

S-Grouper

A Semantic Based System to Semi-Automatic Encode Hospital Activities

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Abstract— This paper presents a pilot implementation of a semantic based system which enables physicians to semi-automatic encode hospital cases. This system, called S-Grouper, is the result of a project carried out by the University of Trento and two Italian companies: GPI S.p.A and ExpertSystem. S-Grouper is aimed to improve the codification process of the so called Diagnosis-related group by (i) implementing semantic content analysis of healthcare records, (ii) providing useful hints and coherent categories that physicians may select, (iii) comparing the codification provided by professionals with the one automatically extracted from the patients' health care records, and (iv) improving management of knowledge.

Keywords- *Diagnosis-related group; coding processes; semantic analysis; information systems; healthcare quality.*

I. INTRODUCTION

In Italy, as in many other countries, hospital acute activities are classified, measured and financed according a standard classification system called Diagnosis-related group (DRG) [1]. DRG is identified manually or semi-automatically by physicians when the treatment on a patient is finished and the discharge letter is written. This activity is often supported by a 3M tool called Grouper that identify the DRG code analyzing the list of ICD-IX-CM codes which represent both diagnosis and clinical procedures adopted in the treatments.

We have analyzed various practices in different hospitals in Italy, and in all cases physicians have to analyze the patients' clinical records, manually codify diagnosis and clinical procedures, identifying the related ICD-IX-CM codes. Then the Grouper tool identifies the corresponding DRG code.

As in a socio-technical system [3], the process of codification (ICD-9-CM and DRG) is interrelated with the individuals' roles in the organization, knowledge they share, and their motivations. It is not hard to imagine, physicians do care more on medical procedures than on administrative

duties, they consider the processes of code identification as irrelevant and oppressive, they may not pay attention on the correctness of the codes, and provide results prone of mistakes [2].

Analyzing the working environment, procedures, inner interests of physicians, and the technology they use, we identified some recommendation to improve the DRG codification process [4, 5, 6].

II. OUR METHODOLOGY

Our approach encourages the interdependencies between social and technical sub-systems and the relations among users, tasks they carry on, technology they use and the social structure they belong to [3]. Our focus does not reflect a disregard for the technical aspects of software engineering, but is meant to underline features of the process that are oftentimes neglected by software developers, but are essential for the success of any socio-technical based application. Ideally the process of design and development starts with a field analysis aimed at identifying the motivations of individuals and the groups' practices which they belong to. Direct observations, interviews and questionnaires are very effective techniques that can be used to unveil and better define behaviors and motivations. In the second phase, the raw knowledge is then analyzed and requirements identified. The third phase is the creation of the software prototype which should be the simplest possible solution that can effectively support the users. In the fourth phase, the resulting prototype is tested, initially in a controlled environment with selected testers, then with real users, tasks (daily activities that actors usually carry on), and situations (the field and the social structure which actors belong to). The software changes in response to these findings, and the process is repeated until the desired outcome is achieved.

III. A SEMANTIC BASED TOOL

After a first analysis of clinicians practices we defined the requirements for a new tool aimed at improve the ICD-

IX-CM and DRG codification processes. The resulting tool called S/Grouper had the following high level architecture (Figure 1).

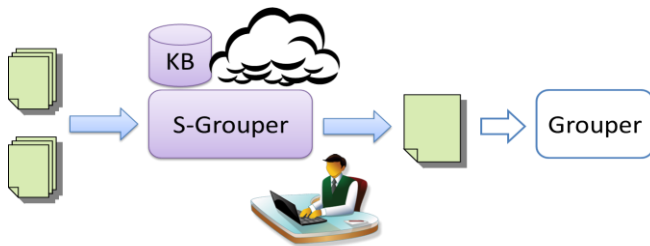


Figure 1. The system architecture of S-Grouper

S-Grouper is an expert system that:

- integrates semantic linguistic analysis in the Grouper software
- analyzes medical records and any other relevant document the physicians may need,
- and suggests some ICD-IX-CM categories.

These are used by physicians to:

- encode the medical treatments, reducing the time they spend dealing with bureaucratic procedures,
- suggest alternative codifications enabling clinicians to improve their abilities,
- check the coherence between the treatments described in the healthcare records and the codification chosen by doctors.

- analyze the document and extract entities from unstructured sources of information (see the underlined text at the right) such as the patients' health care records, the resignation letters, the nursing and surgical registers, etc.
- identify various ICD-IX-CM codes and propose them to the physicians (box at the left)
- select, organize and change the ICD-IX-DM codes (box at the left)
- recognize the most appropriate DRG code and close the patient discharge letter.

From the back office side, the system provides useful knowledge that enable administrative officers to:

- compare the resulting codes provided by the semantic engine with the ones manually listed by doctors in the hospital discharge form
- identify some lacks in physicians abilities
- measure the performances of physicians and identify some opportunistic behaviors
- report on potential errors or omissions, and provide some alerts
- measure the benefits generated by a more accurate reporting and ICD-IX-CM identification
- reduce time in dealing with bureaucratic procedures.

Finally, the public administration or the local government may take advantage of this tool. With S-Grouper they can automatically compare the DRG codes identified by physicians with the ones automatically identified through the semantic analysis of the patient's health care records, identifying opportunistic behaviors in DRG reporting..

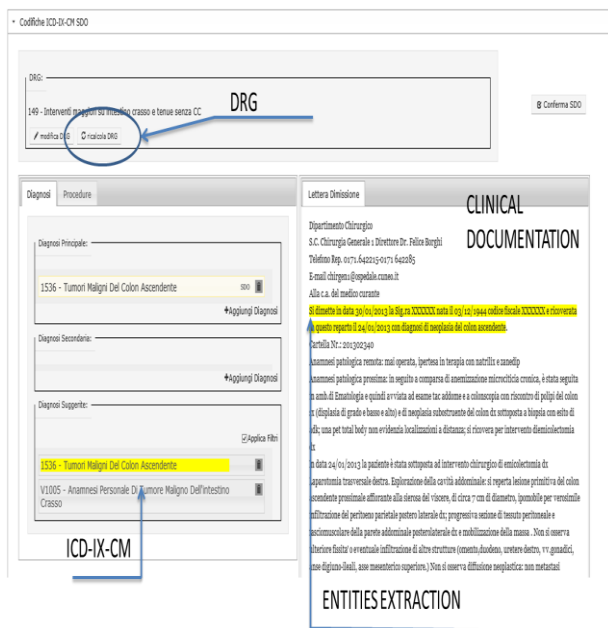


Figure 2. The interface of S-Grouper

As shown in the Figure 2, S-Grouper allows physicians to:

- connect in a "transparent" mode to the clinical documentations already digitalized (box at the right)

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