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

Della Mea V.1, Frattura L.2, Chiaraavolli M.T.3, Pasceri E.4, Cardillo E.4, Guarasci R.5, Eccher C.6
1Università di Udine; 2Central Health Directorate, Classification Area, Friuli Venezia Giulia Region, IT WHO-FIC CC; 3National Research Council (CNR), Institute for High Performance Computing and Networking; 4CNR, Institute of Informatics and Telematics; 5University of Calabria, Department of Languages and Education Sciences; 6Bruno Kessler Foundation

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 by which 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. Translating 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.

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.

Acknowledgements
This work results from the Collaboration Agreement signed by the Institute of Informatics and Telematics of the Italian National Research Council, the Central Health Directorate, Classification Area, Friuli Venezia Giulia Region, IT WHO-FIC CC and the Bruno Kessler Foundation (prot. n. 0005688). It is supported by the following projects: SemanticHealthNL Expert Agreement (prot. 0008991), Smart Health 2.0 (PON04A2_C20 “Smart Health - Cluster COSH Smart FSE - Staywell”).

References

Figure 1 – Rule-based CSS Development Process

Scan this to get a digital version