



Coding rules for the patient summary: analysis and requirements to develop an automated coding system.

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Abstract In the frame of federated and interoperable Electronic Health Records, specific coding systems are mandatory for filling out the Patient Summary. Because of the sensitivity of its content, PS needs to be validated by General Practitioners. This work proposes a support system based on standardized and formalized coding rules to ease the coding process supporting GPs in the compilation of the PS, thus avoiding coding errors and misspecifications of clinical data.

Introduction

In adopting the EU directive on Patient Summary, most Countries are regulating the use of coding systems, making some of them mandatory. Nonetheless, General Practitioner (GPs) massively use natural language to record health conditions in the Electronic Health Records (EHRs) [1], thus generating unstructured and not coded data, which cannot be used as they are for the compilation of the Patient Summary (PS). In fact, they require text processing and translation to a structured language before being mapped to coding systems. Moreover, data related to health conditions cannot be automatically derived from those available in the EHRs, because they need to be validated by the GP, the sole responsible of their content. In this scenario, an automated coding support system (CSS) can be of help without breaking the law. A centralized coding system management through a rule-based supporting tool [2] would solve a number of critical issues reported in the literature about the use of coding systems by GPs and other healthcare professionals. This work proposes a methodology for the creation of a CSS that will be initially experimented for the Italian PS use case.

Methods & Materials

According to the EU Guidelines, the PS is the minimum set of information needed to assure healthcare coordination and the continuity of care. PS reference elements, tagged as mandatory or optional, can be reported as free text or by using dedicated coding systems. Because of its highly structured content, the PS could be well coded using formal rules and implementing a challenging automated support system. In order to set up an automated CSS, an Italian collaborative work group was set up and a work plan was defined for developing the resources and tools to assist physicians in coding the PS.

A four-step methodology is proposed (see Figure 1):

1. Analysis of existing projects results (e.g. epSOS) and of the automated ICD-10 coding rules for mortality data. This step will produce standardized *coding rules* based on general guidelines by qualified institutions (e.g. WHO);
2. Design of an *algorithm* that applies coding rules to produce candidate codes and assess their accuracy;
3. Creation of a *cross reference terminology* of structured technical and lay terms (based on existing terminological tools such as ICD-10 Alphabetical Index, the ICMV [3], ICD-11 narrower terms, and Dictionary for NLP created from a database of 295,000 EHRs [1]), as intermediate between natural language and concepts of the international coding systems. *Transcoding tables will be used* to manage different versions of a coding system or to map between different systems;
4. Composition of the cited tools to build a web service-based CSS.

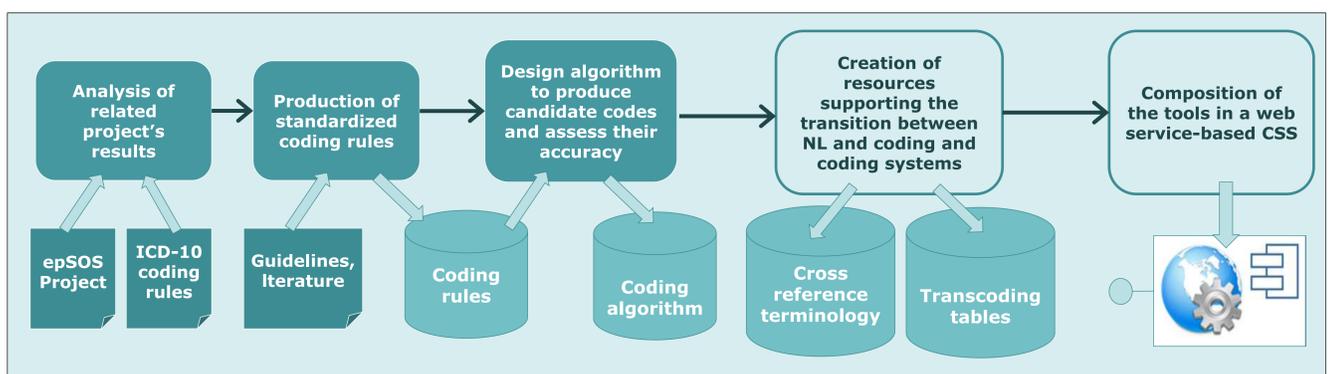


Figure 1 – Rule-based CSS Development Process

Expected Results

The following resource to be used by the CSS will be generated:

- a set of coding rules in an open format based on general guidelines defined by qualified institutions (e.g. WHO) and described by the literature, to be embedded in third-party software;
- the algorithm that applies the coding rules implemented in a suitable computable formal language for representing guidelines/rules and the domain (e.g., OWL + SWRL, Asbru, etc.);
- a set of complementary tools to support the transition from the specialized and natural language used by GPs to the coding language (i.e. the cross reference terminology);
- a web service to directly support natural language text coding.

Conclusions

This work proposes a standardized methodology for the development of a rule-based CSS that facilitates the compilation and coding of PS by GPs. The advantages of a sound rule-based CSS are: (i) it is based on internationally updated standard coding systems and standardized methodology to code health conditions; (ii) it could significantly reduce coding time and costs; (iii) it improves the quality of coding by reducing the variability due to different subjective interpretations.

Limitations are mainly related to the computational costs of the system and to the complexity of the domain, since it could be necessary to formalize a huge amount of rules. Although developed for the Italian PS, this methodology could be further adapted to other UE Countries.

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