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# The FHIR platform as an interoperability basis. Clinician Dashboard overview

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# Standards proliferation



# openEHR

HOW STANDARDS PROLIFERATE:  
(SEE: A/C CHARGERS, CHARACTER ENCODINGS, INSTANT MESSAGING, ETC.)



© xkcd: <https://xkcd.com/927/>

# What is FHIR?

- Fast (to design and implement)
  - Health
  - Interoperable
  - Resources
- 
- <https://www.hl7.org/fhir/>



# Why FHIR is better?

- Strong focus on implementation
- Multiple implementation libraries
- Free for use with no restrictions
- Interoperability out-of-the-box
- Strong foundation in Web standards: XML, JSON, HTTP, OAuth, etc.
- Support for RESTful architectures
- Concise and easily understood specifications
- A human-readable serialization format for ease of use by developers
- Ontology-based analysis with formal mapping



# Example Resource

```
<Patient xmlns="http://hl7.org/fhir">
```

```
  <id value="glossy"/>
```

```
  <meta>
```

```
    <lastUpdated value="2014-11-13T11:41:00+11:00"/>
```

```
  </meta>
```

```
  <text>
```

```
    <status value="generated"/>
```

```
    <div xmlns="http://www.w3.org/1999/xhtml">
```

```
      <p>Henry Levin the 7th</p>
```

```
      <p>MRN: 123456. Male, 24-Sept 1932</p>
```

```
    </div>
```

```
  </text>
```

```
  <extension url="http://example.org/StructureDefinition/trials">
```

```
    <valueCode value="renal"/>
```

```
  </extension>
```

```
  <identifier>
```

```
    <use value="usual"/>
```

```
    <type>
```

```
      <coding>
```

```
        <system value="http://hl7.org/fhir/v2/0203"/>
```

```
        <code value="MR"/>
```

```
      </coding>
```

```
    </type>
```

```
    <system value="http://www.goodhealth.org/identifiers/mrn"/>
```

```
    <value value="123456"/>
```

```
  </identifier>
```

```
  <active value="true"/>
```

```
  <name>
```

```
    <family value="Levin"/>
```

```
    <given value="Henry"/>
```

```
    <suffix value="The 7th"/>
```

```
  </name>
```

```
  <gender value="male"/>
```

```
  <birthDate value="1932-09-24"/>
```

```
  <careProvider>
```

```
    <reference value="Organization/2"/>
```

```
    <display value="Good Health Clinic"/>
```

```
  </careProvider>
```

```
</Patient>
```

Resource  
Identity &  
Metadata

Human  
Readable  
Summary

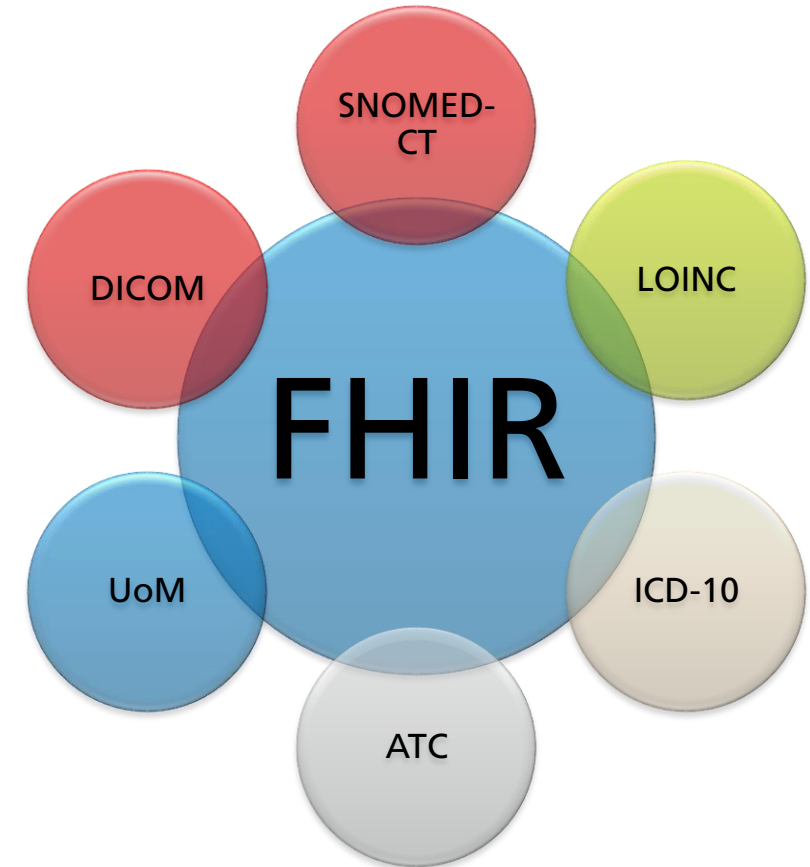
Extension  
with URL to  
definition

Standard  
Data:

- MRN
- Name
- Gender
- Birth Date
- Provider

# Integration through standardisation

- Commission Recommendation (EU) 2019/243 (6 February 2019) on a European Electronic Health Record exchange format
  - HL7/FHIR compliance is a strategic goal
  - [https://ec.europa.eu/newsroom/dae/document.cfm?doc\\_id=57253](https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=57253)



# Reference Data Server

- Full-fledged HL7/FHIR server
- Enables interoperability between different data sources coming from different health providers
- Built upon a scalable NoSQL database that supports data clustering
- REST interface (also based upon the FHIR specification)
- Used in the PICASO public cloud as:
  - Terminology server
  - Creator of customised templates

Schemes	
HTTPS	▼
<b>root</b> ▼	
GET	/
<b>appointment</b> ▼	
GET	/Appointment
POST	/Appointment
GET	/Appointment/{id}
PUT	/Appointment/{id}
DELETE	/Appointment/{id}
<b>careplan</b> ▼	
GET	/CarePlan
POST	/CarePlan
GET	/CarePlan/{id}
PUT	/CarePlan/{id}
DELETE	/CarePlan/{id}

# Clinician Dashboard overview



The screenshot displays the PICASO Clinician Dashboard for a patient named TestUTV. A modal window titled "Handover comment" is open, showing a text input field with the comment "Valutazione dello stato di atrofia del giro dell'ippocampo." Below the input field, there are sections for "Indicate here necessary further diagnostic procedures:" with checkboxes for "Blood tests" (Blood count, Serology, Haemostaseology, Thyroid hormones), "Urine exams", "Microbiology", "Virology", and "Imaging" (Conventional imaging, MRI, Sonography, Computer tomography, Nuclear medicine: Dat Scan, Myocardial scintigraphy, PET). A "Save handover comment" button is at the bottom of the modal.

The background dashboard shows patient information: Specialist: Radiologist, Requested: From 20.11.2018, Author's role: Neurologist. The status is "Active" and the speciality is "Radiologist". The clinician is "Dr. Agostino Chiaravalloti". The requested period is from 20.11.2018 to 20.03.2019. A reminder to arrange an appointment for MRI is visible.

At the bottom, a note for the patient is shown: "NOTE FOR PATIENT: Regular check-up SOURCE: OIV SERVICE TYPE: STATUS: overdue CLINICIAN ROLE: Orthopaedist CLINICIAN NAME: Dr. Gamal Chehab REQUESTED START: 27.9.2018 REQUESTED END: 29.12.2018".

On the right, there are two charts: "Patient's Measurements and Recordings" and "Patient's Measurements and Recordings - Separate Charts". The first chart shows Resting Heartrate (beats/min) and Blood Pressure (mmHg) over time. The second chart shows Resting Heartrate (beats/min), Blood Pressure (mmHg), and Weight (kg) over time. The data is for the period from 2.10.2018 08:20 to 2.11.2018 07:20.



# Care Management as a Service



- Enables care organisations to benefit from cloud technologies and experience benefits of scalability and software resource sharing without violating regulations
- Cloud divided into three loosely coupled node types:
  - Software for care management and decision support hosted in a public cloud
  - Clinical data resides inside the care organisations
  - Allows creation of templates for different services
  - Integrated care (patient handover; communication center)
  - Access and use of clinical data is done securely, GDPR-compliant

A screenshot of the PICASO - CLINICIAN DASHBOARD. The interface is split into a dark sidebar on the left and a main content area on the right. The sidebar contains navigation items: Patient Selection, Patient Data Viewer, Care Plan Manager (highlighted), Communication Center, and Risk Manager. The main content area shows the 'Care plan manager' page. It includes a breadcrumb 'Home / Care Plan Manager', a title 'Care plan manager', and a section for 'Care plan information'. This section displays 'CarePlan ID: cd4eedb4-d336-8d3e-3e1a-07d101da3ccc' and 'Patient ID: TestUTV Patient (e0776d22290b11e8a2bb525477465977)'. Below this is a 'Description' field with the text 'Il paziente inizia terapia con pantorc 40 mg 1 cp/die per 2 settimane per MRGE'. Further down are 'Status' (Active), 'From:' (22.03.2018), and 'To:' (05.04.2019) fields. At the bottom, there are three buttons: 'Delete care plan' (red), 'Save changes in care plan' (blue), and 'Add care plan service' (blue with a dropdown arrow).

# Patient activities



- 🔍 Patient Selection
- 📄 Patient Data Viewer
- 📅 Care Plan Manager
- 💬 Communication Center
- 📊 Risk Manager

## Task timing

From 2018-09-27 onwards, daily, 1 time(s) per day (Morning).

Define time period by start and end date

**Starts:** 27.09.2018

**Ends:**  Same Day  Never  On

Define the time frame of repeats

**Repeats:**

- Select
- ✓ Daily
- Weekly
- Monthly
- Yearly
- Every ... day(s)
- Every ... week(s)
- Every ... month(s)
- Every ... year(s)
- As needed

Schedule per day

**Frequency per day :**

**Start date (Thursday)**

27.09.2018

Morning

# Patient reminders



- 🔍 Patient Selection
- 📄 Patient Data Viewer
- 📅 Care Plan Manager
- 💬 Communication Center
- 📊 Risk Manager

## Reminder settings

### Time settings

- No reminders: Do not fill in anything in this section.
- Reminders same as 'Task timing': Insert ,0' in field 'Reminder before'.  
Unspecific task timings like 'Morning' follow a predefined time schedule for firing of reminders. [\[More\]](#)
- Reminders before/after ,Task timing': Insert requested amount of minutes in field(s) ,Reminder before/after'.  
When defining a reminder for unspecific task timings like 'Morning', consider the predefined time schedule for firing of reminders. [\[More\]](#)

Reminder before:  mins

\* Reminder before message (mandatory, if a reminder is defined):

Assumere Pantorc 40 mg.

Reminder after:  mins

\* Reminder after message (mandatory, if a reminder is defined):


Hai assunto Pantorc 40 mg ?


Remind patient by:


Pop up on Patient Dashboard

**Medication**

Care Plan Manager  
Communication Center  
Risk Manager

 Medication intake: Status 'Suspended',  
Medication: Metformina (500mg), p.e. Metforal,  
Count per intake: 1, Total quantity: Metformina (1500mg), p.e. Metforal,  
Intake: From 2018-09-26 onwards, daily, 3 time(s) per day (After breakfast, After lunch, After dinner). Reminder before: 10 mins, Reminder after: 10 mins  
Author's role: Neurologist

 Medication intake: Status 'Active',  
Medication: Pantoprazolo (40mg), p.e. Pantopan,  
Count per intake: 1, Total quantity: Pantoprazolo (40mg), p.e. Pantopan,  
Intake: From 2018-09-27 onwards, daily, 1 time(s) per day (Morning). Reminder before: 10 mins, Reminder after: 10 mins  
Author's role: Neurologist

 Medication intake: Status 'Active',  
Medication: Acido acetilsalicilico (300mg) / magnesio e alluminio idrossido (80mg), p.e. Ascriptin,  
Count per intake: 1, Total quantity: Not applicable,  
Intake: From 2018-09-27 onwards, daily, 2 time(s) per day (After breakfast, After dinner). Reminder before: 10 mins, Reminder after: 10 mins  
Author's role: Neurologist

# Follow-up appointments



🔍 Patient Selection

📄 Patient Data Viewer

📅 Care Plan Manager

💬 Communication Center

📊 Risk Manager

🗑️ 📄 📄 📄 Follow-up appointment: Status 'Active',  
Specialist: Radiologist, Name: Dr. Agostino Chiaravalloti,  
Requested: From 2018-11-20 until 2019-03-20.  
Author's role: Neurologist

**Status**

Active

**Speciality**

Radiologist

**Clinician**

Dr. Agostino Chiaravalloti

**Requested period**

**From:**

20.11.2018

**To:**

20.03.2019

**You may define here details about the follow-up appointment to be shown on the patient's dashboard:**

Visita con Dr. Chiaravalloti per MRI encefalo

**A reminder to arrange the follow-up appointment will be automatically displayed on the Patient Dashboard after half of the time until the defined 'end date' is expired.**

**Please define what should be displayed:**

Appuntamento MRI encefalo; Dr. Chiaravalloti. Policlinic Tor Vergata

Create handover comment

# Risk Manager



- Provides patient specific risk estimates
- Selection of risk scores from standard risk charts and novel risk scores that use machine learning to fuse data
- Integrated simulation tool allows clinician to explore with their patients what life-style changes will have the strongest impact on improving outcomes

Risk Manager

SCORE CUORE

### SCORE Calculator

Result					
10	12	14	16	19	180
7	8	10	11	14	160
5	6	7	8	10	140
4	4	5	6	7	120
150	190	230	270	310	

SBP [mmHg]

TC [mg/dl]

### Patient Information

Gender:  Male  Female

Age [full years]:

Smoking:  No  Yes

Systolic Blood Pressure [mmHg]:

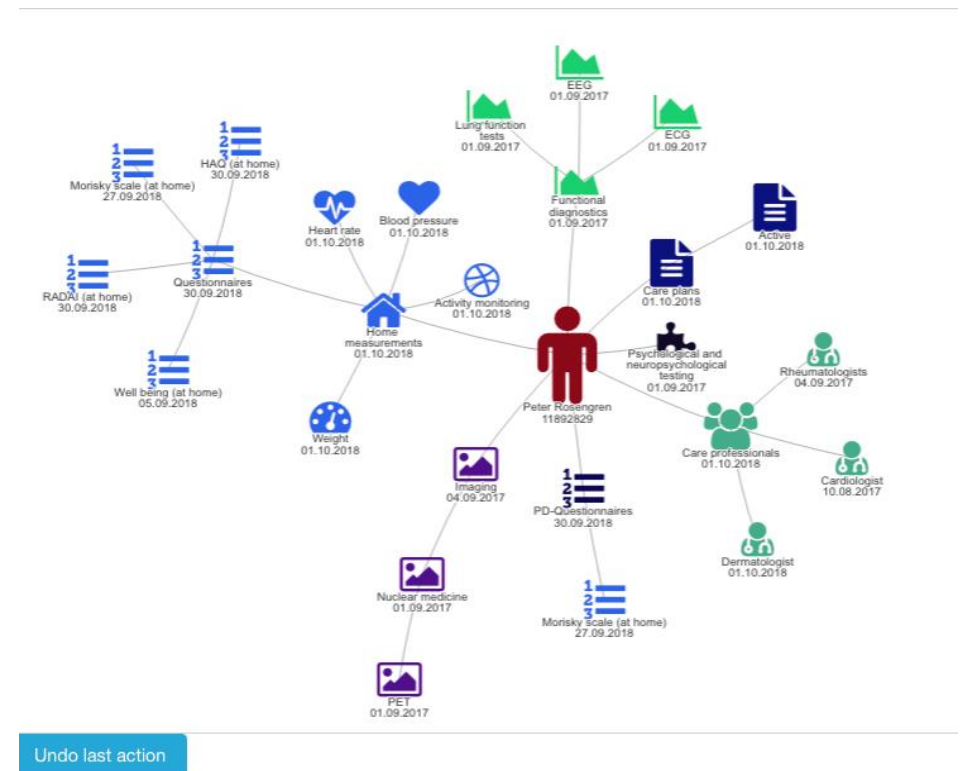
Total Cholesterol [mg/dL]:

HDL-C:

# Data Resource Browser/Patient Data Viewer



- Clinicians can browse all available patient data
- Designed in cooperation with care professionals to make the browsing of distributed data sources in search for relevant patient data intuitive and quick



# References



- PICASO:  
<https://www.picaso-project.eu/>  
<https://twitter.com/ProjectPicaso>
- Fraunhofer FIT:  
<https://www.fit.fraunhofer.de/>  
[https://twitter.com/webcc\\_fhg](https://twitter.com/webcc_fhg)

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