Integrating the Healthcare Enterprise

IHE Patient Care Coordination Technical Framework Supplement

Retrieve Clinical Knowledge (RCK)

Trial Implementation

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Foreword

This is a supplement to the IHE Patient Care Coordination Technical Framework V9.0. 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 October 4, 2013 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 Patient Care Coordination Technical Framework. Comments are invited and may be submitted at http://www.ihe.net/PCC_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: www.ihe.net.

Information about the IHE Patient Care Coordination domain can be found at: http://www.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://www.ihe.net/IHE_Process and http://www.ihe.net/Profiles.

The current version of the IHE Patient Care Coordination Technical Framework can be found at: http://www.ihe.net/Technical_Frameworks.

CONTENTS

Introduction to this Supplement

The HL7 Infobutton standard is widely deployed, but still requires a good deal of custom integration to support access to clinical knowledge.

Implementations typically:

- Use a variety of vocabularies
- Respond in a variety of formats, including HTML, PDF, XHTML, and may include scripting appropriate only for some browsers
- Do not address the need to locate multiple resources on a single topic
- Are not aggregable across implementations
- Do not have a consistent use of HTTP error codes
- Do not specify how to secure communications
- Do not provide a mechanism supporting audit trails

Because of this, each time an EHR or PHR wants to integrate with a new provider of clinical content, a new interface needs to be developed. The purpose of this profile is to provide a more complete implementation specification that will ensure that the same interface can be used across a wide variety of clinical content.

Open Issues and Questions

1. What value set should be assigned to the ageGroup parameter? In the US, age greater than 79 is considered to be individually identifiable health information, and so some form of age group representation is needed to ensure that age can be sent when available and legal.
2. What value set should be used for subTopic? LOINC FDA Insert sections are suitable for many medication related queries, but no relationship such section list appears for lab compendia, procedures, problems, or other clinical concepts.

Closed Issues

1. How will we coordinate this profile with pending Infobutton implementation work in the HL7 CDS Workgroup?
    a. This profile will be based on existing balloted Infobutton specifications from HL7.
    b. We will ensure consistency with current specifications and future directions proposed by HL7 CDS in the Trial Implementation
    c. Trial implementation will be revised in 2013 to be based on newer guides and will refer to the HL7 Infobutton specifications when they are completed.

d. The committee will provide input to HL7 CDS on existing Infobutton specifications under development.

2. Should there be separate transactions for knowledge request vs. subscribe? No. One transaction can serve both purposes. We have eliminated any discussion of the use of subscribe in this profile. It is possible to subscribe using the URL, but we leave this out of scope.

3. What standard should we use to format the response? The choices seem to be Atom or RSS. We used Atom because it has been used by other HL7 published implementation guides, is more cleanly extensible, and has a schema for validation. For additional comparison see http://www.intertwingly.net/wiki/pie/Rss20AndAtom10Compared

4. Should we support holder.assignedEntity.n and holder.assignedEntity.certificateText to pass authentication parameters? No, because this is incompatible with methods used to authenticate with other web resources, violates separation of security and application layers, and would result in inconsistent mechanisms for authentication between the two transactions.

5. What version of the HL7 Infobutton Standard should we reference? The latest Implementation guide (in DSTU status) is based on the current draft content rather than the last DSTU of the standard. We will reference the current draft (being balloted now), in the anticipation that it will be finished when this profile goes to trial implementation. The guide is already at DSTU.

6. GET or POST? We agreed that POST is the best choice.

7. How much freedom should we give Clinical Knowledge Requester applications with the parameters? We should normalize the behaviors of the requester as much as possible to ensure that Clinical Knowledge Directories receive what they may need. Clinical Knowledge Directories are free to ignore information that isn't needed in their implementation.

8. How should we deal with bibliographic citations and funding sources (to meet US Meaningful Use requirements). We addressed these by profiling the use of three Dublin Core terms as Atom feed extensions.

Volume 1 – Profiles

Copyright Permission

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

Not applicable

Add to section X

X Retrieve Clinical Knowledge (RCK) Profile

This profile describes how Health IT systems, Person Health Records, and HIEs can retrieve clinical knowledge on a topic suitable for presentation to a clinician or patient.

There are a great number of web resources available that support access of Clinical Knowledge on a specific disease, medical condition, set of symptoms or complaints, medications, et cetera for both clinicians and patients. However, these resources have inconsistent representations of content, search APIs, and responses, making them difficult to integrate into Healthcare IT solutions. This profile provides a consistent set of rules for issuing knowledge requests for information that is either patient-, clinician- or payer-oriented, and on how to return results so that EHRs and PHRs can process the results and display them in a uniform way.

This profile combines information presently found in standards and implementation guides from Health Level 7 International (HL7), the Internet Engineering Task Force (IETF), the World Wide Web Consortium (W3C) and IHE to describe a single interface that can be used by any system needing access to clinical content.

X.1 RCK Actors, Transactions, and Content Modules

Figure X.1-1 shows the actors directly involved in the RCK Profile and the relevant transactions between them. If needed for context, other actors that may be indirectly involved due to their participation in other related profiles are shown in dotted lines. Actors which have a mandatory grouping are shown in conjoined boxes.

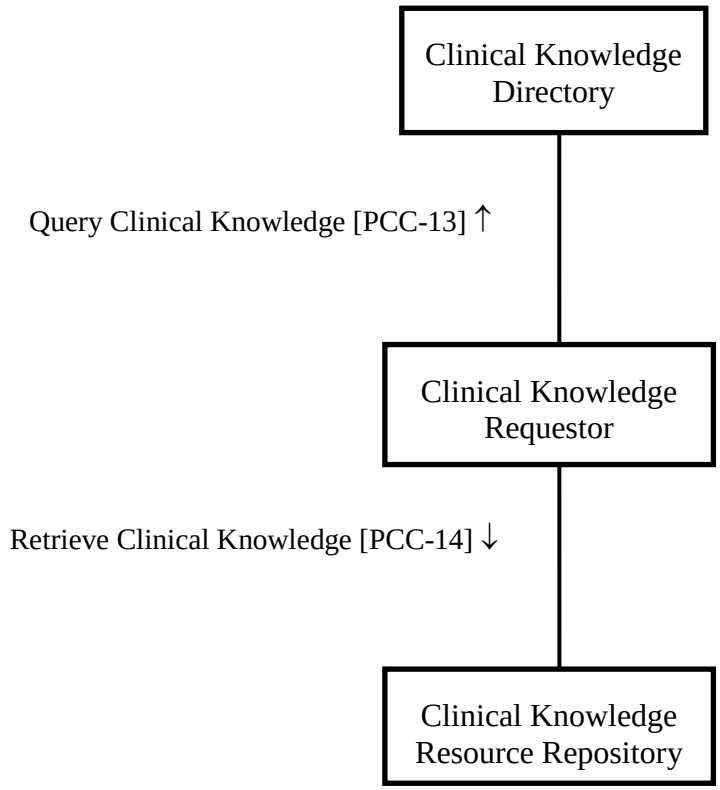


Figure X.1-1: RCK Actor Diagram

Table X.1-1 lists the transactions for each actor directly involved in the RCK Profile. In order to claim support of this Profile, an implementation of an actor must perform the required transactions (labeled "R") and may support the optional transactions (labeled "O"). Actors groupings are further described in section X.3.

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

Actors	Transactions	Optionality	Section in Vol. 2
Clinical Knowledge Directory	Query Clinical Knowledge	R	3.Y
Clinical Knowledge Requester	Query Clinical Knowledge	R	3.Y
	Retrieve Clinical Knowledge	R	3.Z
Clinical Knowledge Resource Repository	Retrieve Clinical Knowledge	R	3.Z

X.1.1 Actor Descriptions and Actor Profile Requirements

Normative requirements are typically documented in Volume 2 (Transactions) and Volume 3 (Content Modules). Some Integration Profiles, however, contain requirements which link transactions, data, and/or behavior. Those Profile requirements are documented in this section as normative requirements ("shall").

X.1.1.1 Clinical Knowledge Directory

A Clinical Knowledge Directory receives requests for clinical knowledge and returns a list of relevant clinical knowledge resources based on the content of the knowledge request.

X.1.1.2 Clinical Knowledge Requester

A Clinical Knowledge Requester collects appropriate clinical context and uses it to request clinical knowledge.

X.1.1.3 Clinical Knowledge Resource Repository

A Clinical Knowledge Resource Repository stores documents providing clinical knowledge and returns them to Requesters on demand.

X.1.2 Transaction Descriptions

This section describes the general behavior of the transactions described above.

X.1.2.1 Query Clinical Knowledge

This transaction is sent from the Clinical Knowledge Requester to obtain a list of references to relevant Clinical Knowledge Resources that can be presented to the end user based upon their current context. The Query Clinical Knowledge transaction is described in detail in section 3.Y Query Clinical Knowledge below.

X.1.2.2 Retrieve Clinical Knowledge

This transaction is used by the Clinical Knowledge Requester to access a specific knowledge resource presented to it via the Query Clinical Knowledge transaction. The accessed resource can be then presented to the end user. The Retrieve Clinical Knowledge transaction is described in detail in section 3.Z Retrieve Clinical Knowledge.

X.2 RCK Actor Options

Options that may be selected for this Profile are listed in the table X.2-1 along with the Actors to which they apply. Dependencies between options when applicable are specified in notes.

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

Actor	Options	Volume & Section
Clinical Knowledge Directory	*No options defined*	- -

Actor	Options	Volume & Section
Clinical Knowledge Requester	*No options defined*	- -
Clinical Knowledge Resource Repository	*No options defined*	- -

X.3 RCK Actor Required Groupings

Actor(s) which are required to be grouped with another Actor(s) are listed in this section. The grouped Actor may be from this profile or a different domain/profile. These mandatory required groupings, plus further descriptions if necessary, are given in the table below.

An Actor from this profile (Column 1) must implement all of the required transactions in this profile in addition to all of the required transactions for the grouped profile/actor listed (Column 2).

Table X.3-1: RCK - Actors Required Groups

RCK Actor	Required Grouping Actor	Technical Framework Reference	Note
Clinical Knowledge Directory	Secure Node or Secure Application	ITI TF-1:9 ATNA	
Clinical Knowledge Requester	Secure Node or Secure Application	ITI TF-1:9 ATNA	
Clinical Knowledge Resource Repository	Secure Node or Secure Application	ITI TF-1:9 ATNA	

X.5 RCK Overview

X.5.1 Overview of the Knowledge Request

Clinical content is typically organized using different kinds of index terms. A system that wishes to locate relevant content (a Clinical Knowledge Requester) supplies the terms of interest it knows, and the system retrieving the content (a Clinical Knowledge Directory) matches these terms against the index terms it has for the clinical content. A variety of different technical approaches allow results to be ranked by according to relevance and/or filtered based on content in the index terms provided.

One challenge in information retrieval applications is to ensure that requesters of information specify relevant index terms. There are numerous different types of index terms, as well as different vocabularies that can be used with them. When the requestor is not aware of which index terms are available, or which values can be used with them, the receiver of the request is challenged to find appropriate content.

Main search terms can come from a wide variety of vocabularies, and it is difficult in a healthcare setting to limit the vocabulary for the main search terms. However, there are numerous secondary search terms that can help the receiver of a request to filter relevant content. For example, in Internet search engines, you can often filter results by date of last update, or type of content (e.g., PDF, HTML). Use of these secondary search terms can greatly increase chances of being able to quickly find relevant content when those secondary index terms are supplied.

The Retrieve Clinical Knowledge profile specifies the names of the different index terms that can be used to retrieve relevant content, and the range of possible values that can be used for those terms. It also places requirements upon which terms must be used in the request. Receivers of the request are free to ignore search terms that they do not use.

Foreknowledge of the index terms allows content suppliers to appropriately index and or map requests into the values they use to access content. It also makes it possible for applications making requests to use a common interface, without requiring complex interface configuration to enabling discovery and mapping to index terms used by the content supplier.

In this profile, the collection of index terms that is used is known as the request context. This is because the values for the secondary index terms come from details about the current situation. This context is passed to a Clinical Knowledge Directory that uses those details to locate clinical content.

The context of the request provides details about clinical concepts on which information is being sought. The context helps to determine the kind of information required, and may include:

- Patient Demographics (Age, Age Group or Gender)
- Location
- Audience (Patient or clinician and preferred language)
- Type of Patient Encounter (inpatient, outpatient, emergency, et cetera)
- Knowledge request Topic
- Request Initiator (Clinician, Patient)

The clinical content being returned should be appropriate to the supplied context where possible. It should also be uniquely identified and described so that applications can present the relevant results to the user. Identification is important to enable applications to record information about their use of relevant content, and to enable subsequent retrieval. Descriptions of the relevant content are important to enable presentation of the results to the user.

A Clinical Knowledge Directory can be grouped with the Clinical Knowledge Requester actor of this profile to “fan-out” a single request to multiple other systems implementing the Clinical Knowledge Directory actor. Additional requirements of this grouped pair are described in Appendix A.1 Aggregation of Infobutton Results

X.5.1.1 Patient Demographics

Age and gender assist the Clinical Knowledge Directory in providing information that is most relevant for the patient. Age beyond certain limits is considered to be personally identifiable information, so the Clinical Knowledge Directory must be able to accept age ranges as well as a specific age. For neonates and infants, age must be able to be specified in units smaller than years, e.g., months, weeks or days.

In general, queries containing age should be specified in units greater than two, e.g., for an infant under two years old, the age should be specified in months, under two months old should have age specified in weeks, and under two weeks, should be specified in days. Clinical knowledge Requesters should accept age values specified in years, months, weeks or days, and may normalize age depending on the type of information they provide.

Gender need only be specified as male, female or undetermined.

X.5.1.2 Location

The clinician and/or patient location can be used to customize results based on knowledge of either the patient's home or treatment location. Location information about either the patient, or where they seek treatment could be considered to be personally identifiable information, especially if highly detailed. For most use cases, location information can be limited to simple regional identifiers (postal codes, cities, states).

X.5.1.3 Audience

The information returned may be for consumption by patients, clinicians, or payers. The content may be requested in a specific language.

X.5.1.4 Knowledge Request Topic

The topic for which clinical knowledge is being requested can be divided up into at least three separate components. The main topic of interest is usually based upon a coded term, such as a diagnostic result, problem or diagnosis, medication or procedure.

The subtopics are categorical secondary index terms relevant within the context of the main topic. These identify the kind of information being requested about the main topic. The subtopic should come from a limited vocabulary.

The workflow task being performed can assist the Clinical Knowledge Directory in determining what kind of clinical knowledge may be relevant. For example, a knowledge request on a diagnosis during medication order entry might return clinical knowledge resources describing suggested medications for treatment, whereas the same request during review of discharge notes might return information on that diagnosis and the discharge instructions associated with it. The behaviors associated with use of the workflow task and type of information returned is up to the Clinical Knowledge Directory.

X.5.2 Use Case #1: Patient Education

In this use case, a clinician uses the profile to access Patient oriented education information on a laboratory result, condition, diagnosis, or medication.

X.5.2.1 Patient Education Use Case Description

Upon completion of an encounter, a clinician will request information based on diagnoses made, medications prescribed, or test results used during the encounter from his or her Electronic Health Record. The EHR will format a request, sending it to a Clinical Knowledge Directory. The Clinical Knowledge Directory will locate appropriate patient education materials and return a list of these to the EHR. The EHR will display appropriate metadata about the information to the clinician. The clinician will then print appropriate articles and give them to the patient. The EHR will record the information provided to the patient.

X.5.2.2 Patient Education Process Flow

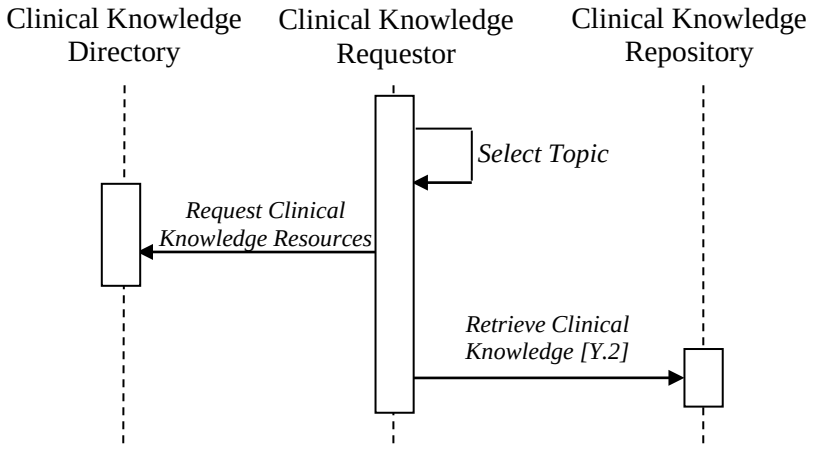


Figure X.5.2.2-1: Basic Process Flow in RCK Profile

X.6 RCK Security Considerations

X.6.1 Individually Identifiable Information and User Credentials

The context information may include age, gender and location information, which may be sufficient to individually identify a single person or small group of persons. It may also include information about sensitive health related topics, e.g., HIV, Alcohol or Drug Abuse treatment, etc. A Clinical Knowledge Requester could expose individually identifiable data to other systems nearby it or the recipient of the knowledge request, and to anyone with access to communications channels between the two systems. This might include exposure to nearby computers,

maintainers of the IT infrastructure where the knowledge request is originated or received, and any intermediaries.

In order to protect the individually identifiable information, IHE requires that actors implementing the RCK profile also implement the ATNA Secure Node or Secure Application actor, and encrypt all communications. Use of ATNA will also ensure that any credentials required to access the Clinical Knowledge Directory are protected from exposure.

IHE mandates the use of ATNA in this profile to ensure that implementers and organizations acquiring these systems can appropriately secure the data. However, IHE cannot mandate that these capabilities be enabled for any given implementation. Organizations that choose to disable these features should take appropriate precautions to secure their systems.

X.6.2 Configuration Information

Some systems used to support requests or retrieval of clinical knowledge (such as publically available feed readers) may not appropriately secure the URL parameters used to retrieve the feed. This can expose individually identifiable health information (e.g., person X is retrieving information on clinical trials for condition Y). Applications which make such URLs readily available for access through a feed reader or publically accessible computer resources should provide adequate warnings to users about the possible exposures of PHI.

X.6.3 Clinical Knowledge

Applications which support consumption of data from a Clinical Knowledge Directory or Repository may not be in a position to control the breadth, appropriateness, readability, availability, accuracy, currency, or overall quality of the content to which users of these data are exposed. Implementers are advised to either configure information systems accessing clinical knowledge with well-qualified clinical resources, or to warn users that the clinical information which they may retrieve is not guaranteed to be accurate, et cetera, and that the end-user is responsible for ensuring the validity of the information source.

The clinical knowledge managed and returned by the Clinical Knowledge Directory and Clinical Knowledge Resource Repository is both valuable and susceptible to a variety of threats, including theft and malicious or accidental corruption. They also may be offered only to licensed or otherwise authorized users. To protect user credentials from exposure, IHE requires the use of the ATNA Secure Node and/or Secure Application actor with actors from the RCK profile. This profile does not specify how credentials are to be exchanged. To ensure appropriate authorization to access content, application developers may wish to consider use of the IHE EUA or XUA profiles as appropriate.

The responsibility to manage server resources used to index and maintain the clinical content remains the responsibility of the organization implementing and/or deploying the Clinical Knowledge Directory and Clinical Knowledge Resource Repository actors.

X.6.4 Interfaces and Services

Clinical Knowledge Directories and Resource Repositories can be implemented using standard HTTP services. These services are subject to the same kinds of attacks as other web servers. Implementers of these systems are advised to provide additional security due to the sensitivity of data which they gather and communicate. For example, server access logs typically gather information about the Requester, including the requested URL and the Requester's IP address. These two information items together could contain individually identifiable information.

Loss of the server logs may be viewed as a privacy breach under laws and regulations of many regions, and could require public reporting, or other remedies to be provided to the individuals whose information was lost; resulting in potential loss of reputation and/or income, and/or increased expenses to remedy those impacted by the breach.

Other attacks, such as denial of service, may prevent services from being accessed, and must be protected against by means not described in this profile.

It is expected that Clinical Knowledge Requester actors will often not reside on the same network as the Clinical Knowledge Directory or Resource Repository. Traditional network protections, such as fire walls and proxies can be used to protect this actor. To ensure that the Clinical Knowledge Requestor can communicate with actors on other networks, this profile requires that it be configurable to operate through an HTTP proxy.

X.6.5 Client Applications and Systems

Information returned from a knowledge request may be accessed and displayed using common browser technology and/or feed readers, and as such, is susceptible to the same variety attacks to which browsers are susceptible (e.g., trojans, viruses, scripting attacks, et cetera). Clinical Knowledge Requestors making information available to consumers through these applications should provide information about the security risks associated with accessing the information.

X.7 RCK Cross Profile Considerations

The Retrieve Clinical Knowledge profile can be used to assist patients or clinicians in interpreting information found in clinical documents which are exchanged using templates described in the PCC Technical Framework. For example, it could retrieve appropriate patient education and follow-up instructions during creation of a discharge summary or history and physical examination. It could also be used by a PHR to assist a patient in understanding the content of information exchanged using the Exchange of Personal Health Records (XPHR) profile, or provide more details about lab results reported using the Antepartum Laboratory Profile (APL).

This profile might also be used to help educate those responsible for completing data capture forms used with the Request Form for Data Capture (RFD) profile.

Appendices

Actor Summary Definitions

Clinical Knowledge Directory

A Clinical Knowledge Directory receives requests for clinical knowledge and returns a list of relevant clinical knowledge resources based on the content of the knowledge request.

Clinical Knowledge Requester

A Clinical Knowledge Requester collects appropriate clinical context and uses it to request clinical knowledge, and presents the resulting knowledge to the user.

Clinical Knowledge Resource Repository

A Clinical Knowledge Resource Repository stores documents providing clinical knowledge and returns them to Requesters on demand.

Transaction Summary Definitions

Query Clinical Knowledge

This transaction is used to obtain a list of references to relevant Clinical Knowledge Resources that can be presented to the end user based upon their current context.

Retrieve Clinical Knowledge

This transaction is used to access a specific knowledge resource for presentation to the user.

Glossary

Infobutton

An Infobutton is a graphical user interface element which allows the user of an application to quickly obtain information about a specialized term or value found on application displays. It is typically represented as a lowercase letter i in a blue circle  . The term may also be used to refer to the HL7 Context Aware Information Retrieval standard, which is often used to implement the information retrieval side of the interface.

Volume 2 – Transactions

Add section 3.Y

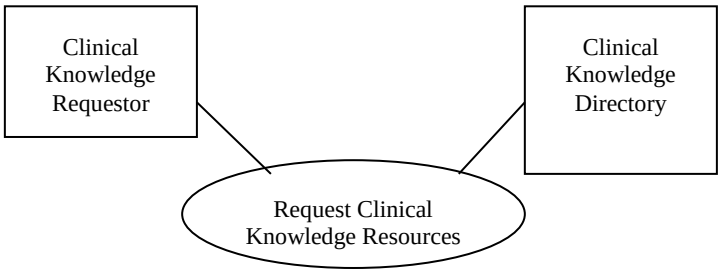
3.Y Query Clinical Knowledge

3.Y.1 Scope

This transaction returns a list of references to clinical knowledge resources relevant to the requested clinical knowledge. This may occur when a user attempts to lookup information relevant to a particular term or collection of terms found on a patient's chart, such as a problem, medication, allergy, laboratory result, et cetera.

To support access to a wide variety of information sources, information is returned as an Atom feed listing links to relevant resources.

3.Y.2 Use Case Roles



Actor: Clinical Knowledge Requester

Role: Electronic Health Record (REDS_AR010002UV01)

Actor: Clinical Knowledge Directory

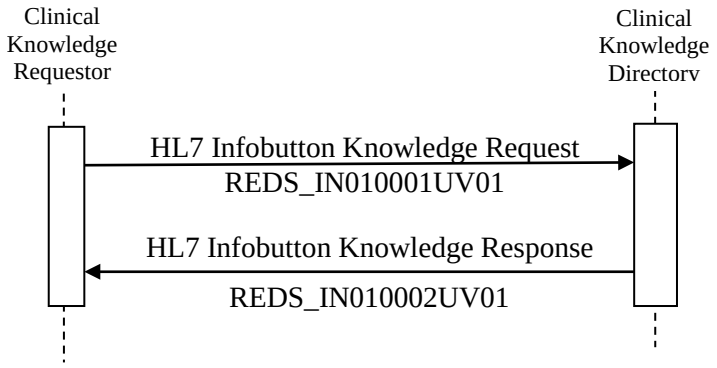
Role: Decision Support System (REDS_AR010001UV01)

3.Y.3 Referenced Standards

- [Infobutton] HL7 Version 3 Standard: Context-Aware Retrieval Application (Infobutton); Release 1http://www.hl7.org/implement/standards/product_brief.cfm?product_id=208
- [InfobuttonURL] HL7 Version 3 Implementation Guide: URL-Based Implementations of the Context-Aware Information Retrieval (Infobutton) Domain, Release 3 http://www.hl7.org/implement/standards/product_brief.cfm?product_id=22
- [InfobuttonSOA] Context-Aware Knowledge Retrieval (Infobutton) Service Oriented Architecture Implementation Guide, Release 1 http://www.hl7.org/implement/standards/product_brief.cfm?product_id=208

- [Atom] RFC-4287 The Atom Syndication Format
  http://tools.ietf.org/html/rfc4287
- [DC] DCMI Metadata Terms (Dublin Core)
  http://dublincore.org/documents/dcmi-terms/
- [RFC3986] Uniform Resource Identifier (URI): Generic Syntax
  http://tools.ietf.org/html/rfc3986
- [HTML4] HTML 4.01 Specification
  http://www.w3.org/TR/1999/REC-html401-19991224

3.Y.4 Interaction Diagram



3.Y.4.1 Infobutton Knowledge Request

The Infobutton Knowledge Request is an HTTP Request conforming to [InfobuttonURL]. This IHE profile includes several extensions to that guide which are expected to be incorporated into Release 4. This profile is expected to be revised in 2013 after that version of the standard has been adopted.

3.Y.4.1.1 Trigger Events

A context aware knowledge request event is triggered by the Clinical Knowledge Requester, e.g., in response to a user clicking on an Infobutton in an EHR.

3.Y.4.1.2 Message Semantics

The Infobutton Knowledge Request is sent as a set of name-value pairs in an HTTP GET or POST transaction.

[InfobuttonURL] describes how to translate the classes and attributes in the HL7 Infobutton Message Model found in [Infobutton] to HTTP parameters for a GET or POST request. Many of the attributes thus exchanged use the HL7 Concept Descriptor (CD) data type. That data type

includes values for the code, code system, code system name, original text being coded and the display name. The code system name and display name are optional components of the CD data type which are permitted, but only aid in human interpretation, rather than conveying any semantics in the message. The display name attribute is often mistakenly used to convey the original text used in the knowledge request. To avoid this confusion, this profile allows the display name and code system name parameters to be sent in the message, but provides no details about them in the text below.

Translations in [InfobuttonURL] are ambiguous as to how to deal with the code system attribute for coded terms. According to the HL7 Data Types specifications, code system must always be specified, but may be fixed by the model, and thus need not be sent in a message. This profile takes the approach that where a code system has been recommended or required by the model or by this profile, the code system attribute need not be sent, as the receiver can simply assume the parameter uses the default coding system in these cases. Messages that include the code system attribute must use the code system(s) allowed by this profile. The table below summarizes the requirements of this profile. The first column identifies the parameters that may be sent in the knowledge request. The second column indicates whether the parameter can repeat (Y), or which can only be sent once (N). The third column indicates whether the parameter is required (R) or optional (O) in a request. Where this profile has extended the Infobutton specification, the parameter is marked in italics. Where the profile is more constrained than the Infobutton specification, the constraint is in bold. Those that are identical to [InfobuttonURL] are in normal type.

The [Infobutton] and [InfobuttonURL] specifications reference the severityObservation class. The use of this class is out of scope for this profile. The text below does not address the use of this class.

Table 3.Y.4.1.2-1 below lists the required and optional parameters for the Query Clinical Knowledge transaction and whether or not they are repeatable. The name of the first occurrence of a repeatable parameter is provided as shown in the table. Second and subsequent occurrences of a repeatable parameter use the same name as the first, and append sequential numbers starting at 1. See [InfobuttonURL] for more details on numbering parameters. Detailed requirements on each of the parameters follow the table. A complete list of parameters can be found in Appendix 1 List of Parameter Names in [InfobuttonURL].

Table 3.Y.4.1.2-1: Infobutton Request Parameters

Parameter Name	Repeatable	Required/ Optional
knowledgeRequestNotification.id.root	**N**	**R**
knowledgeRequestNotification.effectiveTime.v	N	O
holder.assignedEntity.n	**Deprecated**[4]	
holder.assignedEntity.certificateText	**Deprecated**[4]	
assignedAuthorizedPerson.id.root	**N**	O
assignedAuthorizedPerson.id.extension		

Parameter Name	Repeatable	Required/ Optional
representedOrganization.id.root	**N**	O
representedOrganization.id.extension		
patientPerson.administrativeGenderCode.c	N	R
age.v.v	**N**	R[1]
age.v.u		
ageGroup.v.c	**N**	
taskContext.c.c	N	R
subTopic.v.c	N	O
subTopic.v.cs		
mainSearchCriteria.v.c	Y	**R**[2]
mainSearchCriteria.v.cs		
mainSearchCriteria.v.ot		
informationRecipient	N	**R**
informationRecipient.healthCareProvider.c.c	N	O
informationRecipient.healthCareProvider.c.cs		
informationRecipient.languageCode.c	Y	R
payor[5]	N	O
performer	N	O
performer.languageCode.c	Y	C[3]
performer.healthCareProvider.c.c	N	O
performer.healthCareProvider.c.cs		
encounter.c.c	N	O
serviceDeliveryLocation.id.root	Y	O
serviceDeliveryLocation.id.extension		

[1] The age.v.v and age.v.u parameters SHALL be sent when they are not considered to be individually identifiable information. Otherwise, ageGroup.v.c SHALL be sent.

[2] At least mainSearchCriteria.v.c and mainSearchCriteria.v.cs must be sent, or mainSearchCriteria.v.ot must be sent. [3] This parameter shall be sent when mainSearchCriteria.v.ot is present as a parameter.

[4] These parameters are not to be used under this profile.

[5] payor is an extension to [InfobuttonURL] that is expected to be adopted in the next release.

The sections following describe each parameter in detail. The numbered items beneath each parameter specify conformance requirements of this profile. Numbered conformance requirements marked in bold are constraints that are more restrictive than those provided in the HL7 Infobutton standard or guides. Those marked in italics are extensions to those specifications.

`knowledgeRequestNotification.id.root`

The identifier for the knowledge request is used both in the query clinical knowledge transaction, and in audit logs. It is required to be sent to ensure that audit logs between the Clinical Knowledge Request actor and the Clinical Knowledge Directory actor can be correlated.

1. **The Clinical Knowledge Requester SHALL send this parameter for every retrieval. The value SHALL be an OID or UUID that uniquely identifies the individual request and SHALL not be repeated for any subsequent request.**
2. **The Clinical Knowledge Directory SHALL report this identifier in its subsequent responses.**

`knowledgeRequestNotification.effectiveTime.v`

The effective time specifies the time at which the request is made. Because both the sender and receiver typically have a clock, it need not be sent. However, this parameter may also be relevant to the request (e.g., for knowledge that varies based upon the current time). For example, a public health alert may expire at a particular point in time, and thus be no longer relevant to a knowledge request, or a health resource referred to by a knowledge resource might not be available at a particular point in time.

3. The Clinical Knowledge Requester MAY send this parameter.
4. **When this parameter is present, the Clinical Knowledge Directory MAY use this date and time to limit the search results, but is not required to. This may be used for example, when querying for information about public health alerts relevant to patient symptoms.**
5. **When this parameter is used to limit the search, the Clinical Knowledge Directory SHOULD NOT return any results which were updated after this date and time. Clinical Knowledge Requesters SHALL NOT rely on this behavior.**

`holder.assignedEntity.n (deprecated)`
`holder.assignedEntity.certificateText (deprecated)`

These parameters are designed to hold the user name and password used to authenticate with the Clinical Knowledge Directory from the HL7 Version 3 message content. However, this violates the separation of the security and access control layer from the application layer, and provide for an alternate method to request access to content that is not supported by common web application frameworks and tools.

6. **The Clinical Knowledge Requester Actor SHOULD NOT use these parameters. There are numerous methods supported through the HTTP protocol to authenticate users with a web server, and one of these should be used instead.**

`assignedAuthorizedPerson.id.root`
`assignedAuthorizedPerson.id.extension`

These parameters are intended to convey the identifier of the person who is authorized to make the knowledge request.

7. The Clinical Knowledge Requester MAY use these parameter to pass the user id and assigning authority to the Clinical Knowledge Directory.
8. **When present, the Clinical Knowledge Directory SHALL use this information in the audit log to identify the requester.**

`representedOrganization.id.root`
`representedOrganization.id.extension`

These parameters are intended to convey the identifier of the organization who is authorized to make the knowledge request.

9. The Clinical Knowledge Requester MAY use these parameters to pass the organization's id and assigning authority to the Clinical Knowledge Directory.
10. **When these parameters are present and the assignedAuthorizedPerson.id parameters are absent, the Clinical Knowledge Directory SHALL use this information in the audit log to identify the requester.**

`patientPerson.administrativeGenderCode.c`

11. The Clinical Knowledge Requester SHALL send the gender when it is known. When the gender is not known, this parameter MAY be omitted[1].

The code system is fixed by the HL7 Infobutton Standard to be codes from the HL7 Administrative Gender domain. Table 3.Y.4.1.2-2 below lists the allowed codes that SHALL be used in a request.

Table 3.Y.4.1.2-2: Administrative Gender Codes

Code	Description
M	Male
F	Female
UN	Undifferentiated, used when gender cannot be distinguished. This is commonly misinterpreted to be Unknown, but that interpretation is not correct.

`age.v.v`
`age.v.u`

12. **The Clinical Knowledge Requester SHALL send age when it is known and not considered (e.g., due to advanced age) to be individually identifiable information.**

[1] A conforming Clinical Knowledge Requester must demonstrate the ability to send this parameter.

Age ranges that are considered individually identifiable are determined by local policy.

13. The values in table 3.Y.4.1.2-3 Age Unit Codes are the only values allowed for the age unit found in age.v.u and SHALL be interpreted by the Clinical Knowledge Directory according to the table below.
14. **The Clinical Knowledge Requester SHOULD send the age in years when the patient is more than 2 years old, in months when the patient is more than 2 months old but less than 2 years old, weeks when the patient is more than 2 weeks old but less than 2 months old, days when the patient is more than 2 days old but less than 2 weeks old, and in hours when the patient is less than 2 days in age.**
15. **The Clinical Knowledge Requester SHALL NOT send age as a decimal fraction.**
16. **The Clinical Knowledge Directory SHALL appropriately interpret age specified in any unit.**
17. The Clinical Knowledge Directory MAY use appropriate mathematical approximations to convert between units (e.g., a year may be treated as 365.25 days).

Table 3.Y.4.1.2-3: Age Unit Codes

Unit Code	Description
a	Year
m	Month
w	Week
d	Day
h	Hour

Note: Gestational Age rather than age as days since birth is often quite relevant in neonatal contexts. However, this profile expects the Clinical Knowledge Requester to send the age since birth. Clinical Knowledge Directorys should consider the range of possible gestational ages associated with the days since birth when searching for relevant content in these cases.

`ageGroup.v.c`
`ageGroup.v.cs`

18. **The Clinical Knowledge Requester SHALL send these parameters when age is known but is considered (e.g., due to advanced age) to be individually identifiable information.**

Note: The code system is not profiled. We would welcome suggestions for an appropriate value set to apply for the ageGroup parameters.

19. The ageGroup parameter MAY use terms from the Medical Subheadings (MeSH) Code System (2.16.840.1.113883.6.177) from UMLS described in the table below.

20. **When the MeSH Code system is used, ageGroup.v.cs need not be sent, as this is the default cause system. If any other code system is used, the ageGroup.v.cs parameter must be sent.**

Concept code	Display name
D007231	infant, newborn; birth to 1 month
D007223	Infant; 1 to 23 months
D002675	child, preschool; 2 to 5 years
D002648	child; 6 to 12 years
D000293	adolescent; 13-18 years
D055815	young adult; 19-24 years
D000328	adult; 19-44 years
D000368	aged; 56-79 years
D008875	middle aged; 45-64 years
D000369	aged, 80 and older; a person 80 years of age and older

`taskContext.c.c`

21. **The Clinical Knowledge Requester SHALL send the task currently being performed using terms from the HL7 ActTaskCode value set of the ActCode vocabulary. The codes found in table 3.Y.4.1.2-4 Task Context Codes are the only codes that may be sent in this parameter.**

22. The Clinical Knowledge Directory MAY use this parameter to filter relevant content for the user.

Table 3.Y.4.1.2-4: Task Context Codes

Code	Display Name	Description
OE	order entry task	A clinician creates a request for a service to be performed for a given patient.
LABOE	laboratory test order entry task	A clinician creates a request for a laboratory test to be done for a given patient.
MEDOE	medication order entry task	A clinician creates a request for the administration of one or more medications to a given patient.
PATDOC	patient documentation task	A person enters documentation about a given patient.
ALLERLREV	allergy list review	A person reviews a list of known allergies of a given patient.
CLINNOTEE	clinical note entry task	A clinician enters a clinical note about a given patient
DIAGLISTE	diagnosis list entry task	A clinician enters a diagnosis for a given patient.
DISCHSUME	discharge summary entry task	A clinician enters a discharge summary for a given patient.
PATREPE	pathology report entry task	A pathologist enters a report for a given patient.
PROBLISTE	problem list entry task	A clinician enters a problem for a given patient.
RADREPE	radiology report entry task	A radiologist enters a report for a given patient.

Code	Display Name	Description
IMMLREV	immunization list review	A person reviews a list of immunizations due or received for a given patient.
REMLREV	reminder list review	A person reviews a list of health care reminders for a given patient.
WELLREMLREV	wellness reminder list review	A person reviews a list of wellness or preventive care reminders for a given patient.
PATINFO	patient information review task	A person (e.g., clinician, the patient herself) reviews patient information in the electronic medical record.
ALLERLE	allergy list entry	A person enters a known allergy for a given patient.
CLINNOTEREV	clinical note review task	A person reviews a clinical note of a given patient.
DISCHSUMREV	discharge summary review task	A person reviews a discharge summary of a given patient.
DIAGLISTREV	diagnosis list review task	A person reviews a list of diagnoses of a given patient.
IMMLE	immunization list entry	A person enters an immunization due or received for a given patient.
LABRREV	laboratory results review task	A person reviews a list of laboratory results of a given patient.
MICRORREV	microbiology results review task	A person reviews a list of microbiology results of a given patient.
MICROORGRREV	microbiology organisms results review task	A person reviews organisms of microbiology results of a given patient.
MICROSENSRREV	microbiology sensitivity test results review task	A person reviews the sensitivity test of microbiology results of a given patient.
MLREV	medication list review task	A person reviews a list of medication orders submitted to a given patient
MARWLREV	medication administration record work list review task	A clinician reviews a work list of medications to be administered to a given patient.
OREV	orders review task	A person reviews a list of orders submitted to a given patient.
PATREPREV	pathology report review task	A person reviews a pathology report of a given patient.
PROBLISTREV	problem list review task	A person reviews a list of problems of a given patient.
RADREPREV	radiology report review task	A person reviews a radiology report of a given patient.
REMLE	reminder list entry	A person enters a health care reminder for a given patient.
WELLREMLE	wellness reminder list entry	A person enters a wellness or preventive care reminder for a given patient.
RISKASSESS	risk assessment instrument task	A person reviews a Risk Assessment Instrument report of a given patient.
FALLRISK	falls risk assessment instrument task	A person reviews a Falls Risk Assessment Instrument report of a given patient.

690 In the above, many tasks appear twice, once in the context of list entry, and a second time in the context of review. For example, there is a task for medication order entry, and a second task for order review. In general, review tasks should be used with Infobuttons attached to information already entered or present in the patients chart. List entry tasks should be used with Infobuttons attached to pick lists or other data entry controls from which a clinician could create a new entry.

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`mainSearchCriteria.v.c`
`mainSearchCriteria.v.cs`
`mainSearchCriteria.v.ot`

The mainSearchCriteria parameters are used to send information about the term being queried. Usually this will be a coded term and be sent using the mainSearchCriteria.v.c and mainSearchCriteria.v.cs parameters. However, if there is no code associated with the search term, the string value of the term can be sent using the mainSearchCriteria.v.ot.

23. The Clinical Knowledge Directory SHALL send at least one search term in mainSearchCriteria.v.c or mainSearchCriteria.v.ot.

24. **If mainSearchCriteria.v.c is sent, the coding system used SHALL be sent in the mainSearchCriteria.v.cs parameter.**

`subTopic.v.c`
`subTopic.v.cs`

25. The subtopic parameter identifies the kind of information being sought using mainSearchCriteria above. The Clinical Knowledge Requestor MAY use this parameter to represent the specific kind of content being sought.

There are many common sections in clinical content used to provide information about problems, medications, lab tests, et cetera. However, there is no single vocabulary which codifies all of these concepts.

LOINC includes a set of values used in FDA Package inserts which represent many concepts common to clinical content on medications. MESH also includes a number of terms that could be used for these concepts. A number of relevant terms also appear in SNOMED CT.

A list of different kinds of publications appears below with some of the expected subsections.

Clinical Trial Descriptions

- Purpose
- Condition
- Intervention
- Eligibility
- Contacts and Locations

Lab Test Compendia

- Specimen (type, handling, et cetera)
- Indications
- Contraindications
- Interpretation

- Reference Range
- Method

Public Health Alerts

- Description
- Screening
- Diagnosis
- Treatment
- Prognosis
- Reporting

Problems and Allergies

- Description
- Risks
- Diagnosis
- Treatment
- Prognosis

Procedures

- Purpose
- Indications
- Contraindications
- Risks, Complications and Side Effects
- Prognosis

Vaccination Information

- Indications
- Contraindications
- Risks, Complications and Side Effects

`informationRecipient`

26. **The Clinical Knowledge Requester SHALL send this parameter.**
27. It SHALL have the value PAT if the final information recipient is to be the patient, or PROV if the final information recipient is to be a clinician, *or PAYOR if the final information recipient is to be a payer*. No other values are permitted.

`informationRecipient.languageCode.c`

28. **The Clinical Knowledge Requester SHALL send this parameter. It indicates the desired language of the information recipient.**
29. This parameter MAY be sent more than once if the information recipient is interested in content available in additional languages.
30. Each subsequent parameter SHALL have its ordinal appended according to the requirements of the Infobutton URL Implementation guide.
31. Clinical Knowledge Directory SHOULD NOT return resources in languages other than specified by this parameter (it MAY do so if alternative resources are available in the requested language).
32. The value of this parameter SHALL be a language code as specified by RFC 1766 Tags for Identifying Languages.

`informationRecipient.healthCareProvider.c.c`
`informationRecipient.healthCareProvider.c.cs`

33. When the information recipient is a clinician, these parameters MAY be sent by the Clinical Knowledge Requester to identify the specialty or level or training of the clinician.

`performer`

34. The Clinical Knowledge Requester MAY send this parameter.
35. It SHALL have the value PAT if the performer of the request is the patient, or PROV if the performer of the request is a clinician*, or PAYOR if the performer of the request is a payer*. No other values are permitted.

`performer.healthCareProvider.c.c`
`performer.healthCareProvider.c.cs`

36. The Clinical Knowledge Requester MAY send this parameter to identify the specialty and/or level of training of the performer of the request when performer contains the value PROV.
37. This parameter MAY be used by the Clinical Knowledge Directory to locate appropriate resources facilitating communication between clinicians (e.g., with different specialties).

`performer.languageCode.c`

38. **The Clinical Knowledge Requester SHALL send this parameter when mainSearchCriteria.v.ot is sent. This parameter indicates the human language of the text found in the mainSearchCriteria.v.ot parameter.**

39. The Clinical Knowledge Directory MAY use this parameter to assist in interpretation of the mainSearchCriteria.v.ot parameter (e.g., to select appropriate language specific processing algorithms).

`encounter.c.c`

40. The Clinical Knowledge Requester MAY send this parameter to indicate the type of encounter in which the request is being performed. Values SHALL be drawn from the list of codes found in table 3.Y.4.1.2-5 below. These codes can be found in the HL7 ActCode Vocabulary.

41. The Clinical Knowledge Directory MAY use this parameter to filter the resources returned.

Table 3.Y.4.1.2-5: Encounter Type Codes

Code	Description
AMB	ambulatory
EMER	emergency
FLD	field
HH	home health
IMP	inpatient encounter
ACUTE	inpatient acute
NONAC	inpatient non-acute
SS	short stay
VR	virtual

`serviceDeliveryLocation.id.root`
`serviceDeliveryLocation.id.extension`

42. The Clinical Knowledge Requester MAY send this parameter to identify the location where care is being performed.

43. The Clinical Knowledge Directory MAY use this parameter to locate relevant resources based on location.

Note: Traditional service delivery location identifiers may not be useful for many cases. However, postal codes (zip codes), county, state and country names can all be represented as identifiers within an appropriate assigning authority domain, and could be useful in filtering information passed on service delivery location, which is why this parameter has been included in the profile. Note that this location may not be the same as the location from where the request is being performed. Future editions of the Infobutton standard are expected to provide better support for use of location as a search criterion.

3.Y.4.1.3 Expected Actions

1. The Clinical Knowledge Requester SHALL generate an HTTP GET or POST request passing the Infobutton parameters described above.

2. When the Clinical Knowledge Requester generates an HTTP GET request, the parameters are passed as URL Query parameters as specified in section 3.4 of [RFC3986].
3. The GET parameter values SHALL be URL-encoded (just as if a form was being submitted using the GET method in an HTML web page).
4. *The Content-Type header of an HTTP POST request SHALL be application/x-www-form-urlencoded specified in section 17.13.4 of [HTML4] (just as if a form was being submitted using the POST method in an HTML web page).*

Note: [InfobuttonURL] specifies an alternate method of encoding for passing the parameters. This profile adopts the mechanism of earlier releases of the guide as being the most compatible with existing implementations, and which is expected to be re-adopted in later releases of the URL guide. This mechanism is also compatible with HTML Forms.

5. **A Clinical Knowledge Requestor actor SHALL be configurable to send its HTTP GET or HTTP POST request to a Clinical Knowledge Directory through a Proxy.**
6. The URL to which the request is made is left unspecified by this profile.
7. The Clinical Knowledge Requester Actor MAY send other HTTP headers (e.g., Authorization).
8. **The Clinical Knowledge Requester Actor MAY specify the Accept-Language header to indicate the preferred language of the Atom feed content for human readable text (e.g., titles of articles, et cetera). This HTTP parameter does not have any effect on the preferred language of the resources returned by the Clinical Knowledge Directory (see informationRecipient.languageCode.c above).**
9. **The Clinical Knowledge Requester Actor MAY specify the Accept-Charset header to indicate the preferred character set for the Atom feed content for human readable text (e.g., titles of articles, et cetera). This HTTP parameter does not have any effect on the character set used for the resources returned by the Clinical Knowledge Directory.**

3.Y.4.1.4 Sample Infobutton Knowledge Request

The example in the figure below shows an example Infobutton Knowledge Request. It was generated with the assistance of the HTML Page described in Appendix A – Infobutton Knowledge Request from a common browser.

```
POST / HTTP/1.1
Host: sample.com
Connection: keep-alive
Content-Type: application/x-www-form-urlencoded
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,*/*;q=0.8
Accept-Encoding: gzip,deflate,sdch
Accept-Language: en-US,en;q=0.8
Accept-Charset: ISO-8859-1,utf-8;q=0.7,*;q=0.3

knowledgeRequestNotification.id.root=67234cef-f312-49d3-bf62-eaa362db5bd0&knowledgeRequestNotific
ation.effectiveTime.v=20120503121700&assignedAuthorizedPerson.id.root=55f42dca-858f-4656-8d95-d53
250dc897f&assignedAuthorizedPerson.id.extension=KWB&patientPerson.administrativeGenderCode.c=M&ag
e.v.v=47&age.v.u=a&taskContext.c.c=LABOE&mainSearchCriteria.v.c=55454-3&mainSearchCriteria.v.cs=2
.16.840.1.113883.6.1&informationRecipient=PAT&informationRecipient.languageCode.c=en&encounter.c.
c=AMB
```

Figure 3.Y.4.1.4-1: Sample Request

3.Y.4.2 Infobutton Knowledge Response

3.Y.4.2.1 Trigger Events

The Infobutton Knowledge Response is triggered in response to the receipt of the Infobutton Knowledge Request message.

3.Y.4.2.2 Message Semantics

The Infobutton Knowledge Response is returned in the form of an atom feed pointing to appropriate clinical knowledge resources based on the parameters given in the request. This response is formatted as specified in section 4.2.1 Overall Atom Structure found in [InfobuttonSOA]. Requirements upon how a Clinical Knowledge Directory must interpret these parameters is given in section 3.Y.4.1.2 above. Requirements of the atom feed are described in the sections below.

Atom is an extensible format. This profile extends atom by drawing on three properties from the Dublin Core to provide a mechanism to optionally record bibliographic citations, identifiers for cited resources, and other information relevant to the provenance of the content (e.g., funding sources).

Elements appearing in the text and examples below are bound to the http://www.w3.org/2005/Atom namespace if no namespace prefix is present. The namespace prefix dcterms is used for extension elements borrowed from the Dublin Core and are bound to the http://purl.org/dc/terms/ namespace.

Numbered paragraphs in the text below identify requirements of this profile. Paragraphs marked in bold are more constrained than the [InfobuttonSOA] specification. Paragraphs marked in italic represent extensions to the [InfobuttonSOA] specifications.

3.Y.4.2.2.1 <feed>

The feed element is constrained as specified in [InfobuttonSOA]. Additional constraints added by IHE appear in bold. Extensions are italicized.

1. The response SHALL be contained within a single atom `<feed>` element.
2. The <id> element SHALL be present and may be a URL representing the endpoint to which the request was sent, or may be some other unique URI.
3. The <title> element SHALL be present.
4. The <subtitle> element MAY be present.
5. The <updated> element SHALL be present to indicate the last time the feed was updated.
6. At least one <author> element SHALL be present to indicate the publisher of the feed.
7. **The response SHALL include a <link> element, where the href attribute is a representation of the endpoint URL and the clinically related knowledge request parameters formatted as HTTP query parameters. This <link> element shall include a rel attribute that has the value self.**
8. *The feed SHALL include a <category> element representing the values sent in the request for each of the subtopic, task context, encounter, age/age group, gender and information recipient parameters, and used by the Clinical Knowledge Directory to select appropriate content. These shall be structured as specified in section 3.Y.2.4.3.1 Categories below. This is an extension to the material described in [InfobuttonSOA].*
9. Other <category> elements MAY be present to represent additional knowledge request parameters at the option of the Clinical Knowledge Directory. These may be formatted as specified in section 4.3.2.1 Atom:category domain specific extensions in [InfobuttonSOA].

Note: The HL7 SOA Guide specifies the representation of Category using the HL7 Version 3 XML as an extension. The next release of the guide is expected to adopt the simpler format described in section 3.Y.2.4.3.1 Categories below.

10. The <feed> element MAY contain an <icon> element.
11. The <feed> element SHALL contain 0 or more <entry> elements conforming to the requirements below.
12. The <feed> element may contain legal Atom extension elements to communicate additional information.

3.Y.4.2.2.2 <entry>

1. Each <entry> element SHALL contain an <id>.
2. Each <entry> element SHALL contain a <title>.

3. **The <entry> MAY include a <published> element giving the original publication date of the content.**
4. The <entry> SHALL contain an <updated> element giving the date of last update or publication of the content.
5. **The <published> and <updated> time stamps SHOULD be reported with a time zone offset.**
6. Each <entry> element SHALL contain at least one <author> element representing the organizational or individual author of the content.
7. **The name or the person or organization SHALL be provided in the <name> element.**
8. *The feed MAY include a <category> element representing the values sent in the request for each of the subtopic, task context, encounter, age/age group, gender and information recipient parameters, and used by the Clinical Knowledge Directory to select the content represented in this <entry>.*
9. Each <entry> element MAY contain additional <author> or <contributor> elements to name additional authors and contributors.
10. **The <entry> element SHALL contain at least one <link> element containing rel attribute set to alternate.**
11. **The href attribute of the <link> element SHALL point to a URL from which the content can be subsequently retrieved. This URL can subsequently be used in the Retrieve Clinical Knowledge transaction described in section 3.Z below.**
12. **The type attribute used with the <link> element SHOULD be text/xhtml or application/pdf.**
13. Each <entry> element MAY contain a <summary> element.
14. Each <entry> element MAY contain a <content> element.
15. **When present, the <content> element SHALL contain the content of the resource.**
16. **The type attribute of the <content> element SHOULD use the value xhtml.**
17. **Content SHOULD appear in an <xhtml:div> element beneath the <content> element.**
18. *The <entry> element MAY contain an <dcterms:bibliographicCitation> element to provide a citation for the content being returned.*
19. *The <entry> MAY contain an <dcterms:isPartOf> element to provide a URI for the cited publication. That URI may be URL to a web page, a URN, an ISSN or ISBN encoded as a URN, or a DOI number prefixed with the doi: URL scheme.*
20. *The <entry> element MAY contain an <dcterms:provenance> element to provide statements about the provenance of a resource (e.g., source of funding, changes in ownership, et cetera).*

21. The <entry> element MAY contain other legal Atom extension elements to communicate additional information about the entry (e.g., priority of a public health alert).

3.Y.4.2.3 Expected Actions

1. **A Clinical Knowledge Directory SHALL accept requests using both the HTTP GET and HTTP POST methods.**
2. **Upon receipt of the Infobutton Knowledge Request, the Clinical Knowledge Directory Actor SHALL parse the request.**
3. **If there are no errors, it SHALL return the Infobutton Knowledge Response as specified in 3.Y.4.2.2 and HTTP response code 200 - OK.**
4. **If there are syntax errors in the request the Clinical Knowledge Directory SHALL return a 400 - Bad Request response code.**
5. **If the Clinical Knowledge Requester is not authorized to access the Clinical Knowledge Directory, it SHOULD return a 401 – Request Unauthorized failure, but MAY return other values depending upon how the system implements authentication.**
6. **If the Infobutton Knowledge Request supplied credentials in the HTTP request and they are not valid Clinical Knowledge Directory SHALL log an authentication error in the audit log. If no credentials were supplied, an audit log entry SHOULD NOT be generated.**
7. **Other error codes MAY be returned by the Clinical Knowledge Directory as needed.**

Some web-based authentication mechanisms use HTTP redirects to provide for user authentication (e.g., OAuth) or access controls. This IHE profile neither requires nor prohibits use of these mechanisms to enforce user authentication or enable access controls. The use of these methods for authentication or access control is out of the scope of this profile.

Note: A Clinical Knowledge Requester should fail gracefully upon receipt of an unrecognized return code in the HTTP response (e.g., such as a redirect request in the example above). Additional error return codes may be introduced by web intermediaries such as firewalls and caches that appear between the Clinical Knowledge Directory and Clinical Knowledge Requester actors. These servers may introduce additional failure modes and failure codes.

Responses to the Infobutton Knowledge Request should not be cached[2].

8. **To ensure this, the Clinical Knowledge Directory SHALL set the HTTP Cache-Control header to no-cache and also send an HTTP Pragma header to no-cache (for HTTP/1.0 caches).**

[2] This is not a formal requirement of the Clinical Knowledge Directory or Requester actors because they do not exert anything other than advisory control on proxies, caches or other intermediaries that may lie between them on a network.

9. **The Clinical Knowledge Directory SHALL report each parameter or set of related parameters it used to filter information as a <category> in the Infobutton Knowledge Response.**
10. **The Clinical Knowledge Directory MAY ignore parameters that are not relevant. The ignored parameters SHALL NOT be included in a <category> element. For example, the administrativeGenderCode.v.c parameter is required to be sent by the Clinical Knowledge Requestor. However, it may not be relevant to an Infobutton Knowledge response when the mainSearchCritiera parameter is about an immunization, for example.**
11. **The Clinical Knowledge Directory shall log the request in the audit log.**

3.Y.4.2.3.1 Categories

The parameters in the Infobutton Knowledge Request are named based on the model elements and data type components associated with them in the HL7 model. Several model elements are associated with multiple parameters because the data type has several components. For the purpose of categorization the information about the model element should only appear in one <category> element. In order to collapse multiple parameters into one <category> element, the values associated multiple parameters must be combined. The rules for combining are based on the data type of the model element and can be found in table 3.Y.4.2.3.1-1 Literal Representations below.

Table 3.Y.4.2.3.1-1: Literal Representations

Data Type	Suffix	Literal Representation
PQ	.v.v	concat(X.v.v, X.v.u) e.g., 1mg, 2{tablet}, 9%
	.v.u	
CD	.c, .c.c or .v.c	concat(X.c.cs, ":",X.c.c) or concat(X.v.cs, ":",X.v.c) e.g., 2.16.840.1.113883.6.96: 22298006
	.c.cs or .v.cs	
	.v.ot	X.v.ot e.g., myocardial infarct
II	.root	concat(X.root, ":",X.extension) e.g., 2.16.840.1.113884.13.9:123456
	.extension	

12. **The term attribute of the <category> element SHALL populated by the code, value or identifier associated with the parameter.**
13. **The scheme attribute of the <category> element SHALL be populated with the name of the parameter after removing the suffixes found in the table above. This generates the scheme names found in the table below.**

Table 3.Y.4.2.3.1-2: Category scheme Names

Scheme Name	Suffixes
patientPerson.administrativeGenderCode	.c.c
age	.v.v .v.u
ageGroup	.c.cs:.c.c
taskContext	.c.c
subTopic	.c.c
informationRecipient	
informationRecipient.languageCode	.c.c
encounter	.c.c
serviceDeliveryLocation.id	.root:.extension

3.Y.4.2.4 Sample Infobutton Knowledge Response

```
<?xml version="1.0" encoding="UTF-8"?>
<feed xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:dcterms="http://purl.org/dc/terms/"
  xsi:schemaLocation="http://www.w3.org/2005/Atom ../../atom.xsd"
  xmlns="http://www.w3.org/2005/Atom">
  <category term="47" scheme="age"/>
  <category term="M" scheme="administrativeGenderCode"/>
  <category term="PAT" scheme="informationRecipient"/>
  <category term="en" scheme="informationRecipient.languageCode"/>
  <category term="AMB" scheme="encounter"/>
  <generator>Sample Generator</generator>
  <id>http://sample.com</id>
  <link rel="self" href="http://endpointURI/Infobutton?knowledgeRequestNotification.id.root=67234
cef-f312-49d3-bf62-eaa362db5bd0&amp;knowledgeRequestNotification.effectiveTime.v=20120503121700&a
mp;assignedAuthorizedPerson.id.root=55f42dca-858f-4656-8d95-d53250dc897f&amp;assignedAuthorizedPe
rson.id.extension=KWB&amp;patientPerson.administrativeGenderCode.c=M&amp;age.v.v=47&amp;age.v.u=a
&amp;taskContext.c.c=LABOE&amp;mainSearchCriteria.v.c=55454-3&amp;mainSearchCriteria.v.cs=2.16.84
0.1.113883.6.1&amp;informationRecipient=PAT&amp;informationRecipient.languageCode.c=en&amp;encoun
ter.c.c=AMB"/>
  <title>Sample Infobutton Response</title>
  <entry>
    <author>
      <name>Keith W. Boone</name>
      <uri>http://motorcycleguy.blogspot.com</uri>
    </author>
    <link rel="alternate"
      href="http://motorcycleguy.blogspot.com/2012/05/two-ihe-profiles-for-meaningfuluse.html"/>
    <published>2012-05-01T14:05:17-06:00</published>
    <dcterms:bibliographicCitation> Boone, K. (May 1, 2012). Two IHE
      Profiles for MeaningfulUse Stage2. Healthcare Standards. Retrieved
      May 2, 2012 from
      http://motorcycleguy.blogspot.com/2012/05/two-ihe-profiles-for-meaningfuluse.html
    </dcterms:bibliographicCitation>
    <dcterms:provenance> The opinions represented in this blog are my
      own, and not that of my employer or the respective standards
      organizations that I work with. </dcterms:provenance>
  </entry>
</feed>
```

Figure 3.Y.4.2.4-1: Sample Response

3.Y.5 Security Considerations

3.Y.5.1 Security Audit Considerations

3.Y.5.1.1 Clinical Knowledge Requester 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(“PCC-Y”, “IHE Transactions”, “Query Clinical Knowledge”)

Source (Clinical Knowledge Requester) (1)
Human Requester (0..n)
Destination (Clinical Knowledge Directory) (1)
Audit Source (Clinical Knowledge Requester) (1)
Query Parameters(1)

Where:

Source **AuditMessage/ ActiveParticipant**	UserID	M	????
	AlternativeUserID	M	the process ID as used within the local operating system in the local system logs.
	UserName	*U*	*not specialized*
	UserIsRequester	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 RFC 3881.
Human Requester (if known) **AuditMessage/ ActiveParticipant**	UserID	M	Identity of the human that initiated the transaction. The content of the assignedAuthorizedPerson.id.root and assignedAuthorizedPerson.id.extension in the form: root^extension, or just root if extension is not present.
	AlternativeUserID	*U*	*not specialized*
	UserName	*U*	*not specialized*
	UserIsRequester	M	"true"
	RoleIDCode	U	Access Control role(s) the user holds that allows this transaction.
	NetworkAccessPointTypeCode	*NA*	
	NetworkAccessPointID	*NA*	

Destination **AuditMessage/ ActiveParticipant**	UserID	M	HTTP endpoint URI.
	AlternativeUserID	*U*	*not specialized*
	UserName	*U*	*not specialized*
	UserIsRequester	M	"false"
	RoleIDCode	M	EV(110152, DCM, "Destination")
	NetworkAccessPointTypeCode	M	"1" for machine (DNS) name, "2" for IP address
	NetworkAccessPointID	M	The machine name or IP address, as specified in RFC 3881.

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("PCC-Y", "IHE Transactions", "Query Clinical Knowledge")
	ParticipantObjectSensitivity	*U*	*not specialized*

	ParticipantObjectID	M	The content of knowledgeRequestNotification.id.root (a UUID or OID)
	ParticipantObjectQuery	M	The content of the HTTP POST body base64 encoded.

1075 **3.Y.5.1.2 Clinical Knowledge Requester 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("PCC-Y", "IHE Transactions", "Query Clinical Knowledge")
Source (Document Consumer) (1)			
Destination (Document Registry) (1)			
Audit Source (Document Registry) (1)			
Patient (0..1)			
Query Parameters(1)			

Where:

Source **AuditMessage/ ActiveParticipant**	UserID	M	?
	AlternativeUserID	*U*	*not specialized*
	UserName	*U*	*not specialized*
	UserIsRequester	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 RFC 3881.

Destination **AuditMessage/ ActiveParticipant**	UserID	M	HTTP endpoint URI.
	AlternativeUserID	M	the process ID as used within the local operating system in the local system logs.
	UserName	*U*	*not specialized*
	UserIsRequester	M	"false"
	RoleIDCode	M	EV(110152, DCM, "Destination")
	NetworkAccessPointTypeCode	M	"1" for machine (DNS) name, "2" for IP address
	NetworkAccessPointID	M	The machine name or IP address, as specified in RFC 3881.

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("PCC-Y", "IHE Transactions", "Query Clinical Knowledge")

	ParticipantObjectSensitivity	*U*	*not specialized*
	ParticipantObjectID	M	The content of knowledgeRequestNotification.id.root (a UUID or OID)
	ParticipantObjectQuery	M	The content of the HTTP POST body base64 encoded.

3.Y.5.1.(z) Actor Specific Security Considerations

When individually identifiable data are provided in an Infobutton request, additional security may be required by the Clinical Knowledge Directory to protect information systems that have access to this information. For example, if locations are specified using the full zip code associated with a patient, or age is provided for patients older than 89, this is considered to be individually identifiable information in the US. Applications created by certain entities in the US that have access to such information must include additional security and access control measures. This can substantially increase the cost of deployment of a Clinical Knowledge Directory by those entities. Careful consideration must be given to how much information is provided in a Clinical Knowledge Request transaction to ensure that applications can be designed in a cost effective manner.

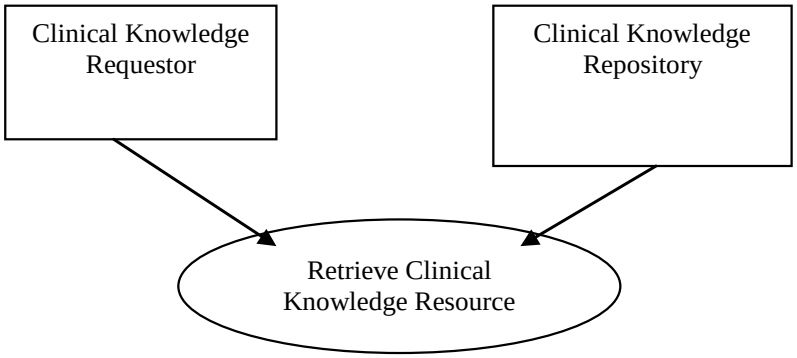
3.Z Retrieve Clinical Knowledge

This section corresponds to Transaction PCC-Z of the IHE Technical Framework. The Clinical Knowledge Requester and Clinical Knowledge Resource Repository actors use transaction PCC-Z.

3.Z.1 Scope

This transaction is used by the Clinical Knowledge Requester to retrieve a document from the Clinical Knowledge Resource Repository. The Clinical Knowledge Requester has already obtained the URI information from the Clinical Knowledge Directory by means of the Query Clinical Knowledge transaction.

3.Z.2 Use Case Roles



Actor: Clinical Knowledge Requester

Role: Obtains document.

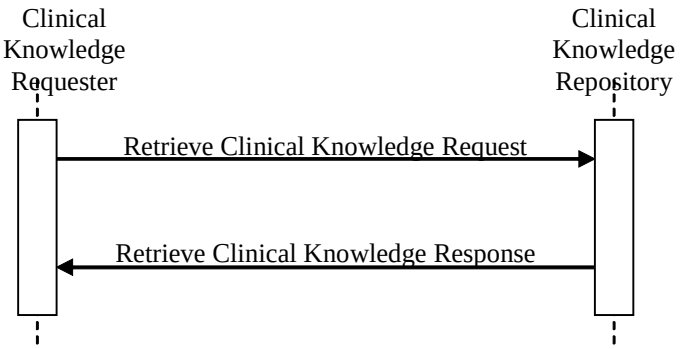
Actor: Clinical Knowledge Resource Repository

Role: Provides documents.

3.Z.3 Referenced Standard

HTTP	Hyper Text Transfer Protocol HTTP 1.1 (RFC 2616)
MIME	Multipurpose Internet Message Extensions (RFC 2045 to RFC 2049)

3.Z.4 Interaction Diagram



3.Z.4.1 Retrieve Clinical Knowledge Request

3.Z.4.1.1 Trigger Events

The Clinical Knowledge Requester has obtained URI information from the Clinical Knowledge Directory by means of the Query Clinical Knowledge transaction.

3.Z.4.1.2 Message Semantics

The URI specifies the protocol and protocol parameters that are to be used to retrieve the document. The Clinical Knowledge Resource Repository shall support the following parameters for protocol in the URI:

- HTTP
- HTTPS

The details of URI handling are specified in the HTTP standard (RFC 2616).

The Clinical Knowledge Resource Repository shall fully implement support for any protocol parameters that are required by the HTTP standard.

3.Z.4.1.2.1 Request Headers

The HTTP Protocol specifies a variety of request headers that can affect the result returned by the server. Clinical Knowledge Requesters may use any request header allowed by the HTTP Protocol[3]. However, Clinical Knowledge Repositories are not required to acknowledge or support of these headers not required by the protocol, and may be required in certain cases to ignore certain headers. See the table below for details.

[3] Ed Note: To allow common web browsers to be used without restriction.

Table 3.Z.4.1.2.1-1: Request Headers

Request Header	Repository Support	Comments
Accept Accept-Charset Accept-Language	O	These headers can alter the charset or language of the requested resource.
Accept-Encoding	O	This header requests that an encoded form of the data be returned [e.g., gzip or compress]. Repositories may support this header, but are not required to. Clinical Knowledge Requesters must support responses that ignore this content header.
Authorization	O	This header may be sent in environments where EUA is used. See the EUA profile for more details.
If-Modified-Since	O	Since Repositories need not be expected to change documents once stored, they are free to ignore this header or respond as appropriate.

3.Z.4.1.3 Expected Actions

A Retrieve Clinical Knowledge Response will be generated in return. Details are specified in the HTTP standard.

3.Z.4.2 Retrieve Clinical Knowledge Response

3.Z.4.2.1 Trigger Events

This message is triggered by the Retrieve Clinical Knowledge Request.

3.Z.4.2.2 Message Semantics

A Clinical Knowledge Resource Repository actor is required to return the following values:

Table 3.Z.4.2.2-1: Response Codes

Response Code	When to Return	Support
200 – OK	If the request is valid and data are available.	R
304 – Not Modified	If the request is a valid conditional GET [see HTTP specification], and the document has not been modified since the requested modification date.	O
400 – Bad Request	If the request is not valid.	R
401 – Authorization Required	If the request requires authentication, and an Authorization header is not present, or is not valid.	O
403 – Forbidden	If access needs to be denied for reasons other than authentication failure [e.g., because the request comes from a Node that is not allowed access to the document].	R
404 – Not Found	If the request is syntactically valid, but the document cannot be located, or does not otherwise exist.	R
410 – Gone	If the request is valid, and the document once existed, but is no longer available [e.g., the document may have been removed at the patients request].	O
5XX – Server Error	The server may return any error code beginning with the digit 5 to indicate a server error.	O

3.Z.4.2.2.1 Response Headers

The HTTP Protocol specifies a variety of response headers that provide more information about the response. The use of these headers is described in the table below:

Table 3.Z.4.2.2.1-1: Response Headers

Response Header	Repository Support	Comments
Expires	R	Any valid value according to RFC2616, or 0 [c.f. RID volume]
Content-Encoding	O	If the Clinical Knowledge Requester requested encoding of the response, and the repository is able to fulfill that request, it must return the appropriate value in this header.
Content-Type	R	These headers correspond to the mimeType, languageCode, and size attributes of the Content. Content-Type is required in the response. The other two are optional.
Content-Language Content-Length	O	
Last-Modified	R	This header should correspond to the date the document was last published or updated in the repository, and should be the same as the most recent of the published or updated element in the atom feed entry for the document.
WWW-Authenticate	O	If the Repository requires authentication and the request did not contain valid credentials, this header must be returned in the 401 response.

3.Z.4.2.3 Expected Actions

1. A Clinical Knowledge Requestor actor SHALL be configurable to send its HTTP GET request to a Clinical Knowledge Resource Repository through a Proxy.

The Clinical Knowledge Requester now has the content of the document to process.

3.Z.5 Security Requirements

This transaction involves the retrieval of clinical knowledge. There is no individually identifiable health information being exchanged, and therefore no audit logging requirements. Encryption of the communication is still required because this transaction may pass authentication parameters, and/or communicate content that needs to be access controlled.

Appendix A – Infobutton Implementation Considerations

This appendix describes additional considerations for Infobutton implementations.

A.1 Aggregation

One of the design goals of the RCK Profile is to enable a single request to be usable across multiple Clinical Knowledge Directories. This capability is enabled by grouping a Clinical Knowledge Directory actor with a Clinical Knowledge Requester actor. The Clinical Knowledge Directory actor receives the Query Clinical Knowledge transactions, and sends copies of it to one or more other Clinical Knowledge Directories. It then aggregates the responses from each Clinical Knowledge Directory into a single response, and returns it to the original Clinical Knowledge Requester.

This section describes the requirements of the grouped Clinical Knowledge Directory and Clinical Knowledge Requester actors.

A.1.1 Requirements of the Clinical Knowledge Directory

1. The Clinical Knowledge Directory SHALL pass the existing clinical knowledge request to the Clinical Knowledge Requester actor for each additional Clinical Knowledge Directory that needs to be contacted.
2. Each response which returns with 200 – OK SHALL be aggregated into a response containing a single atom <feed> element.
3. The <feed> element SHALL include all <author> elements found in all aggregated responses (and may contain additional <author> elements).
4. The <feed> element SHALL contain all <category> elements found in all aggregated responses.
5. Duplicate <category> elements SHALL be removed.
6. The <feed> element SHALL include all <entry> elements found in all aggregated responses.

It is up to the implementation to determine how to handle cases where one or more requests failed.

A.1.2 Requirements of the Clinical Knowledge Requester

1. The Clinical Knowledge Requester SHALL create a new clinical knowledge request and send it to each Clinical Knowledge Directory that it is connected to.
2. The new request SHALL be given a new value in knowledgeRequestNotification.id.root.
3. All other parameters SHOULD be copied to the new request unmodified.