Trillium II

Reinforcing the Bridges and Scaling up EU/US Cooperation on Patient Summary

Hacking Health Athens – Webinar
January 29th, 2019
Topics

• Trillium II project – working with patient summaries and global standards

• HL7 FHIR International Patient Summary (IPS): an essential toolkit
  • What’s the IPS?
  • HL7 FHIR in a nutshell
  • HL7 FHIR IPS specifications, tools (ArtDecor, Simplifier, GitHub, FHIR servers)
  • Examples

• Q&A
The Trillium II project
Mission EU/US Memorandum of Understanding

“To support an innovative collaborative community of public- and private-sector entities working toward developing, deploying, and using eHealth science & technology

- to empower individuals
- to support care
- to advance clinical outcomes
- to enhance patient safety, and
- to improve the health of populations.”

Critical Levers:

- International interoperability
- workforce development
- innovation ecosystems
The story began with epsos...can trans-European patient summaries be understood across the Atlantic?

- **Gap analysis**
  - Compared patient summary specifications in EU/US
  - Shared clinical elements: problems, medications, allergies

- **Interoperability Assets**
  - Established a terminology prototype CTS-2 service: [http://extension.phast.fr/STS_UI](http://extension.phast.fr/STS_UI)
  - Developed Transformer of Patient summaries: [http://informatics.mayo.edu/trillium-bridge](http://informatics.mayo.edu/trillium-bridge)
  - Mediated Differences in EU/US IHE XCPD/XCA profiles for Patient Identity and Document Query/Retrieve

- **Validation activities: 4 EU countries/ Kaiser Permanente**
  - EU/US Marketplace; HIMSS 2015; IHE Europe Connectathon 2015, eHealthWeek 2014,15

- **Feasibility study:**
  - Reflected upon standards, cross-vendor integration, incentives, clinical research, security and privacy, innovative business models, education

**Recommendation:**
“Advance an International Patient Summary (IPS) standard to enable people to access and share their health information for emergency or unplanned care anywhere and as needed. At minimum the IPS should include immunizations, allergies, medications, clinical problems, past operations and implants.”
What do we do with international patient summary (IPS) standards?

- Highlight the **social value** of patient summaries
- Contribute to their **Governance**
- Develop, Collect, Assess **learning resources**
- Foster innovation & inform **health policy**
- Collaborate across **standardization bodies**
- Bridge **grassroot patient summary initiatives**
- Engage **mobile Health** companies & app developers
- Establish a **Global Community of Practice**
  for Digital Health Innovation using International Patient Summary Standards (IPS)
Scaling-up use of patient summaries

- Consider the IPS as an active window, a landing page to navigate a person’s linked health data across locations & jurisdictions.

- Trillium-II will select and elaborate:
  - resources to accelerate implementation and sharing of experience
  - new use cases on the use of patient summaries’ from unplanned emergency care
More information about Trillium II?

• Web Site: https://trillium2.eu/

• Contacts
  • Scientific coordinator Catherine Chronaki [HL7]: chronaki@hl7europe.org;
  • Administrative coordinator Janne Rasmussen [MedCom]: jar@medcom.dk
What is the IPS?
What is the IPS?

- **International**
  It emphasizes the need to provide generic solutions for global application beyond a particular region or country.

- **Patient**
- **Summary**
  Health record **extract** comprising a standardized collection of clinical and contextual information (retrospective, concurrent, prospective) that provides a **snapshot in time of a subject of care’s health information and healthcare**

HL7 Int. and CEN/TC 251 agreement (April, 2017)

Vision

• “In order to further the care for citizens across the globe, we agree to **collaborate on a single, common International Patient Summary (IPS)** specification that is readily usable by all clinicians for **the (cross-border) unscheduled care of a patient**.”

Scope

• “The IPS specification shall focus on a **minimal** and **non-exhaustive** Patient Summary, which is **specialty-agnostic** and **condition-independent**, but still **clinically relevant**.”

IPS Principles

- Implementable
- Applicable for global use
- Extensible and open
- Sustainable

The Five IPS project Products

- HL7 FHIR IG
- SNOMED
- CEN EN 32069
- CEN TS 5588
- eHIN EU IPS Guidelines
The Five IPS project Products

- eHN EU PS Guidelines
  - refine
  - implement
  - provide guidance for EU
    - CEN
      - EN 17269
      - TS 17288
    - CEN IPS FHIR IG
      - refer
        - HL7 IPS CDA IG
        - SNOMED IPS Free Set
          - use
          - use
The Five IPS project Products

- **eHN EU PS Guidelines**
  - **refine**
  - implement

- CEN EN 17269
  - provide guidance for EU
  - implement

- CEN TS 17288

- **HL7 IPS FHIR IG**
  - refer

- **HL7 IPS CDA IG**

- **SNOMED IPS Free Set**
  - use

- **Global aspiration**

- **European**

- **Global**

- **Global**
Timelines

**CEN/TC251**
- prEN 17269
  - ballot passed
- DTS 17288
  - ballot passed
- Ready for publication on March 2019

**HL7**
- HL7 CDA IPS IG (STU)
  - published
- HL7 FHIR IPS IG (STU)
  - ballot passed
  - expected publication begin 2019

**SNOMED Int.**
- **IPS Free Set** (provisional)
  - Content finalised - January 2019
  - Available to be added to specifications at drafting stage – February 2019
  - Publicly available from SNOMED International – June 2019
The International Patient Summary

Data Set

- Minimal
- Non-exhaustive
- Specialty-agnostic
- Condition-independent

Principles

- Implementable
- Applicable for global use
- Extensible and open
- Sustainable

..but still clinically relevant
The International Patient Summary

- Reflects the ideas of ‘summary’ and the need to be concise
- It alludes to the existence of a core set of data items that all health care professionals can use;
The International Patient Summary

- It recognises that the ideal dataset is not closed, and is likely to be extended, not just in terms of requirement evolution, but also pragmatically in instances of use.

- Such data is outside the scope of the IPS standards until review.
The International Patient Summary

- Minimal
- Non-exhaustive
- Specialty-agnostic
- Condition-independent

It does not imply that all the items in the dataset will be used in every patient summary.

It is a starter set of data to help inform a person’s treatment at the point of care, irrespective of the condition of the patient or of the specialist trying to manage the care.
Implementable

Applicable for global use

Extensible and open

Sustainable

• Promote (the evolution and convergence of) existing standards
• Rely on solutions that are already implemented or ready for implementation
• Consider new or additional solutions as they become available
Implementable

Applicable for global use

Extensible and open

Sustainable

- Strive for global accessibility of standards for free
- Strive for a core set of globally accessible and broadly usable terminologies
- Do not include local solutions in that are not available in other jurisdictions
- Include free text in addition to the structured codes as needed
International Patient Summary

- Provide **common content** that can be **extended for other use cases**
- Be **open** to **emerging solutions** for unresolved issues or improvements (e.g. IDMP)

Implementable

Applicable for global use

Extensible and open

Sustainable
International Patient Summary

- Implementable
- Applicable for global use
- Extensible and open
- Sustainable

- Ensure robust maintenance and update process for the IPS
- Ensure clinical validity of the IPS, meeting requirements regarding
  - Clinical Workflow
  - Clinical Documentation
  - Information Quality
What is the first iteration of IPS?

- The focus of use for IPS is unscheduled (cross-border) care.
- ..the data model for the IPS has been constructed to serve this case...
- ...but it provides a base-line usable also within other scheduled or planned care cases.
IPS Progressive Approach

Problems:
- Essential hypertension

Allergies:
- No known Allergies

Medications
- hydrochlorothiazide 25 mg + triamterene 37.5 mg

Diagnostic Results:
- 11/11/2017 XYZ 999

Vital Signs:
- Average Blood pressure 150/100

Medical Devices
- No known devices

History of Procedures
<.....>

Diagnostic Results:
- 11/11/2017 Procedure XYZ
  - Specimen <..>
  - Performer <...>
  - Exam1 xxx/xx
    - InterpretationCode
  - Exam 2...
  - Report ID = 123456

Allergies:
- No known Allergies
- Asserter: patient

Trillium II IPS Webinar
The IPS is not an EHR!

..but it could be the basis for the future European EHR exchange format (EU EHR-xF) ..
Trillium II: extending the IPS

Towards a FHIR IPS “library”

- Vaccinations
- Survival Passport
- Frailty
- Child Health
- Disaster Management
- Extending the scope of patient summaries beyond emergency/unplanned
- Chronicity

Refine the IPS components, with the knowledge gained from the project.
IPS Progressive Approach

1. The IPS document
2. The IPS data blocks

Current Intended Use
- as a document

Expected Future Use
- as a document and a library

Trillium II IPS Webinar
IPS Progressive Approach

Library of reusable..
(fragment; resources; building blocks;...)

Common “core” set of data

With minimal common terminologies

Extensible

Trillium II IPS Webinar
Trillium II IPS Sections

- Subject
- Author
- Attester
- Custodian

IPS

- Medication Summary
- Allergies and Intolerances
- Problem List
- Immunizations
- History of Procedures
- Medical Devices
- Diagnostic Results
- Vital Signs
- Past History of Illness
- Pregnancy (status + history summary)
- Social History
- Functional Status (Autonomy/Invalidity)
- Plan of Care
- Advance Directives

Encounters

"Header" Required Recommended Optional Optional
FHIR in a nutshell..
Acknowledgments

- This presentation is based on the Kramer’s presentation.
The Acronym

**F**ast
Relative – No technology can make integration as fast as we’d like

**H**ealthcare
That’s why we’re here

**I**nteroperability

**R**esources
Building blocks – more on these to follow
Resources

“Resources” are:

- Small logically discrete units of exchange
- Defined behaviour and meaning
- Known identity / location
- Smallest unit of transaction “of interest” to healthcare

Concept is akin (in terms of scope) to HL7v2 segments, HL7v3 CMETs, as well as DICOM IEs.
Resources

Patient

Observation
The 80/20 rule

- Design for the 80%, not 100%
  - Only include data elements in the artifacts if 80% of all implementers of that artifact will use the data element

- Allow easy extension for the remaining 20% of elements
  - which often make up 80% of current specs
  - Vocabulary approach to extension definition

V3/OpenEHR are designed to cover the 100%.
A Resource’s identity

- In fact: a URL
  
  ➢ **http://server.org/fhir/Patient/1**
# Resource Index

This page is provided to help find resources quickly. There is also a more detailed classification, ontology, and description. For background to the layout on the layers in this page, see the Architect's Overview. See also the abstract Base Resources Resource and DomainResource.

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<th>By Standards Status</th>
<th>By Committee</th>
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<tr>
<td>StructureMap</td>
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<tr>
<td>GraphDefinition</td>
<td></td>
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<tr>
<td>ExampleScenario</td>
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<td></td>
</tr>
</tbody>
</table>

Extensibility
Extensibility
Extending a Patient resource

Key = location of formal definition

Value = value according to definition

```xml
<Patient xmlns="http://hl7.org/fhir">
  <!-- some metadata and narrative -->
  <extension url="http://hl7.org/fhir/StructureDefinition/patient-mothersMaidenName">
    <valueString value="Williams"/>
  </extension>
  <!-- more patient data -->
</Patient>
```

```json
{
  "resourceType": "Patient",
  "extension": [{
    "url": "http://hl7.org/fhir/StructureDefinition/patient-mothersMaidenName",
    "valueString": "Williams"
  }]
}
```
It’s all about combining resources . . .
<table>
<thead>
<tr>
<th>DiagnosticReport</th>
<th>DomainResource</th>
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</thead>
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<td>identifier</td>
<td>0..* Identifier</td>
</tr>
<tr>
<td>subject</td>
<td>0..1 Reference(Patient</td>
</tr>
<tr>
<td>context</td>
<td>0..1 Reference(Encounter</td>
</tr>
<tr>
<td>issued</td>
<td>0..1 instant</td>
</tr>
<tr>
<td>performer</td>
<td>0..* BackboneElement</td>
</tr>
<tr>
<td>role</td>
<td>0..1 CodeableConcept</td>
</tr>
<tr>
<td>actor</td>
<td>1..1 Reference(Practitioner</td>
</tr>
<tr>
<td>specimen</td>
<td>0..* Reference(Specimen)</td>
</tr>
<tr>
<td>result</td>
<td>0..* Reference(Observation)</td>
</tr>
</tbody>
</table>
example snippet taken from a DiagnosticReport:

```xml
<subject>
  <reference value="Patient/f001"/>
  <display value="P. van den Heuvel"/>
</subject>
```

```json
"subject": {
  "reference": "Patient/f001",
  "display": "P. van den Heuvel"
},
```
Datatypes, complex
Complex datatypes

```
"name" : [
    {
        "family" : "Everyman",
        "given" : [
            "Adam",
            "A."
        ]
    }
]
```

```
<name>
  <family value="Everyman" />
  <given value="Adam" />
  <given value="A." />
</name>
```
Coded types

```
<code>
  <system value="http://hl7.org/fhir/sid/icd-10" />
  <code value="G44.1" />
</code>
```

"code": {
  "system": "http://hl7.org/fhir/sid/icd-10",
  "code": "G44.1"
}

Codes are defined in code systems
“Choice” properties

Observation (DomainResource)

- identifier : Identifier [0..*]
- status : code [1..1] ObservationStatus!
- category : CodeableConcept [0..*] Observation Category
- code : CodeableConcept [1..1] LOINC ??
- subject : Reference [0..1] Patient | Group | Device | Location
- context : Reference [0..1] Encounter | EpisodeOfCare
- effective[x] : Type [0..1] dateTime | Period
- issued : instant [0..1]
- performer : Reference [0..*] Practitioner | Organization | Patient

value[x] : Type [0..1] Quantity | CodeableConcept | string | boolean | Range | Ratio | SampledData | Attachment | time | dateTime | Period

dataAbsentReason : CodeableConcept [0..1] Observation Value Absent Reason...

interpretation : CodeableConcept [0..1] Observation Interpretation
“Choice” properties

```
<valueQuantity>
  <value value="107" />
  <unit value="mm[Hg]" />
</valueQuantity>

"valueQuantity" : {
  "value" : 107,
  "unit" : "mm[Hg]"
}

<valueString
  value="Patient loves to sing" />

"valueString" : "Patient loves to sing"
```
Updating, creating & deleting single resources using REST

REST – CRUD
REST: “Repository” model of healthcare

Hospital System
- POST Patient
- POST Order

Lab System
- GET Orders
- POST Lab result

FHIR server
- GET new Lab results

Patient
Order
Diagnostic Report
Observation
REST “representations”

Request:
GET http://myserver.org/fhir/Patient/1?_format=json

Response
HTTP/1.1 200 OK
Content-Type: application/fhir+json
Content-Length: 787

Request:
GET http://myserver.org/fhir/Patient/1
Accept: application/fhir+json
Communicating resources
(with REST, see also http://www.hl7.org/fhir/http.html)

**create**
The create interaction creates a new resource in a server assigned location. The create interaction is performed by an HTTP POST operation as shown:

```
POST [base]/[type] {_format=[mime-type]}
```

**read**
The read interaction accesses the current contents of a resource. The interaction is performed by an HTTP GET operation as shown:

```
GET [base]/[type]/[id] {_format=[mime-type]}
```

**update**
The update interaction creates a new current version for an existing resource or creates a new resource if no resource already exists for the given id. The update interaction is performed by an HTTP PUT operation as shown:

```
PUT [base]/[type]/[id] {_format=[mime-type]}
```

**delete**
The delete interaction removes an existing resource. The interaction is performed by an HTTP DELETE operation as shown:

```
DELETE [base]/[type]/[id]
```
How FHIR communicates sets of resources

BUNDLES
Bundling resources

“searchset Bundle”

Or Order Order Order Practitioner

Query Orders

FHIR server

Lab System

“transaction Bundle”

Dx Report

Obs

Post Lab result

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## Types of Bundles

<table>
<thead>
<tr>
<th>Code</th>
<th>Display</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>document</td>
<td>Document</td>
<td>The bundle is a document. The first resource is a <strong>Composition</strong>.</td>
</tr>
<tr>
<td>message</td>
<td>Message</td>
<td>The bundle is a message. The first resource is a <strong>MessageHeader</strong>.</td>
</tr>
<tr>
<td>transaction</td>
<td>Transaction</td>
<td>The bundle is a transaction - intended to be processed by a server as an atomic commit.</td>
</tr>
<tr>
<td>transaction-response</td>
<td>Transaction Response</td>
<td>The bundle is a transaction response. Because the response is a transaction response, the transaction has succeeded, and all responses are error free.</td>
</tr>
<tr>
<td>batch</td>
<td>Batch</td>
<td>The bundle is a set of actions - intended to be processed by a server as a group of independent actions.</td>
</tr>
<tr>
<td>batch-response</td>
<td>Batch Response</td>
<td>The bundle is a batch response. Note that as a batch, some responses may indicate failure and others success.</td>
</tr>
<tr>
<td>history</td>
<td>History List</td>
<td>The bundle is a list of resources from a history interaction on a server.</td>
</tr>
<tr>
<td>searchset</td>
<td>Search Results</td>
<td>The bundle is a list of resources returned as a result of a search/query interaction, operation, or message.</td>
</tr>
<tr>
<td>collection</td>
<td>Collection</td>
<td>The bundle is a set of resources collected into a single package for ease of distribution that imposes no processing obligations or behavioral rules beyond persistence.</td>
</tr>
</tbody>
</table>
SEARCH FUNCTIONALITY
Basic search

- Syntax
  
  `GET [base]/[resourcetype]?key=value&...`

- Getting all patients

  `GET http://acme.org/fhir/Patient`

- Example:

  `GET http://acme.org/fhir/Patient?name=eve`
Search parameters

Each resource has a set of “standard” search parameters, so **not every element can be searched!**:

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>Description</th>
<th>Paths</th>
</tr>
</thead>
<tbody>
<tr>
<td>active</td>
<td>token</td>
<td>Whether the patient record is active</td>
<td>Patient.active</td>
</tr>
<tr>
<td>address</td>
<td>string</td>
<td>An address in any kind of address/part of the patient</td>
<td>Patient.address</td>
</tr>
<tr>
<td>birthdate</td>
<td>date</td>
<td>The patient’s date of birth</td>
<td>Patient.birthDate</td>
</tr>
<tr>
<td>family</td>
<td>string</td>
<td>A portion of the family name of the patient</td>
<td>Patient.name.family</td>
</tr>
<tr>
<td>gender</td>
<td>token</td>
<td>Gender of the patient</td>
<td>Patient.gender</td>
</tr>
<tr>
<td>given</td>
<td>string</td>
<td>A portion of the given name of the patient</td>
<td>Patient.name.given</td>
</tr>
<tr>
<td>identifier</td>
<td>token</td>
<td>A patient identifier</td>
<td>Patient.identifier</td>
</tr>
<tr>
<td>language</td>
<td>token</td>
<td>Language code (irrespective of use value)</td>
<td>Patient.language</td>
</tr>
<tr>
<td>link</td>
<td>reference</td>
<td>All patients linked to the given patient</td>
<td>Patient.link</td>
</tr>
<tr>
<td>name</td>
<td>string</td>
<td>A portion of either family or given name of the patient</td>
<td>Patient.name</td>
</tr>
</tbody>
</table>
Parameter types

- For each type there are specific prefixes and modifiers

  number, date and quantity:
  
  Search for `[param]=gt[value]` retrieves resources where `[param]` has a value greater than `[value]`

  http://acme.org/fhir/Patient?name:contains=eve
More information

3.1.1 Search

Searching for resources is fundamental to the mechanics of FHIR. Search operations traverse through an existing set of resources file operation. The text below describes the FHIR search framework, starting with simple cases moving to the more complex. Implementer complexity that they require for their implementations.

3.1.1.1 Summary Table

<table>
<thead>
<tr>
<th>Search Parameter Types</th>
<th>Parameters for all resources</th>
<th>Search result parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>_id</td>
<td>_sort</td>
</tr>
<tr>
<td>Date/DateTime</td>
<td>_lastUpdated</td>
<td>_count</td>
</tr>
<tr>
<td>String</td>
<td>_tag</td>
<td>_include</td>
</tr>
<tr>
<td>Token</td>
<td>_profile</td>
<td>_revinclude</td>
</tr>
<tr>
<td>Reference</td>
<td>_security</td>
<td>_summary</td>
</tr>
<tr>
<td>Composite</td>
<td>_text</td>
<td>_total</td>
</tr>
<tr>
<td>Quantity</td>
<td>_content</td>
<td>_elements</td>
</tr>
<tr>
<td>URI</td>
<td>_list</td>
<td>_contained</td>
</tr>
<tr>
<td>Special</td>
<td>_has</td>
<td>_containedType</td>
</tr>
</tbody>
</table>

http://www.hl7.org/fhir/search.html
FHIR DOCUMENTS
Documents

- Collection of resources bound together
  - Root is a “Composition” resource
  - Composition is a sort of extended CDA header (includes sections; reference to entries;…)
- Sent as a Bundle resource
- Can be signed, authenticated, etc.
- No context conduction

http://www.hl7.org/fhir/documents.html
Documents – are bundles

<Bundle>
  <entry>
    <Composition/>
  </entry>
  <entry>
    <Observation/>
  </entry>
  <entry>
    <Device/>
  </entry>
  <entry>
    <List/>
  </entry>
  <entry>
    <Condition/>
  </entry>
</Bundle>
The IPS Composition
Regardless of **paradigm**, the content is the same
The Five IPS project Products

- **eHN EU PS Guidelines**
  - refine
  - implement
  - provide guidance for EU

- **CEN EN 17269**
  - implement

- **CEN TS 17288**
  - implement

- **HL7 IPS FHIR IG**
  - refer
  - use

- **HL7 IPS CDA IG**
  - refer
  - use

- **SNOMED IPS Free Set**
  - use
The IPS data set (prEN 12679)

https://art-decor.org/art-decor/decor-datasets--hl7ips-
The Trillium II data set (based on prEN 12679)

https://art-decor.org/art-decor/decor-datasets--trilm2--
The FHIR IPS IG (STU)

https://build.fhir.org/ig/HL7/fhir-ips/

Based on FHIR R4
(Published on January 2019)

It describes the “IPS document” and the data blocks (FHIR profiles) used to build it
The Trillium II IPS FHIR Profiles

https://github.com/gcangioli/trilliumII

All the source files for
1. HL7 FHIR Profiles
2. specified HL7 FHIR Value Set
3. examples
The Trillium II IPS FHIR Profiles

Based on FHIR STU3

It describes the “IPS document” and the data blocks (FHIR profiles) used to build it

https://simplifier.net/TrilliumII/~resources?category=Profile
The IPS Composition
The IPS Composition

The IPS “document”

Resources that have to be included (STU3)
- Composition.subject
- Composition.encounter
- Composition.author
- Composition.attester.party
- Composition.custodian
- Composition.event.detail
- Composition.section.entry

- All referred resources for the IPS Profile
The IPS “document”

FHIR Servers

- Trillium II test servers (FHIR STU3)

- Other FHIR Test Server
  - http://test.fhir.org/r4
Trillium II examples

https://github.com/gcangioli/trilliumII/tree/master/examples

...ready to include also yours....