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FROM ETHNOGRAPHY TO TECHNOLOGY: AUTOMATIC SUPPORT TO HEALTH INFORMATION CODING PROCESS IN TICINO

Health information coding is an important issue in the field of health communication. It is a complex and widespread activity and constitutes the premises for hospitals' correct reimbursement and epidemiological statistics. Furthermore, this topic is crucial for patient safety and assuring the continuity of care as long as it involves the transmission of accurate information to general practitioners and other health care providers. This paper presents an ongoing research project conducted in collaboration with Ente Ospedaliero Cantonale (EOC) in Ticino, Switzerland. The goals of the study are (a) to analyze the practice of the coders in order to elicit its critical factors, (b) starting from the results of (a) and assuming the potential of automation in enhancing collaborative tasks, to evaluate possible strategies to support this practice with a technological intervention (is it possible to reduce time, costs and errors?). The methodology mainly uses qualitative methods, in particular ethnography of the workplaces. In the ethnographic study we elicited 6 main problematic issues in the EOC process, namely 1) lengthy time or inaccuracy for first redaction of medical records (MRs), 2) lengthy time for first review of MRs 3) lengthy time for final validation of MRs, 4) double receiver of the MRs (conflicting scopes of the same communication channel and message structuring), 5) difficult interpretation of MRs, 6) double scope of the coding process (statistical and economic). In conclusion, the paper discusses our results, their relevance for designing technological interventions, strategies of improvement, alongside supporting further research developments and challenges.

Keywords: health communication, ethnography, health technology, medical records.

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1. Introduction

The health information coding process is an important issue in current research because of a set of reasons strictly related to the domain: these reasons make this theme unique and scientifically crucial for the development of modern health systems. First, this is a complex and heterogeneous issue: coding health information involves (and is involved in) a great number of communicative, institutional, interpersonal, political and organizational relations. Secondly, it is a worldwide activity and should conciliate tendencies aimed at developing a uniform and international system with the necessity of taking into account specific needs of different countries. Thirdly, the activity constitutes the method to realize correct statistical and epidemiological measurements and to evaluate the health conditions of a population. Currently, health information coding practices regulate the complex system of hospital reimbursement and contributes to maintaining the difficult balance between the interests of health insurers, hospitals and collectivity (Canadian Institute for Health Information 2004).

The issue of health information coding has been addressed by disciplines such as health informatics and health technology assessment. So far, the results of the analyses are mainly focused on the functionalities of the technological devices and on the techniques for evaluating their impact on the medical practice (Shortliffe & Blois 2001, Lehoux 2006). These efforts have brought an enhancement of medical technologies such as health management systems, electronic patient records and telemedicine (Coiera 2003). In spite of the relevance of these findings, there are still some critical features that are problematic, many of which concern information transfer and translation. To our knowledge there is relatively little research centered on the role played by communication in the health information coding process (Coiera 2003). Moving from a communication perspective, we have underlined how the coding practice is indeed the core of a complex network of communication flows among various stakeholders: general practitioners, health insurances, hospital physicians, coding experts, patients, government institutions involved in collecting and maintaining statistics about the population, and administrators of the public health system.

In the majority of modern health care systems, when a patient is discharged, hospitals' physicians must write their medical record (MR). MR are letters meant to provide the general practitioner with all significant information regarding the patient's stay in a hospital. This information is also passed to the hospital Coding Office, where the coders translate it into codes, according to standard medical vocabularies in order to reach statistical and economic goals. On the one hand, codes are then transmitted to statistical offices to perform epidemiological studies and, on the other hand, they are used to compute *Diagnosis Related Groups* (DRGs), which constitute a useful system for hospital administrators to aggregate the hospital services into clinically uniform cost categories and evaluate hospital performances (Filippini & Farsi 2006; Silverman & Skinner 2004). This process is defined as *health information coding*. It is rather clear that there is a difference in the communication process between those who produce the health information (i.e. hospital physicians) and those who have to code the information (i.e. the coders). According to (Coiera 2003: 198), when addressing this specific topic, "it is because of the burden that the coding process imposes that attempts have been made to reduce the efforts involved by automating the process." Automation can be interpreted in terms of information coding or support system's design effort: (a) free code entry with no support, (b) free code entry with operational support (as systems to retrieve terms and codes from standards nomenclatures: note that the effort due to information interpretation is still on the coder's side), (c) semi-structured information entry (i.e. systems designed to shift the act of coding at the time of information capture: note that in this case the coding is directly accomplished by the hospital physicians, overcoming any interpretation uncertainty), (d) automatic coding (intelligent systems able to automatically recognize and code the information within the patient MR, note that this solution still has many technological boundaries).

2. Aims of the Study

In the following sections, we illustrate the activities carried out and results obtained during a project conducted in collaboration with the Ente Ospedaliero Cantonale (EOC), a public institution that manages the network

of the seven main hospitals in Ticino, Switzerland. In particular, we worked with the coders of the Coding Office (EOCOD) of the EOC.

So far, EOC has reached the second level of automation explained in the previous section. In this perspective, the case study illustrated herein explores the possibility of moving towards a more comprehensive support system for the coding practice in Ticino, exploiting a communicative approach to ground and contextualize the requirements elicitation phase of technology design. We analyzed the health information coding activity and examined potential technological interventions to support it. The overall aim was to maximize the efficacy and the effectiveness of a process, which is crucial for maintaining precise and reliable statistics about the health status of the population and the funding system of the health institutions.

In details, the aims of the research are (a) to analyze the practice of the coders to elicit its critical factors, (b) starting from the results of (a) and, by assuming the potential of automation in enhancing collaborative tasks, to discuss the possibility to introduce a technological support into this practice (is it possible to reduce time, costs and errors?). The relevance of these goals is reinforced by the fact that in Switzerland the coding activity is still not technologically supported but by some legacy software. This research can be considered as a case or pilot study to reach better decisions concerning the introduction of new technologies in the health information coding system.

3. Methodology

The methodology used is the ethnography of the workplaces. Ethnography is a method of analysis of contexts and working practices, which, in this case, has been designed to elicit the critical aspects of the activity under examination. It is based on the idea that the researcher should work in direct contact with the actors of the practice, collecting data in form of notes, recordings and interviews (Fetterman 1998; Millen 2000). In particular, we applied a specific kind of ethnographic analysis called *quick and dirty,* defined by (Hughes et al. 1994) as the study where "brief ethnographic studies are undertaken to provide a general but informed sense of the setting for designers." This methodology is particularly useful to

go in depth into the practice, overcoming the mere organizational level. Many of the critical aspects, in fact, are not dependent on organizational mistakes, but rather on the informal practices established by individuals as everyday work strategies (Mantovani 2002; Zucchermaglio 2002).

We performed four days of multiple participative observations in two of the main hospitals in Ticino (San Giovanni in Bellinzona and Civico in Lugano) during a period of one month (March 2007). We conducted three semi-structured interviews with the key actors in the coding practice in order to get an overview of the perceived problems in the activity. Then we asked the coders to perform oral coding of MRs and, finally, we observed their work and interactions. Furthermore, we took part in a monthly meeting of the coders, to get a better insight into the problem-solving activities between the coders. All interviews and observations were audio recorded (video recording has not been possible for privacy reasons) and further transcribed. These transcribed data, in addition to the field-notes taken by the researchers, were analyzed in order to produce a systematic list of the problems that occur during the coding practice. The idea was to perform a double comparison, first between the formal coding rules and the real coding practice and secondly between the general problems elicited by the coders and the ones emerging during their activity.

4. Ethnographic Study at the Coding Office of EOC: Results

The coding process is an activity distributed among the hospitals of the EOC network. It involves the whole hospital structure and not only the Coding Office. There are several activity flows inside the hospitals, where the greater part of the elaboration of the medical records is accomplished. The documents that are relevant to the coding process are pre-elaborated during the hospitalization and, once gathered together, they are sent to the EOCOD. Through the ethnographic methodology, it was possible to probe this assumed scheme and to locate the major problems that arise in everyday coding activities.

Six main problems regarding specifically the coding process are summarized in Table 1. Each main result is then explained and quotations from the interviews are reported. The names of the informers are replaced by nicknames for privacy reasons. The translations are made by the authors.

Table 1: Synopsis of Elicited Problems

Code	Problem
1	Lengthy time or inaccuracy for the first redaction of MRs
2	Lengthy time for first review of MRs
3	Lengthy time for final validation of MRs
4	Double receiver of the MRs (conflictual scopes of the same communication channel and message structuring)
5	Difficult interpretation of the medical records
6	Double scope of the coding process: statistical and economical

1 – Lengthy time or inaccuracy for the first redaction of MRs: The physicians do not always write the MR right after the patient is discharged. As a rule, they should provide the required documentation within 21 days. From one side, delays in delivery the MR generate a problem of accuracy in reporting basic information such as diagnosis and treatments. On the other side, it is relevant to underline that exceeding the 21 days time limit might produce an economic loss for the hospital that doesn't get the reimbursement until the MRs are coded. Consider, for example, the following excerpt:

> "… *it is unacceptable that some wards with very few hospitalized patients delivered only 60 % of the total amount of medical records* …" (Carlo)

2 – Lengthy time for first review of MRs: The MRs must be reviewed before being delivered to the coding office. In some cases, the physician does not start reviewing the MRs right after having dictated it to secretaries. This also might produce delays and lack of accuracy.

3 – Lengthy time for final validation of MRs: The physician who looks after the patient is not the only one responsible of validating the MR. Before the MRs can be delivered to the coding office, the head physician and the consultant physician must validate it. This triple validation process might create further delays before the MRs are sent out to the coding office. Furthermore, it might happen that the validation is not properly done, and errors are therefore ignored. Consider what the coders report:

"... then, MRs should be signed by chiefs and directors, that should – and I say they SHOULD – check them carefully before signing..."(Anna)

4 – Double receiver of the MRs: One of the main problems concerning the coding process is that the MR is used as the input for the coders' activity, but it primarily serves the purpose of informing the General Practitioners (GP) of what happened during the hospitalization. Using the same channel to reach different targets, namely the coders and the GPs, might generate communication problems. In particular, MR are not structured to favor the coding activity and retrieving the relevant information for the coding practice can be extremely difficult. During the observations and the interviews, we collected several data on this issue, as reported in the following examples:

"... the MR is intended for the General Practitioner. When the patient is discharged, the physician who looked after the patient writes a letter we call medical record, or discharge letter, where he explains everything that occurred during the hospitalization." (Francesca)

"If a patient suffers from multiple conditions... the physician usually writes a list [of the diseases]... instead, we have to choose only the ones they actually treated [in the hospital], otherwise the reimbursement is inflated." (Francesca)

5 – Difficult interpretation of the MRs: As a consequence of the previous problem, coders are faced with a problem in interpreting the MRs in their everyday practice. This has three main causes, namely (a) coders do not have a direct contact with the patient and they must rely only upon the MR, (b) MR can be inaccurate and (c) MR are not properly suited for the coding practice according to their actual structure and goals (see problem n4). Therefore, the coding practice becomes more and more delicate and difficult for the coders. Moreover, not all the coders are trained as physicians. The problem of interpreting the MRs is frequently reported:

"The coder should be objective. He should not interpret things. However, there are ways of describing specific things where the physician

can immediately understand, while a non-physician [coder] can have great troubles." (Anna)

"The main difficulty is indeed the translation of the medical language into codes for diagnosis and treatments. Unfortunately, in medicine there are so many different words to describe the same thing ... and then it's like having to shift from a probabilistic science to a mathematical science ..." (Anna)

Interviewer: *"What are the advantages of a well structured medical record?"* Answer: *"... the coding would be facilitated and it can become more and more objective. I mean, the interpretation should not be subjective and any trained coder should thus be able to code the same medical record in the same way."* (Anna)

6 – Double scope of the coding process: statistical and economical: The coding practice serves two purposes. On one side, it is meant to gather health data to be delivered to the Swiss Federal Statistical Office. On the other side, it produces DRG codes to calculate the reimbursement for the hospital. These goals can be conflictual. The Swiss Federal Statistical Office asks for more information as possible, while the DRG computation requires only specific information. If the coder pursues the statistical goal, the Health Insurances that are in charge of covering the health costs generated by the patients would consider the reimbursement to be inflated by irrelevant information. If, however, the coder pursues the economical goal, a lot of health data will be lost, with subsequent problems for statistical and epidemiological analyses. Consider the following excerpts:

Interviewer: *"So ... the coding process seems to have both statistical and economical goals ... is that correct?"*

Answer: *"Yes ... I mean ... it is oriented to these two goals. But, I should say that in some cases that are fairly frequent there are some contradictions in the two goals. If you just do it [the coding] for statistical goals the more you code the better is. If you do it for the reimbursement there are some rules that force you to exclude the coding of some infor-*

mation. Otherwise, the reimbursement will be inflated compared to the real costs for the hospital." (Anna)

From a communication perspective, the main problem for the whole coding practice elicited by the ethnographic study is the re-use of a pre-existing channel and message structure for communication to coders. Coding Office's input documents, in fact, take the form of a letter (called *discharge letter* – DL) originally created and still used to inform General Practitioners with all significant information related to a specific patient's hospitalization, her previous anamnesis and her overall clinical situation. This is inadequate to the goal of coding only some particular diagnosis and treatments that occurred in the hospital, because it includes too much information which is not relevant and coders are forced to spend a lot of time in locating useful information and interpreting unclear, mixed and unstructured elements. As long as a communicative perspective is concerned, we can conceptualize this issue as a problem of correspondence between the message and its receivers that do not share the same needs. In this particular case, the message is more suited to the goals of the General Practitioners rather than the coders'. This means that a consolidated and pre-existing communicative practice has been resumed together with the attribution of new targets, without taking into account any necessary modification.

5. Discussion: From Ethnographic Results to Technological Choices

The aim of the ethnographic analysis we have conducted was to evaluate the different problems that can be addressed by a technological intervention. Moving from our analysis we assume that the inadequacy of the actual MR to communicate with the coders is the most problematic issue from a communication perspective. The other criticalities are indeed more centered on managerial and organizational issues. We believe that better results can be achieved providing the coders with a more adequate MR. A focused intervention with automatic or semiautomatic tools can be the most effective in supporting the everyday practice of the coders. Therefore, we identified two different directions to face this main problem:

(a) Maintain and refine a single channel and message structure for the MRs to inform both the GPs and the coders, taking into account the

goals of the two different receivers. This solution may be implemented through the definition of a standard for the MRs.

(b) Create two different messages delivered by two different channels respectively to the GPs and to the coders. This solution, in its turn, might be brought on by an automatic filtering of the message included in the MRs or by the introduction of a new device to transmit the message to the coders.

It is evident, both form literature and recent international health policies (Lobach 2007), that the future of health technology is oriented towards the solution (a), exploiting the potential of the Electronic Health Records.

This solution implies restructuring the medical record so that it can be used both as an input for the coding process and as a channel to communicate with the GPs. This alternative can be seen as an application of the Electronic Health Records (EHRs), generally defined by (Dick & Steen 1991) as "an electronic patient record that resides in a system specifically designed to support users by providing accessibility to complete and accurate data, alerts, reminders, clinical decision support systems, links to medical knowledge and other aids."

So far, within the EOC, the EHRs are updated by physicians or their support staff. Even though they are not widespread through every medical service and institution, EHRs are an instrument which is already integrated within the activity of the hospitals and, therefore, widely accepted. Every EHR, in particular, includes some *folders* associated with each hospitalization of the patient. There are many potential benefits that can be identified:

(a) By structuring the information inside the folders in accordance to the need of the coders, many advantages could be achieved:

i. The doctors/staff will not have to do any extra activity: the only change would affect the data entry form, which will be thought to facilitate a coding-oriented entry.

ii. The coders will not have to use the medical records anymore. They will be able to access the data anywhere and at anytime, exploiting the distributed nature of the overall system.

iii. The health services and institution will be encouraged in adopting the new EHRs technology for its close relation to a tricky activity as the coding process.

iv. The coders will be supported in finding and extracting the relevant information for their practice, with a consequent increase of the productivity (in terms of coded information per time-unit).

(b) A well structured EHRs' architecture can permit the implementation of a piece of software able to filter the information included in the EHRs and to create a summary with all and only the information that are useful for the coders.

Starting from Canada and US there is a growing interest in exploring the new possibilities offered by the EHRs. It seems therefore essential to take into account how much the coding process may benefit from this new technology once it will be integrated in the everyday practice of the coders. The EHRs may offer, in fact, a solution to one of the major problems of this activity: the lack of formal standards for medical records. There are several solutions that may support the working practice of the coders without being too much overwhelming but rather maximizing the potential of the EHRs. One feasible and promising direction is, for example, the redesign of the structure of the EHRs so that it can be helpful for the coding activity, underlying the relevant information to enhance a semantic division of the contents of the medical records. Also, the electronic standards of the medical records would be accessible in a distributed network and they would be the basis for an automatic extraction of the contents that must be translated into codes. As a matter of fact, the study of these potentialities is ongoing in the US, in Canada and in the EU as well. Several studies have been undertaken to comprehend the best strategies of using EHRs, which are seen as a useful device to increase the quality of public health services as well as of chronic-diseases management and clinical treatments. Bates et al. (2001) demonstrated that the investments in the introduction of modern technologies in the medical practice lead to a relevant decrease of diagnostic and therapeutic errors. Furthermore, considering the relevance of the coding process for statistical and economic purposes, it is clear that the optimization of its efficacy and effectiveness through modern technologies is becoming a priority for hospital management.

For all these reasons, we believe that the future direction of this study must move towards an analysis of the EHRs as a starting point for the development of supportive technologies for the coding process. Such

research deals with the application of innovative models but also with feasible solutions in terms of time and costs. In fact, the EHRs constitute a good starting point because they are already consolidated form a technological point of view. On the current research agenda in the fields of health communication and health informatics there is not just the topic concerning the introduction of the EHRs, but also (a) their design and integration within the communities of practice and (b) their evaluation in terms of maximizing the benefits for the health services and, eventually, for the patients. The study of the coding process and its specific context is therefore essential to reach these goals. It faces a lot of problematic issues such as the user-oriented design, the privacy policies, the Unique Patient Identifiers, the interoperability of different systems and, eventually, the local introduction of international standards for dictionaries and terminologies, such as the ICD-10 or SNOMED-CT. Considering all these factors, we can conclude that in Ticino the possibility of replacing the traditional medical records with the EHRs is a high priority challenge of great effectiveness.

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