager from PIXm can be grouped with either PIX or PIXV3 Patient Identifier Cross-reference Consumer to proxy the Mobile Patient Identifier Cross-reference Query [ITI-83] to the more traditional PIX Query [ITI-9] and PIXV3 Query [ITI-45], thus acting as a proxy to the Patient Identifier Cross-reference Manager that wants to enable RESTFul query to its data.

41.6.2 Manager group

The Patient Identifier Cross-reference Manager from PIXm does not implement any Patient Identity Feed transactions. A grouping with Patient Identifier Cross-reference Manager from PIX or PIXV3 enables the traditional IHE mechanism to obtain cross-referencing information via Patient Identity Feed transactions [ITI-8] and/or [ITI-44]. Grouping of the PIXm Manager with the PIX or PIXv3 Consumer or Manager is not required if the implementation is able to obtain cross-reference information in another manner. For example, a PIXm Manager could be grouped with an enterprise's main FHIR server.

Volume 2 – Transactions

Add Section 3.83

3.83 Mobile Patient Identifier Cross-reference Query [ITI-83]

This section corresponds to Transaction ITI-83 of the IHE IT Infrastructure Technical Framework. Transaction ITI-83 is used by the Patient Identifier Cross-reference Consumer and Patient Identifier Cross-reference Manager Actors in the Patient Identifier Cross-reference for mobile Profile.

3.83.1 Scope

This transaction is used by the Patient Identifier Cross-reference Consumer to solicit information about patients whose Patient Identifiers cross-match with Patient Identifiers provided in the query parameters of 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 one or more Patient Identifiers for the matching patient.

3.83.2 Actor Roles

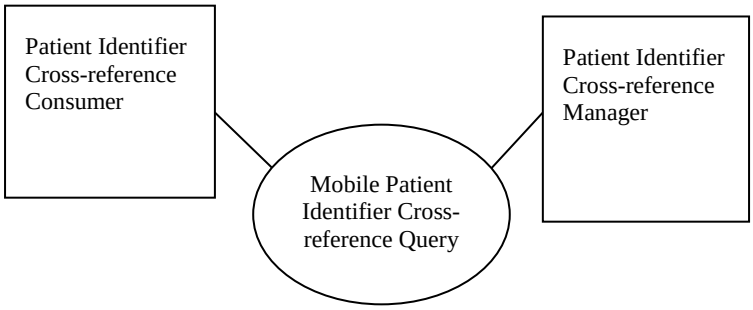


Figure 3.83.2-1: Use Case Diagram

Table 3.83.2-1: Actor Roles

Actor:	Patient Identifier Cross-reference Consumer
Role:	Requests, from the Patient Identifier Cross-reference Manager Actor, a list of patient identifiers matching the supplied 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.

3.83.3 Referenced Standards

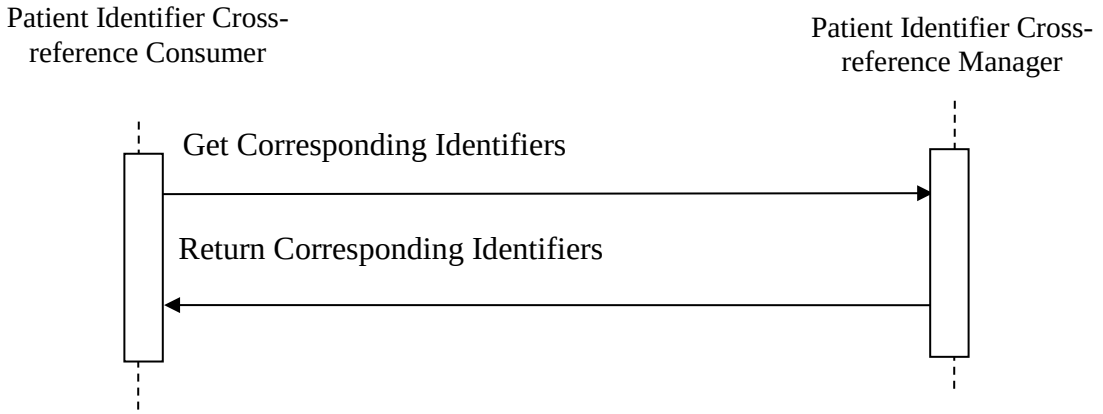
HL7*:* FHIR® DSTU2 Ballot http://hl7.org/fhir/2015May/index.html

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

3.83.4 Interaction Diagram



3.83.4.1 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 3.83.4.1.2 Message Semantics.

3.83.4.1.1 Trigger Events

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

3.83.4.1.2 Message Semantics

The Get Corresponding Identifiers message is a FHIR operation request as defined in FHIR Section 2.2.0 with the input parameters shown in Table 3.83.4.1.2-1. Given that the parameters

are not complex types the HTTP GET operation shall be used as defined in FHIR Section 2.2.0.5.1.

The name of the operation is `$ihe-pix`, and it is applied to FHIR Patient 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.

The Get Corresponding Identifiers message is performed by an HTTP GET command shown below:

```
GET [base]/Patient/$ihe-pix?sourceIdentifier=[token]]{&targetSystem=[uri]}{&_format=[mime-type]}
```

Table 3.83.4.1.2-1: $ihe-pix Message HTTP query Parameters

Query parameter Name	Cardinality	Data Type	Description
Input Parameters			
sourceIdentifier	1..1	Token	The Patient identifier search parameter that will be used by the Patient Identifier Cross-reference Manager to find cross matching identifiers associated with the Patient resource. See Section 3.83.4.1.2.1.
targetSystem	0..1	uri	The target Patient Identifier Assigning Authority from which the returned identifiers should be selected. See Section 3.83.4.1.2.2.
_format	0..1	mime-type	The requested format of the response. See Table 3.83.4.1.2-2

The Patient Identifier Cross-reference Manager may be capable of servicing requests for response formats not listed in Table 3.83.4.1.2-2, but shall, at minimum, be capable of producing XML and JSON encodings. If the Patient Identifier Cross-reference Consumer provides 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.

Table 3.83.4.1.2-2 outlines the format of a response based on the values specified in the format parameter.

Table 3.83.4.1.2-2: 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

3.83.4.1.2.1 Patient Search Parameter

This required HTTP query parameter `sourceIdentifier` is a `token` that specifies a patient identifier associated with the patient whose information is being queried (e.g., a local identifier, account identifier, etc.). Its value shall include both the Assigning Authority and identifier value, separated by a "|".

Please see ITI TF-2x: Appendix Z.2.2 (currently in the PDQm Trial Implementation Supplement) for use of the `token` search parameter type for patient identifiers.

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

For example, a query searching for all patient Identifiers, for a patient with 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**

3.83.4.1.2.2 Populating Which Patient Identity Domain is Returned

The Patient Identifier Cross-reference Consumer may specify the Patient Identity Domain from which the patient identifier is 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 in the `targetSystem` parameter using this format:

&targetSystem=<patient ID Assigning Authority domain>

This optional parameter specifies the Assigning Authority of the Patient Identity Domain whose identifiers need to be returned.

For example, a Patient Identifier Cross-reference Consumer wishing to query for a patient with Identifier NA5404^^^1.3.6.1.4.1.21367.2010.1.2.300&ISO and find that patient’s identifier in 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:oid:1.3.6.1.4.1.21367.2010.1.2.300|NA5404**&targetSystem=urn:oid:1.3.6.1.4.1.21367.2010.1.2.100**

When included, the Identifier Cross-reference Consumer shall populate the `targetSystem` search parameter with values as described in ITI TF-2x: Appendix E.3.

3.83.4.1.3 Expected Actions

The Patient Identifier Cross-reference Manager returns Patient Identifiers and Patient Resource References that are associated with the identifier provided by the Patient Identifier Cross-reference Consumer only when the Patient Identifier Cross-reference Manager Actor recognizes the specified Patient Identification Domain and Patient ID and an identifier exists for the specified patient in at least one other domain.

The `targetSystem` parameter specifies the Assigning Authority of the Patient Identity Domain whose identifiers need to be returned. If the `targetSystem` parameter is supplied, the Patient Identifier Cross-reference Manager shall return all identifiers from that Patient Identity Domain except for the one identified by the sourceIdentifier parameter. Otherwise the Patient Identifier Cross-reference Manager shall return all known identifiers except for the one identified by the sourceIdentifier parameter.

The information provided by the Patient Identifier Cross-reference Manager Actor to Patient Identifier Cross-reference Consumer Actors is a list of cross-referenced identifiers and Patient Resource References in two or more of the domains managed by the cross-referencing Actor. The list of cross-references is not made available until the set of policies and processes for managing the cross-reference function have been completed. The policies for administering identities adopted by the cooperating domains are completely internal to the Patient Identifier Cross-reference Manager Actor and are outside of the scope of this framework. Possible matches should not be communicated until the healthcare institution policies and processes embodied in the Patient Identifier Cross-reference Manager Actor reach a positive matching decision.

The Patient Identifier Cross-reference Manager Actor shall respond to the query request as described by 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 *Parameters Resource* is returned representing the result set described in Section 3.83.4.2.2.

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 *Parameters Resource* is returned representing the result set with the empty set.

Case 3: The Patient Identifier Cross-reference Manager Actor recognizes the specified assigning authority domain in the *sourceIdentifier* search token sent by the Patient Identifier Cross-reference Consumer, but the identifier sent in *sourceIdentifier* search token 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 is not recognized in an `issue` having:

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

Case 4: The Patient Identifier Cross-reference Manager Actor does not recognize the specified Patient Assigning Authority domain in the *sourceIdentifier* search token 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
code	{http://hl7.org/fhir/vs/issue-type} not-supported

Case 5: The Patient Identifier Cross-reference Manager Actor does not recognize the specified Patient Assigning Authority domain in the *targetSystem* search token 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
code	{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 at least one patient with the *sourceIdentifier*, and an identifier in the *targetSystem* exists.

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

A *Parameters Resource* is returned representing the result set as described in Section 3.83.4.2.2.

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.

3.83.4.2 Query Return Corresponding Identifiers message

3.83.4.2.1 Trigger Events

The Patient Identifier Cross-reference Manager received a Get Corresponding Identifiers message from the Patient Identifier Cross-reference Consumer.

3.83.4.2.2 Message Semantics

The response message is a FHIR operation response as defined in FHIR Section 2.2.0 with a single Parameters Resource as shown in Table 3.83.4.2.2-1.

A Parameters Resource Response is sent from the Patient Identifier Cross-reference Manager Actor to the Patient Identifier Cross-reference Consumer Actor. The values may be returned in any order.

Table 3.83.4.2.2-1: $ihe-pix Message Response

Parameter	Card.	Data Type	Description
FHIR Parameters Resource			
targetIdentifier	0..*	Identifier	The identifier found. Constraints to include the assigning authority as specified in ITI TF-2x: Appendix E.3
targetId	0..*	Reference(Patient)	The url of the Patient Resource

```
<Parameters xmlns="http://hl7.org/fhir">
  <parameter>
        <name value="targetIdentifier"/>
        <valueIdentifier>
                <use value="official" />
                <system value="urn:oid:2.16.840.1.113883.16.4.3.2.5" />
                <value value="123" />
        </valueIdentifier>
  </parameter>
  <parameter>
        <name value="targetIdentifier"/>
        <valueIdentifier>
                <use value="official" />
                <system value="urn:oid:1.16.7435.2.315381.13.4.1.2.3" />
                <value value="474" />
        </valueIdentifier>
  </parameter>
  <parameter>
        <name value="targetId"/>
        <valueReference value="http://xyz-server/xxx/Patient/7536642">
        </valueReference>
  </parameter>
  <parameter>
        <name value="targetIdentifier"/>
        <valueIdentifier>
                <use value="official"/>
                <system value="http://www.acmehosp.com/patients"/>
                <value value="44552"/>
                <period>
                        <start value="2003-05-03"/>
                </period>
        </valueIdentifier>
  </parameter>
  <parameter>
        <name value="targetId"/>
        <valueReference value="http://pas-server/xxx/Patient/443556">
        </valueReference>
  </parameter>
</Parameters>
```

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.

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.

3.83.5 Security Considerations

3.83.5.1 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 Mobile Patient Identifier Cross-reference Query is a Query Information event as defined in Table 3.20.6-1.

3.83.5.1.1 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-83", "IHE Transactions", "Mobile Patient Identifier Cross-reference 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 Manager) (1)			
Patient (0..n)			
Query Parameters(1)			

Where:

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.
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*	

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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-83", "IHE Transactions", "Mobile Patient Identifier Cross-reference 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)

3.83.5.1.2 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-83", "IHE Transactions", "Mobile Patient Identifier Cross-reference 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 (1)
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.

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-83", "IHE Transactions", "Mobile Patient Identifier Cross-reference 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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