Using SNOMED CT as a reference terminology in HL7 CDA templates for home-mechanical ventilation care

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SNOMED CT EXPO 2017

Agenda

1. **The project eVent@home**
2. **HL7 CDA standard**
3. **Terminology Binding**
4. **ART-DECOR software tool**
5. **Use Case: SNOMED CT in home-mechanical ventilation care**

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The project eVent@home

> **Optimized integrated care of patients in the field of home-mechanical ventilation through eHealth**

eHealth-based ("e")

documentation and communication approach

for ventilated patients ("Vent")

in the home environment ("@home")

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The project eVent@home

- ➤ **interoperable documentation**

- ➤ **intersectoral connected communication**

- ➤ **in the field of home-mechanical ventilation**

- ➤ **based on HL7 Clinical Document Architecture R2 (CDA®)**

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The project eVent@home

➢ **sponsored by the European Regional Development Fund (EFRE in German)**

➢ **duration: 3 years**

➢ **between: 01/03/2016 – 28/02/2019**

eVent@home collaborative network

Methods

➢ **analysed processes in home ventilation care**

➢ **expert panel from different disciplines defined a dataset**

➢ **semantic annotation of concepts from that dataset with SNOMED CT and LOINC**

➢ **modelled clinical documents based on HL7 CDA**

➢ **terminology binding using SNOMED CT**

➢ **implementation of CDA documents in software solution**

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HL7 Clinical Document Architecture

➢ **a way to define electronic clinical documents in HL7 V3**

➢ **approved standard to exchange documents between health information systems**

➢ **achieve semantic interoperability by structuring clinical information to convey computable semantics e.g. SNOMED CT**
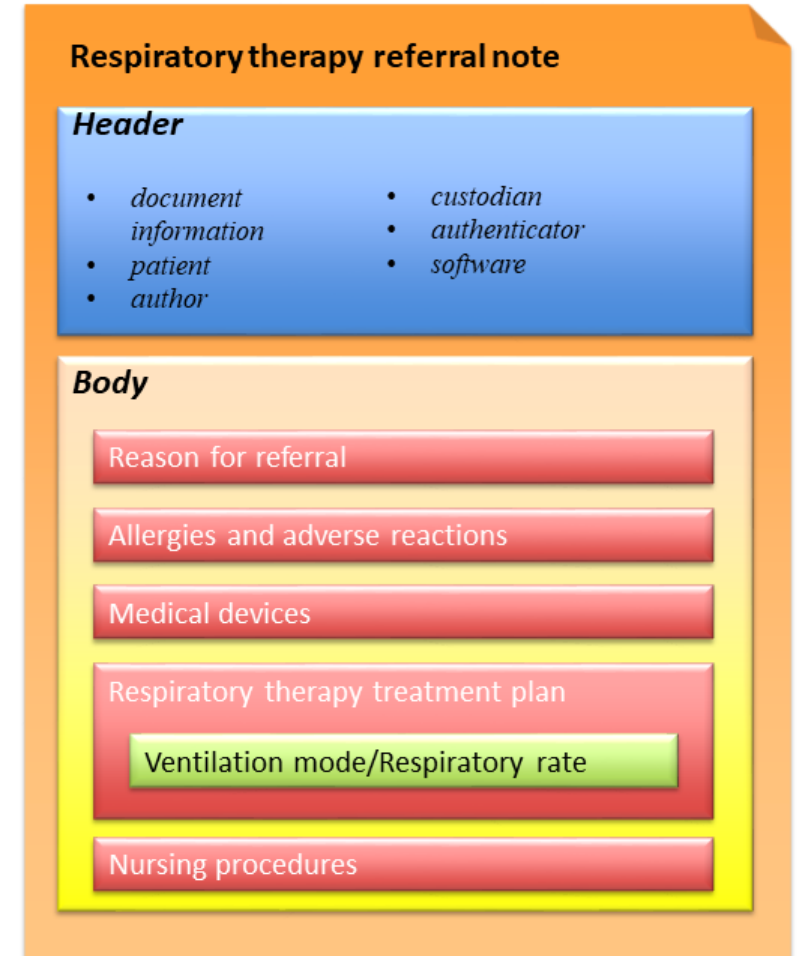
➢ **encoding in XML**

Structure of a CDA Document

Header

➢ **provides the context**

➢ **structured and coded**

Body

➢ **clinical information**

➢ **ordered into sections**

➢ **may contain coded entries that provide information in machine-readable form**

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CDA levels of interoperability

higher degree of semantic interoperability with each level when exchanging clinical documents

➢ **Level 1: CDA Header contains metadata, body consists of an unstructured blob with human readable content**

➢ **Level 2: CDA Header plus XML body with sections identified by a code**

➢ **Level 3: CDA Header plus XML body with human readable narrative blocks, but also machine readable semantic content using vocabulary such as SNOMED CT**

CDA level 3 structure

```xml
<?xml version="1.0" encoding="UTF-8"?>
<ClinicalDocument
        xmlns="urn:hl7-org:v3"
        xmlns:voc="urn:hl7-org:v3/voc"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
        <typeId root="2.16.840.1.113883.1.3" extension="POCD_HD000040"/>

        <!-- CDA Header -->

        <!-- CDA Body -->
        <component>
                <structuredBody>
                        <!-- CDA Section -->
                        <component>
                                <section>
                                        <!-- CDA Entry -->
                                        <entry>
                                                <!-- Clinical Statement -->
                                        </entry>
                                </section>
                        </component>
                </structuredBody>
        </component>
</ClinicalDocument>
```
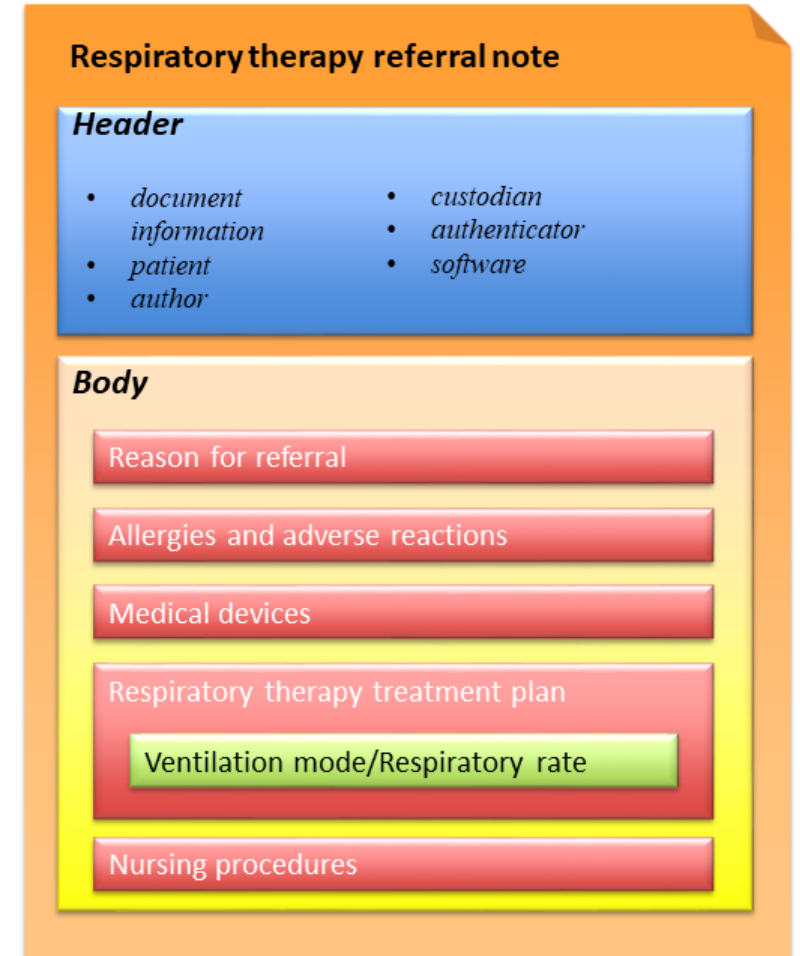
CDA Templates

➢ **a template is a set of further constraints on top of an underlying model**

➢ **reusable blocks**

Types:

• **Document Level Templates**

• **Header Level Templates**

• **Section Level Templates**

• **Entry Level Templates**

Respiratory therapy referral note

Header

- document information
- patient
- author
- custodian
- authenticator
- software

Body

Reason for referral

Allergies and adverse reactions

Medical devices

Respiratory therapy treatment plan

Ventilation mode/Respiratory rate

Nursing procedures

CDA Entries

➢ **structured clinical information**

➢ **Act classes from Clinical Statement Model based on HL7's Reference Information Model (RIM)**

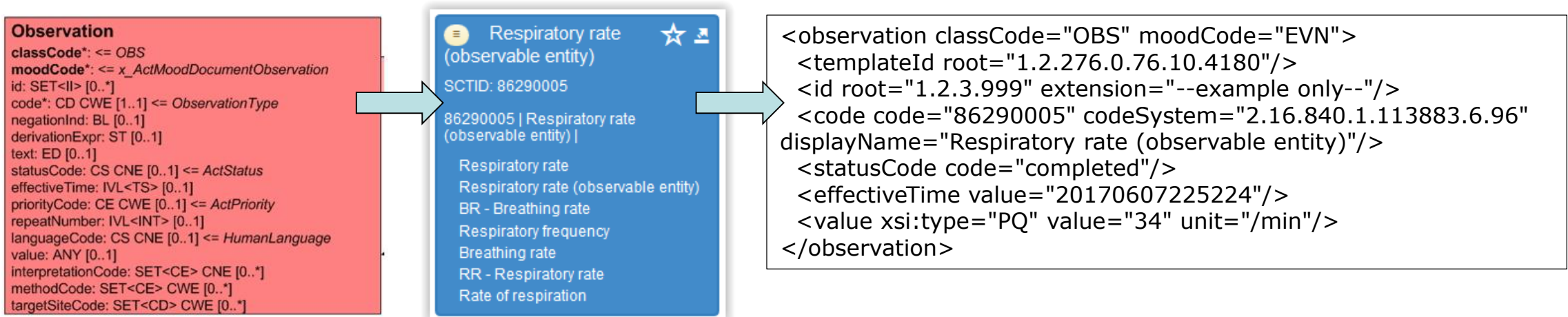➢ **use the structure of RIM/CDA and SNOMED CT together to add meaning**
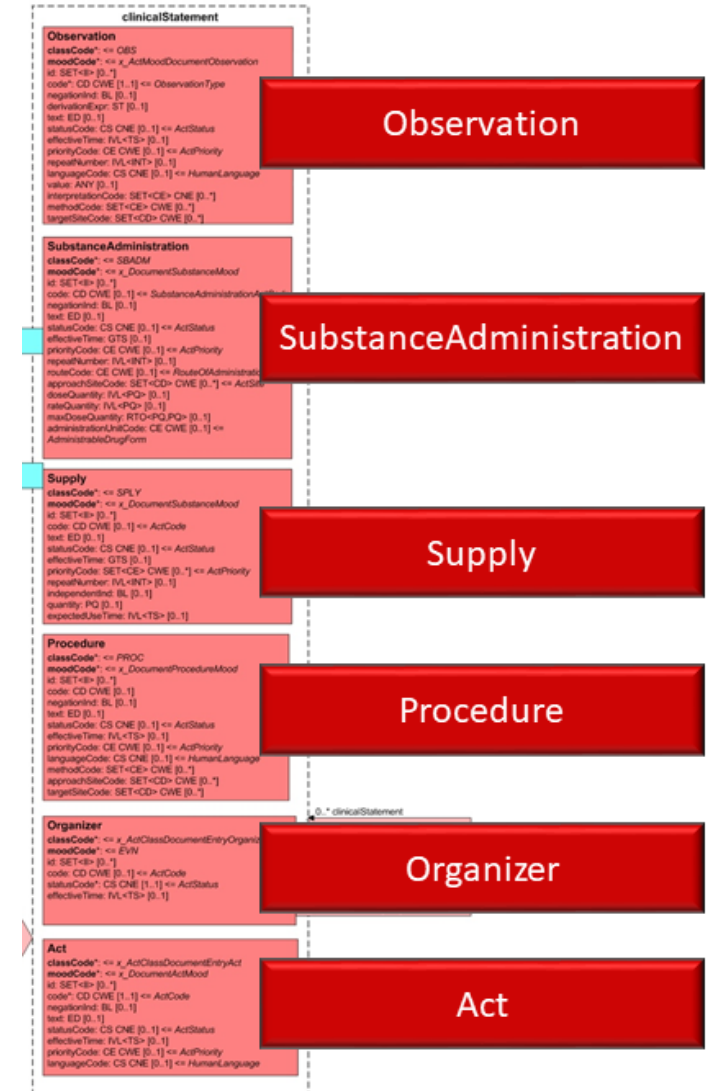
Example

Terminology Binding

➢ **a link between an information model artifact and a terminology artifact**
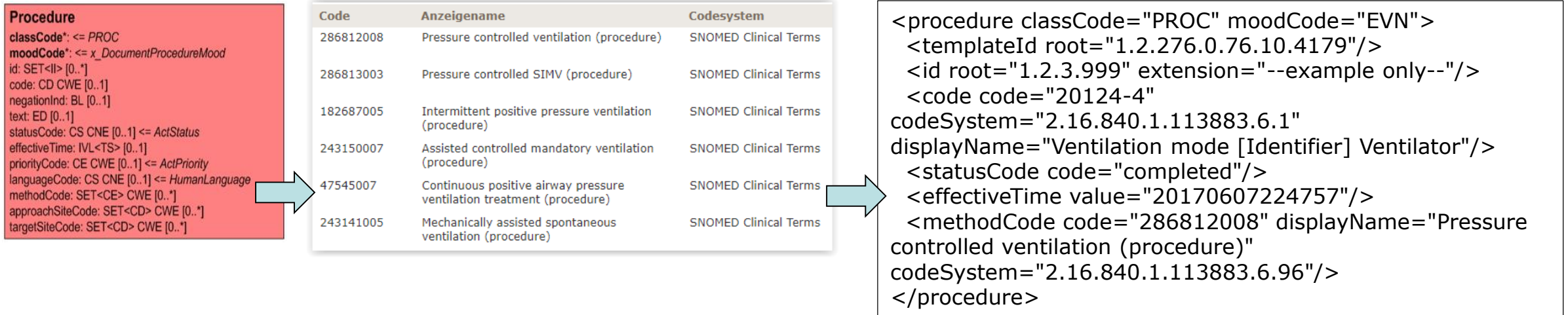
Model Meaning Binding

➢ **defines the meaning of an information model artifact**

Example

Value Set Binding

➢ **records a set of possible values which can populate a coded data element or attribute in an information model**


```
Procedure
classCode*: <= PROC
moodCode*: <= x_DocumentProcedureMood
id: SET<II> [0..*]
code: CD CWE [0..1]
negationInd: BL [0..1]
text: ED [0..1]
statusCode: CS CNE [0..1] <= ActStatus
effectiveTime: IVL<TS> [0..1]
priorityCode: CE CWE [0..1] <= ActPriority
languageCode: CS CNE [0..1] <= HumanLanguage
methodCode: SET<CE> CWE [0..*]
approachSiteCode: SET<CD> CWE [0..*]
targetSiteCode: SET<CD> CWE [0..*]
```

Code	Anzeigename	Codesystem
286812008	Pressure controlled ventilation (procedure)	SNOMED Clinical Terms
286813003	Pressure controlled SIMV (procedure)	SNOMED Clinical Terms
182687005	Intermittent positive pressure ventilation (procedure)	SNOMED Clinical Terms
243150007	Assisted controlled mandatory ventilation (procedure)	SNOMED Clinical Terms
47545007	Continuous positive airway pressure ventilation treatment (procedure)	SNOMED Clinical Terms
243141005	Mechanically assisted spontaneous ventilation (procedure)	SNOMED Clinical Terms

```
<procedure classCode="PROC" moodCode="EVN">
  <templateId root="1.2.276.0.76.10.4179"/>
  <id root="1.2.3.999" extension="--example only--"/>
  <code code="20124-4"
codeSystem="2.16.840.1.113883.6.1"
displayName="Ventilation mode [Identifier] Ventilator"/>
  <statusCode code="completed"/>
  <effectiveTime value="20170607224757"/>
  <methodCode code="286812008" displayName="Pressure
controlled ventilation (procedure)"
codeSystem="2.16.840.1.113883.6.96"/>
</procedure>
```

TermInfo Project

➢ **HL7 project that aims to provide guidance on use of terminologies within information models**

➢ **HL7 Version 3 Implementation Guide: TermInfo – Using SNOMED CT in CDA R2 Models, Release 1**

V3_IG_SNOMED_R1_DSTU_2015DEC

HL7 Version 3 Implementation Guide: TermInfo - Using SNOMED CT in CDA R2 Models, Release 1

Draft Standard for Trial Use
December 2015

Publication of this draft standard for trial use and comment has been approved by Health Level Seven International (HL7). This draft standard is not an accredited American National Standard. The comment period for use of this draft standard shall end 24 months from the date of publication. Suggestions for revision should be submitted at http://www.hl7.org/dstucomments/index.cfm

Following this 24 month evaluation period, this draft standard, revised as necessary, will be submitted to a normative ballot in preparation for approval by ANSI as an American National Standard. Implementations of this draft standard shall be viable throughout the normative ballot process and for up to six months after publication of the relevant normative standard.

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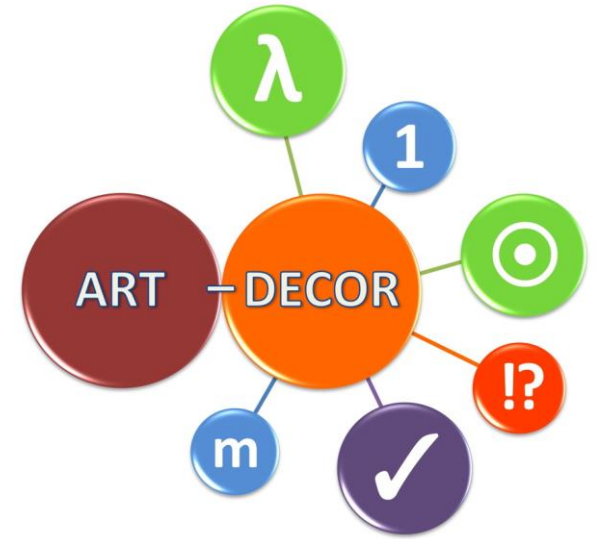
Tooling

ART-DECOR®

➢ **Advanced Requirement Tooling using Data Elements, Codes, OIDs and Rules**

➢ **open-source tool that supports the creation and maintenance of HL7 CDA templates, value sets, scenarios and data sets**

➢ **web-based collaborative platform for various stakeholders**
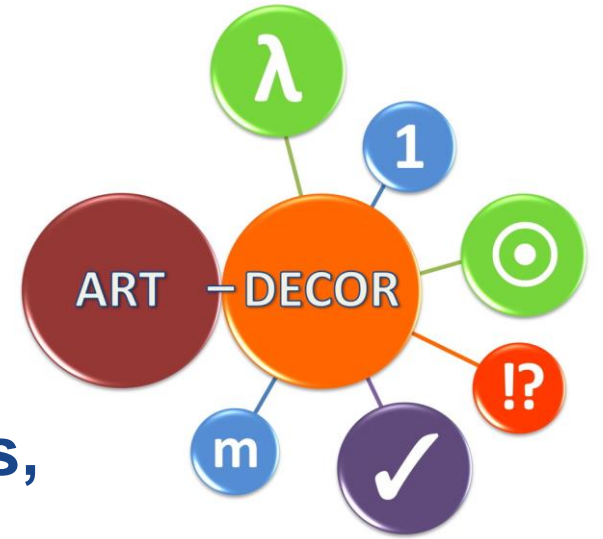
ART-DECOR

features

- ➤ **document datasets**
- ➤ **built-in Terminology Browser**
- ➤ **connect dataset concepts with codes from terminologies**
- ➤ **Value Set Editor**
- ➤ **Template Viewer and Editor**
- ➤ **Building Block Repository (BBR) with templates and value sets from e.g. C-CDA R 1.1 and 2.1, CCD 1, epSOS, IHE Profiles**
- ➤ **validate CDA XML instances**

ART-DECOR Terminology Browser

ART-DECOR Value Set Editor

features

➢ **pre- and post-coordinated expressions**

➢ **intensional and extensional definitions possible**
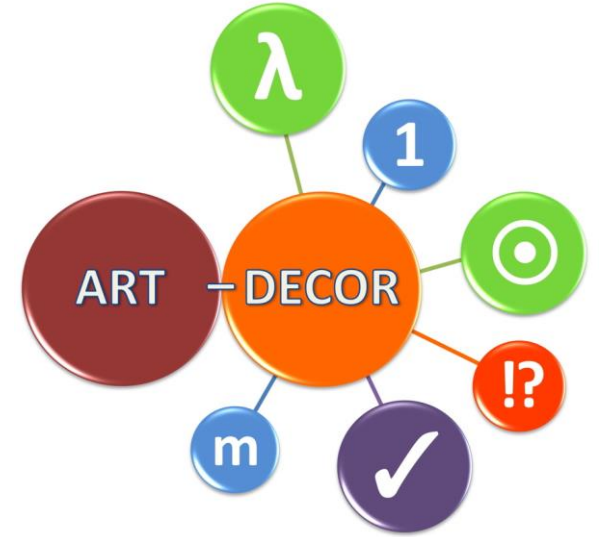
Values					
Level	Type	Code	Display Name	Ordinal	Codesystem
0	L ▾	706172005	Ventilator (physical object) ⊞		2.16.840.1.113883.6.96
0	L ▾	448703006	Pulse oximeter (physical object) ⊞		2.16.840.1.113883.6.96
0	L ▾	706177004	Inhalation therapy device (physical object) ⊞		2.16.840.1.113883.6.96
0	L ▾	706092000	Suction system (physical object) ⊞		2.16.840.1.113883.6.96
0	L ▾	701777007	Ultrasonic cough stimulation system (physi		2.16.840.1.113883.6.96

ART-DECOR Templates

features

➢ **view and edit templates**

➢ **HL7 Templates STU R1 Exchange Format**

➢ **Terminology Binding**

➢ **documentation of templates in ART, HTML, PDF**

➢ **use documentation to create Implementation Guides**

Item	DT	Kard	Konf	Beschreibung	Label
▼ hl7:observation		1 … 1	R		Atem…uenz
@classCode	cs	1 … 1	F	OBS	
▼ @moodCode	cs	1 … 1	R		
	CONF			Der Wert von @moodCode muss gewählt werden aus dem Value Set 1.2.276.0.76.11.447 *ActMoodCodes* (2017-05-31)	
▼ hl7:templateId	II	1 … 1	M		Atem…uenz
@root	uid	1 … 1	F	1.2.276.0.76.10.4180	
hl7:id	II	0 … 1			Atem…uenz
▼ hl7:code	CE	1 … 1	M		Atem…uenz
@code		1 … 1	F	86290005	
@codeSystem	CONF	1 … 1	F	2.16.840.1.113883.6.96	
@codeSystemName		1 … 1	F	SNOMED CT	
@displayName		1 … 1	F	Respiratory rate (observable entity)	
hl7:text	ED	0 … 1			Atem…uenz
▼ hl7:statusCode	CS	1 … 1	R		Atem…uenz
@code	CONF	1 … 1	F	completed	
hl7:effectiveTime	IVL_TS	1 … 1	M		Atem…uenz
▼ hl7:value	PQ	1 … 1	M		Atem…uenz
	◎			evthm-dataelement-28 Atemfrequenz	eVent@home
	CONF			@unit ist "/min"	

Use Case

➢ **mapping of concepts from home-mechanical ventilation care domain to SNOMED CT**

Mapping	Number of clinical concepts from dataset and value sets total of N=204	percentage of concepts mapped to SNOMED CT
1-1 Map	147	72%
1-M Map	12	6%
No Map	45	22%
Total	204	100%

➢ **SNOMED CT covers most of the required concepts**

➢ **Concepts not covered? LOINC or specific to the German healthcare system -> National Extension is needed**

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Use Case

➤ **modelled CDA templates based on expert's dataset using the ART-DECOR tool**

➤ **defined two CDA documents:**

- **a Referral Summary to support discharge of ventilated patients from hospital to outpatient care**

- **a Status Report to facilitate transmission of semantic interoperable data between patient's home and treating physicians**

➤ **structured clinical data in CDA entries using SNOMED CT for model meaning binding and value set binding**

Example

CDA Entry level template

"Airway suctioning"

➢ **Procedure class from HL7 Clinical Statement Model**

➢ **Model meaning binding 230040009|Airway suction technique (procedure)| @code element**

➢ **Value set binding @methodCode**

Item	DT	Kard	Konf	Beschreibung	Label
▼ hl7:procedure					Absaugen
@classCode	cs	1 … 1	F	PROC	
@moodCode	cs	1 … 1	F	EVN	
@negationInd	bl	1 … 1	R		
◎				evthm-dataelement-302 Absaugen ja/nein eVent@home	
▼ hl7:templateId	II	1 … 1	M		Absaugen
@root	uid	1 … 1	F	1.2.276.0.76.10.4210	
hl7:id	II	0 … 1			Absaugen
▼ hl7:code	CE	0 … 1			Absaugen
@code		1 … 1	F	230040009	
@codeSystem	CONF	1 … 1	F	2.16.840.1.113883.6.96	
@codeSystemName		1 … 1	F	SNOMED CT	
@displayName		1 … 1	F	Airway suction technique (procedure)	
hl7:text	ED	0 … 1			Absaugen
▼ hl7:statusCode	CS	0 … 1			Absaugen
@code	CONF	1 … 1	F	completed	
▼ hl7:effectiveTime	IVL_TS	1 … 1	R		Absaugen
◎				evthm-dataelement-109 Zeitpunkt Absaugen eVent@home	
▼ hl7:methodCode	CE	1 … *	R		Absaugen
◎				evthm-dataelement-110 Absaugmethode eVent@home	
CONF				Der Wert von @code muss gewählt werden aus dem Value Set 1.2.276.0.76.11.434 *Absaugmethode* (2017-03-02)	

Level/ Typ	Code	Anzeigename	Codesystem
0-L	260544000	Endobronchial (qualifier value)	SNOMED Clinical Terms
0-L	261180004	Tracheal (qualifier value)	SNOMED Clinical Terms
0-L	260548002	Oral (qualifier value)	SNOMED Clinical Terms
0-L	260540009	Nasal (qualifier value)	SNOMED Clinical Terms
0-L	2261442006	Parastomal approach (qualifier value)	SNOMED Clinical Terms

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Example

CDA Entry level template "Airway suctioning"

➢ **XML instance**

```xml
<procedure negationInd="false" classCode="PROC" moodCode="EVN">
  <templateId root="1.2.276.0.76.10.4210"/>
  <id root="1.2.3.999" extension="--example only--"/>
  <code code="230040009" codeSystem="2.16.840.1.113883.6.96"
displayName="Airway suction technique (procedure)"/>
  <statusCode code="completed"/>
  <effectiveTime value="20170608113715"/>
  <methodCode code="261180004" displayName="Tracheal (qualifier value)"
codeSystem="2.16.840.1.113883.6.96"/>
</procedure>
```

Value Sets

Ventilation specific SNOMED CT value sets:

➢ **ventilation modes**

➢ **types of tracheotomy**

➢ **sizes of respiratory cannulas**

➢ **airway suction techniques**

➢ **suction frequencies**

➢ **consistency of bronchial secretions**

➢ **medical devices**

Level/ Typ	Code	Anzeigename	Codesystem
0-L	706172005	Ventilator (physical object)	SNOMED Clinical Terms
0-L	448703006	Pulse oximeter (physical object)	SNOMED Clinical Terms
0-L	706177004	Inhalation therapy device (physical object)	SNOMED Clinical Terms
0-L	706092000	Suction system (physical object)	SNOMED Clinical Terms
0-L	706204001	Airway secretion-clearing system (physical object)	SNOMED Clinical Terms
0-L	706180003	Respiratory humidifier (physical object)	SNOMED Clinical Terms
0-L	371785003	Ambu bag (physical object)	SNOMED Clinical Terms
0-L	468664004	Enteral feeding pump (physical object)	SNOMED Clinical Terms
0-L	708116006	Battery pack (physical object)	SNOMED Clinical Terms

Level/ Typ	Code	Anzeigename	Codesystem
0-L	286812008	Pressure controlled ventilation (procedure)	SNOMED Clinical Terms
0-L	286813003	Pressure controlled SIMV (procedure)	SNOMED Clinical Terms
0-L	182687005	Intermittent positive pressure ventilation (procedure)	SNOMED Clinical Terms
0-L	243150007	Assisted controlled mandatory ventilation (procedure)	SNOMED Clinical Terms
0-L	47545007	Continuous positive airway pressure ventilation treatment (procedure)	SNOMED Clinical Terms
0-L	243141005	Mechanically assisted spontaneous ventilation (procedure)	SNOMED Clinical Terms

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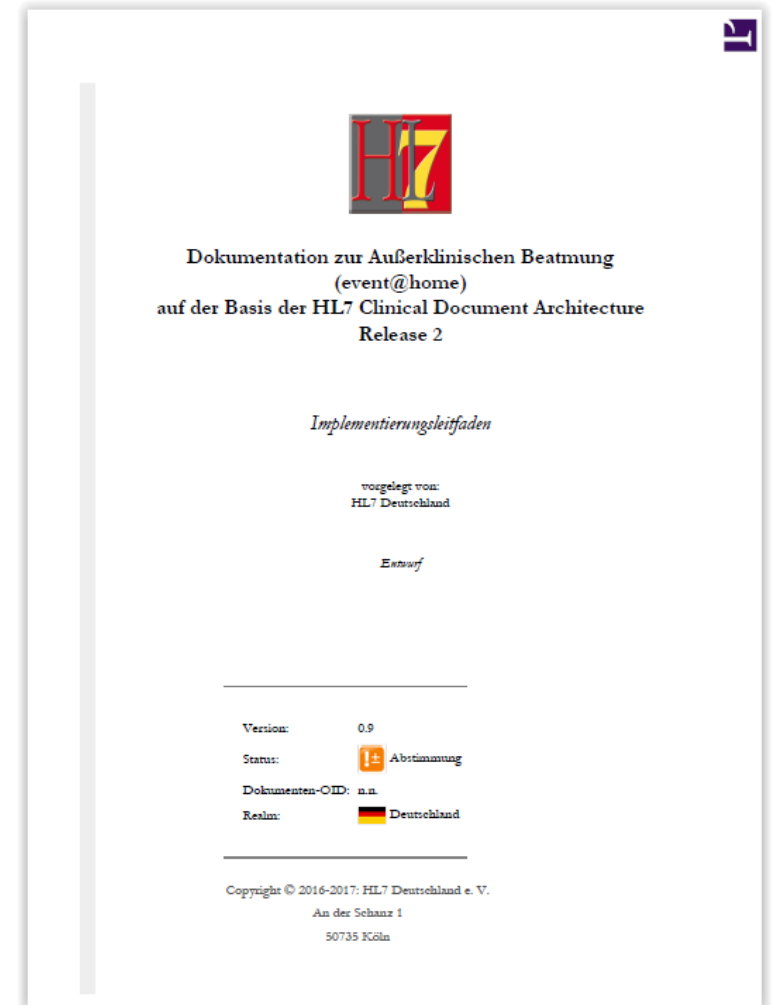**Gesundheitswesen**
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Templates

- ➢ **medical devices**
- ➢ **respiratory therapy treatment plan**
- ➢ **ventilation parameters**
- ➢ **ventilator settings**
- ➢ **ventilator alarm criteria**
- ➢ **nursing procedures**

among others…

Item	DT	Kard	Konf	Beschreibung	Label
▼ hl7:observation					Cuffdruck
@classCode	cs	1 … 1	F	OBS	
@moodCode	cs	1 … 1	F	EVN	
▼ hl7:templateId	II	1 … 1	M		Cuffdruck
@root	uid	1 … 1	F	1.2.276.0.76.10.4224	
hl7:id	II	0 … 1			Cuffdruck
▼ hl7:code	CE	1 … 1	M		Cuffdruck
@code	CONF	1 … 1	F	250856006	
@codeSystem		1 … 1	F	2.16.840.1.113883.6.96	
@codeSystemName		1 … 1	F	SNOMED CT	
@displayName		1 … 1	F	Airway device cuff pressure (observable entity)	
hl7:text	ED	0 … 1			Cuffdruck
▼ hl7:statusCode	CS	0 … 1			Cuffdruck
@code	CONF	1 … 1	F	completed	
hl7:effectiveTime	IVL_TS	0 … 1			Cuffdruck
▼ hl7:value	PQ	1 … 1	M		Cuffdruck
	◎			evthm-dataelement-119 Cuffdruck eVent@home	
	CONF			@unit ist "mm[Hg]"	
	CONF			@unit ist "cm[H2O]"	

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Implementation Guide

"Documentation in the field of home-mechanical ventilation based on the HL7 Clinical Document Architecture Release 2"

➢ **draft status**
➢ **currently in ballot process**

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What's next?

➢ **incorporate comments from ballot into the Implementation Guide**

➢ **implement specified CDA documents on a test basis in eVent@home eNursing software solution**

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Summary

➢ **SNOMED CT is suited as a reference terminology in the field of home-mechanical ventilation**

➢ **using SNOMED CT in HL7 CDA templates can enable semantic interoperability**

➢ **the ART-DECOR tool facilitates creation and maintenance of HL7 models that use SNOMED CT**

Visit us online @

eVent@home website

- ➤ **www.eventathome.de**

ART-DECOR live version

- ➤ **https://art-decor.org/art-decor/decor-project--evthm-**

Implementation Guide wiki

- ➤ **http://wiki.hl7.de/index.php?title=IG:Außerklinische_Beatmung**

Contact

Thank you!

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