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Effective Ways for the Transmission of Infection Prevention Data According to German Legal Specifications via the Medical Terminology SNOMED CT used with HL7 CDA Templates

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Abstract: According to German legal specifications each national federal state is obliged to transmit infection prevention data to the relevant health authority. In case of reasonable suspicion, affection or death by infectious diseases specific information is differently communicated by laboratories and physicians. Proprietary ways of transmission inherit threats like deficient or incomplete availability of data. At least these circumstances imply non-predictable health-related hazards for the population. The international established medical terminology SNOMED CT can contribute semantic interoperability and a highly specific description of diagnoses and procedures. The applicability of SNOMED CT shall be tested in the domain of diagnostic findings respective notifiable infectious agents. In addition, specific hierarchical links from the agents to the associated infectious diseases inside the terminology are expected and verified. As the carrier of the information, HL7's Clinical Document Architecture (CDA) is used by designing appropriate CDA templates to define the contents of the notifiable disease documentation. The results demonstrate that the entirety of the notifiable infectious agents is displayed in the terminology SNOMED CT by relating codes at 100 percent. Furthermore, each single term is hierarchically connected to the relating infectious diseases. The use of SNOMED CT for the purpose of infection prevention in Germany is tied to licensing and license costs. Irrespective of these facts, the use of SNOMED CT shows obvious advantages in this field and an implementation of the terminology can be recommended.

Keywords: Infection prevention, SNOMED CT, HL7 CDA

Introduction

The quality of national medical treatment is highly dependable on the availability of relevant health data in sufficient time. Therapy decisions are based on required clinical information. In Germany, the transmission of health data is provided by different types of media. The common use of standardized information technology is not state of the

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art in whole parts of the country [1]. The leading actors in the German Health Care System (GHCS) have determined the use of insufficient standards that are often incompatible among themselves. Proprietary systems with inadequate networking abilities are often found in particular software utilization [2]. Due to diverging political interests of the stakeholders, essential changes or decisions take a lot of time in the GHCS. Because of this, the spreading of new technologies or standards is insufficient. Currently, there are a few German research publications available that try to remove the drawback and to improve the general conditions [3].

One part of the health care system that is extremely bound to the secure availability of special medical information is the prevention of infections. In Germany, all necessary regulations and obligations concerning this field are determined in the law on the prevention of infections (IfSG). The IfSG´ s 6th and 7th article summarize the modalities in the management of notifiable infectious agent data and infectious diseases data [4][5].

The IfSG doesn´t specify that a single and unique communication form that has to be used throughout the whole country. In case of reasonable suspicion, infection or death by an infectious disease specific data is transferred via the local health authority, the federal state health authority and at least the Robert-Koch-Institute (RKI) in Berlin [6]. The latter is the national health authority with main competence in the prevention and the handling of infectious diseases.

Concerning the electronic interchange of relevant data semantic interoperability between the interfaces is needed to assure the proper ascertainment and transmission [7]. The international established medical terminology SNOMED CT offers a highly specific description of diagnoses and procedures. Clinical information can be comprehensively displayed and exchanged via SNOMED CT. The greater benefit lies in providing a free from breakage electronic exchange of medical information between the involved organizations in the healthcare system [8].

In this approach, the applicability of SNOMED CT shall be tested in the domain of diagnostic findings respective notifiable infectious agents determined in the German IfSG. In addition, it is expected that specific hierarchical links from the agents to the associated infectious diseases can be verified inside the terminology. If SNOMED CT fulfills the requirements it provides a serious room for improvement in the management of infectious data in Germany.

1. Methods

A German version of SNOMED CT that is validated by the IHTSDO is not available at present. Within this research, all notifiable infectious agents specified in the IfSG are translated into English language and entered into the "CliniClue®" SNOMED CT browser [9]. In the browser, we use the SNOMED International edition (2013-01-31).

After discovering each determined infectious agent in the browser we regard the possible connections to the relating infectious diseases. The method is reproduced via using terms like "infection" plus the infectious agent in the meaning of post-coordination. As the carrier of the information, HL7's Clinical Document Architecture (CDA) is used by designing appropriate CDA templates to define the contents of the Notifiable Disease Documentation [10]. In this context, CDA sections have to be built that reproduce the paper documents normally used by physicians. For quality assurance purposes the terminology codes have been verified by two healthcare experts.

2. Results

The entirety of the notifiable infectious agents that are mentioned in the German IfSG is represented in the terminology SNOMED CT at 100 percent. Each agent is determined by a special SNOMED CT Concept-ID. A section of the research results are shown in Table 1.

Table 1. Section of IfSG notifiable infectious agents displayed in SNOMED CT Concept-ID´s

Agent	SNOMED CT Concept-ID	Agent	SNOMED CT Concept-ID
Adenovirus	50842006	Legionella species	115514004
Bacillus anthracis	21927003	Legionella pneumophila	80897008
Borrelia recurrentis	34726005	Leptospira interrogans	116401006

In the next step each single infectious agent is hierarchically connected to relating infectious diseases through phrases like “infection”. The connection is demonstrated via the example of the IfSG notified infectious agent “Rotavirus”. The Rotavirus causes one quarter of all gastro-enteretic disease hospital treatments of babies and children under the age of five around the world. In Germany, this infectious agent is a severe cause of morbidity as well [11]. First, the terms “rotavirus” and “infection” are entered into the search field. In the browser the preferred term “rotavirus infection of children” is suggested. The concept itself is directly linked to its definition by a relationship icon key. The rotavirus infection is defined as a “viral gastroenteritis due to Rotavirus”. The presented example shows that it is possible to create logical links between the infectious agent and the infectious disease in the terminology SNOMED CT. The SNOMED CT terminology links are shown in Figure 1.

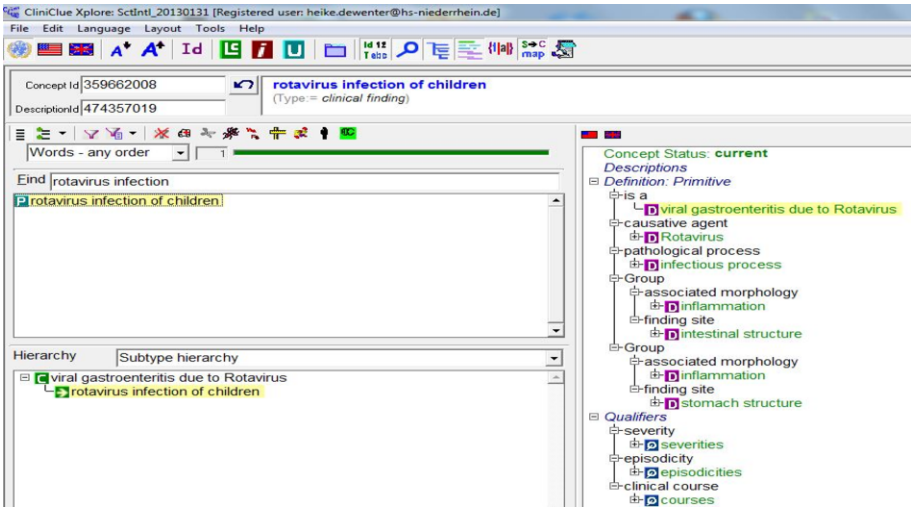

Figure 1. Link between infectious agent and infectious disease in SNOMED CT

In a further step, sections were created that are based on the document used by physicians. These sections are demonstrated in Figure 2.

Name	Typ	Card	Conf	Template Name	Template OID
Diagnose	Section Level	0..1	C	Diagnose Section Notifyable Diseases	1.2.276.0.76.10.3013
__Problemliste	Entry Level	1..1	R	Problem Concern Act Notifyable Diseases	1.2.276.0.76.10.4002
____Diagnose	Entry Level	1..*	R	Diagnosis Observation Notifyable Diseases	1.2.276.0.76.10.4003
____Symptom	Entry Level	0..*	O	Symptoms Observation Notifyable Diseases	1.2.276.0.76.10.4004
Angaben zum Tod	Section Level	0..1	O	Summary Of Death Section	1.2.276.0.76.10.3014
Zusatzangaben	Section Level	0..1	C	Annotation Comment Section	1.2.276.0.76.10.3015
Betreuung	Section Level	0..1	O	Care process or plan Section	1.2.276.0.76.10.3016
Tätigkeit	Section Level	0..1	O	Social History Section	1.2.276.0.76.10.3017
Impfstatus	Section Level	0..1	O	Immunizations Section	1.2.276.0.76.10.3012
Expedition	Section Level	0..1	O	Expedition Section	1.2.276.0.76.10.3018
Spende	Section Level	0..1	O	History Of Donation Section	1.2.276.0.76.10.3019
Ausführendes Laboratorium	Section Level	0..1	O	Performing Laboratory Section	1.2.276.0.76.10.3020

Figure 2. CDA sections

The ICD-10-German Modification provides several attributes indicating that the concept is associated with reports on infectious diseases. Therefore we used this information to build value sets according to the implementation guide. A template was defined used to instantiate these informations via CDA as shown in Figure 3.

```
<observationclassCode="OBS" moodCode="EVN">
  <templateId root="1.2.276.0.76.10.4003"/>
  <id root="08edb7c0-2111-43f2-a784-9a5fdfaa67f0"/>
  <code code="282291009" codeSystem="2.16.840.1.113883.6.96" displayName="Diagnosis"/>
   <text>
      <reference value="#DIAG1"/>
   </text>
   <statusCode code="completed"/>
   <effectiveTime>
      <low value="20130722"/>
   </effectiveTime>
   <value xsi:type="CD" code="B05" codeSystem="1.2.276.0.76.5.413" displayName="Masern"/>
</observation>
```

Figure 3 . CDA template for the section diagnosis. Codes from ICD-10-German Modification (GM) and SNOMED CT are possible

3. Discussion

The results demonstrate that SNOMED CT is suitable for the display of relevant diagnosis data and it is possible to create logical links between agents and infectious diseases. An unimpeded information transfer depends on the correct insertion of SNOMED CT terms in HL7 documents. Relevant instructions have been provided by the TermInfo Project Group in a corresponding implementation guide [12].

Due to the absence of a validated German version of SNOMED CT the results of this investigation are transferrable to a limited extend. A further barrier can be found in the fact that Germany is not a member of the International Health Terminology Standards Development Organization (IHTSDO). The use of SNOMED CT for the purpose of infection prevention in Germany could be tied to license costs. Irrespective of these facts, the use of SNOMED CT shows obvious advantages in this field and an implementation of the terminology can be recommended. Additionally, it is possible to

examine the potential of SNOMED CT concerning laboratory tests in comparison with other recognized medical terminologies, for example LOINC®. Additionally, the results offer a possible linkage between SNOMED CT Codes with ICD-10-GM concepts concerning the infection prevention task.

The German implementation guide "Notifiable Disease Documentation" provides a next step towards semantic interoperability using HL7 CDA V.2 and SNOMED CT. It has been developed in the frame of the research project "Implementing the supra-regional real time operation of an electronic reporting procedure for the transaction of infectious diseases and infectious agent data from the laboratories to the responsible local health authority". The activities focus on local conditions in the federal state North Rhine/Westphalia and they are sponsored by the responsible ministry of health (MGEPA NRW). The research findings will provide more structured data for the RKI in Berlin respective the underlying use cases.

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