Devices on FHIR

Enabling Health Device Data Driven Applications

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Who am I?

• Stefan Schlichting
  • Manager Product & Service Innovation
  • Focussing on Systems Engineering, Interoperability Standards for MedTech and other Industries
  • IEEE 11073, IHE DEV, HL7 DEV, OR.NET e.V.
Health Device Data Driven Applications

Data-Driven Clinical Application
... “Real-time” patient status, Remote supervisor support, Remote Control, Isolation Rooms

Automated Documentation
... for Data Analytics, Forensic Documentation, Reimbursement, Resource Utilization, Track & Traceout

Care Automation
...OR Planning, OR Setup Assistance, Device Setting Recommender, Physiological Closed-Loop Controller

Lack of Interoperability leads to high hurdles for product & service innovations
How to automate the data capturing for electronic medical records?

Seamless plug & play integration of medical devices and storage and retrieval of data
How to minimize stress and hospitalization time for preeclampsia patients?

Collection, integration and interpretation of diagnostic data along the patient journey
How to monitor patients remote & in the hospital during a pandemic?

Collecting invaluable data along the whole patient journey
How to stabilize patients at mass-casualty incidents in remote areas?

Seamless integration and change of medical devices and autonomous patient therapy
How to improve equipment readiness and availability?

Predictive maintenance and location awareness
Patient Monitoring Devices

Point of Care Device

Multi-Parameter Patient Monitor

Personal Health Device

Pulseoximeter

Similar Devices, but different purposes
Interoperability Standards Landscape from a device’s perspective

In the Hospital
- ISO/IEEE 11073 SDC
- FHIR PoCG

Enterprise Hospital IT
- HL7 v2, DICOM
- Exchange and storage of healthcare information

At Home
- FHIR PHG
- ISO/IEEE 11073 PHD

IEEE 11073 & HL7 FHIR – Complementing Standards
IEEE 11073 Device Model(s)

Multi-Parameter Patient Monitor

PHD Pulse Oximeter

PHD Devices use a simplified version of the PoC Device Domain Information Model to reduce device complexity.
Device-related Resources

Recursive Device Structure to model medical devices with different complexity
The Metric Value Model

<table>
<thead>
<tr>
<th>Metric Kind</th>
<th>Kind Description</th>
<th>General Mapping to Observation.value[x]¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Numeric Metrics</td>
<td>Scalar Values, e.g. Temperature, Blood Oxygen Level, Heart Rate</td>
<td>Observation.valueQuantity</td>
</tr>
<tr>
<td>Realtime Sample Array</td>
<td>Sequences of periodic scalars, e.g. ECG waveform traces</td>
<td>Observation.valueSampledData</td>
</tr>
<tr>
<td>Array Metrics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>String Metrics</td>
<td>arbitrary human readable text, e.g. program name that can be customized</td>
<td>Observation.valueString</td>
</tr>
<tr>
<td>Enum Metrics</td>
<td>A finite set of options for a metric value, e.g. a device mode</td>
<td>Observation.valueCodeableConcept (, Observation.valueString)</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

¹ There are Profiles

Measurements, Settings, … are called **Metrics** in medical device interoperability domain
PHD Implementation Guide

http://hl7.org/fhir/uv/phd/
PoCD Implementation Guide

ISO/IEEE SDC 11073

https://build.fhir.org/ig/HL7/uv-pocd/
Ubiquitous Patient Monitor

Real-time patient status overview outside the patient room
The Device Containment Tree Profile
Do we miss observations or are they not produced?

• It depends...

<table>
<thead>
<tr>
<th>Code</th>
<th>Display</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>on</td>
<td>On</td>
<td>The DeviceMetric is operating and will generate Observations.</td>
</tr>
<tr>
<td>off</td>
<td>Off</td>
<td>The DeviceMetric is not operating.</td>
</tr>
<tr>
<td>standby</td>
<td>Standby</td>
<td>The DeviceMetric is operating, but will not generate any DeviceObservations.</td>
</tr>
</tbody>
</table>

Missing Value?
Is the observed value up-to-date?

- It depends...
  DeviceMetric.measurementPeriod

Delayed Value
Outlook

• Physiological & Technical Alarms as well as notifications from the Medical Device
  • Alert Conditions
  • Alert Signals
  • Alert System Status
What did you learn?

• You can build different types of Health Device Data Driven Applications
  • From Device Utilization Dashboards over Predictive Maintenance to Ubiquitous Patient Monitoring

• Core Resources are Device, DeviceMetric, Observation

• Two implementation guides exist that include mappings from medical device interoperability standards, depending on the device kind
  • IEEE 11073 PHD
  • IEEE 11073 PoCD

• More to come…
IEEE PoCD Mappings

• IEEE 11073 SDC standards family
  • https://build.fhir.org/ig/HL7/uv-pocd/mappingsdc.html

• IEEE 11073 Classic standards family
  • https://build.fhir.org/ig/HL7/uv-pocd/mappingdim.html
Let’s Build! Querying Medical Device Data For Clinical & Workflow Applications

November 20, 2020
2:00 PM - 2:45 PM

Description

In this session you will learn how to query device data for usage in different clinical & workflow applications based on the Devices on FHIR point-of-care devices (PoCD) Implementation Guide and the personal health devices (PHD) Implementation Guide. We will cover topics like:

- Which devices are currently connected to a patient?
- What are the current measurement values of a patient?
- Which device settings are currently applied for treatment?
- To which patients was a device connected in the last year?
- Is the patient connected to a device that can measure its pulse and body temperature?
- When is the next calibration of a measurement required?
- How to calculate a trend of a measurement if the measurement site is determined after the measurement started?

NOTE: This session builds upon the information presented in the general Devices on FHIR presentation (19 November)

Speakers

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Thank You!
Questions?

• During DevDays, you can find / reach me here:
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