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Work System Characteristics Impacting the Performance and Quality of the Discharge Letter Process

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Abstract. Studies on the impact of a Health Information Technology seldom consider socio-technical characteristics of the work system in which the technology is implemented. Yet those dimensions may act as hidden variables that could explain the inconsistency of impact studies' results in terms of performance, quality and satisfaction. This paper reports on the identification of those variables in the discharge letter (DL) process. Human Factors experts performed an analysis of the work system of the DL process in 17 medical units. The DL process is composed of three sub-processes running with work system differing according to the distribution of tasks, the technology implemented and the work organization. Hidden variables identified are: verification by the physician, technology's integration, number of editing cycles, physicians' preferences etc. Those variables can be collected automatically or by questionnaire. Statistical analyses will have to be performed to know which variable explain impact indicators.

Keywords. Human engineering, discharge letter, evaluation studies

Introduction

Introducing a Health Information Technology (HIT) in a work system affects healthcare organization, healthcare delivery and outcome. An increasing number of studies are published that evaluate the impact of HIT in terms of satisfaction, performance and healthcare quality. In those impact studies, the socio-technical system in which the technology is implemented is seldom analyzed or described. Yet, some socio-technical dimensions may act as hidden explanatory variables that could explain, at least partly, the (absence of) results of those studies [1]. This paper reports on a national study that aims to develop a methodology for identifying the work system characteristics that may impact indicators of performance and quality of a health

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system. The final goal of this project is to apply this approach to all French hospitals to improve the evaluation of the impact of the HIT on the performance and quality of the healthcare system. A part of this project focuses on the Discharge Letter (DL) process, a key element in the care continuity and patient discharge process. This paper reports on the development of this approach, i.e. identifying the work system characteristics that may impact performance and quality indicators of the DL process.

1. Background

Numerous studies have been published on the impact of introducing a technology to support the DL process. Particularly, they compare "automatically generated" DL to other types of technology (e.g. electronic/analogical dictation) [2]. Those studies focus on four types of impact indicators: the satisfaction of the users [3], the performance of the process: delivery time to the recipient [4,5], process quality: errors in identifying patients/physicians, missing letters, the quality of the letter's content [5,6]: its completeness [6-8], presence of errors in the within the letter [7,8].

In these studies, the lack of description of the socio-technical context in which the technology is implemented prevents (i) identifying precisely the type of technology (process completely or partially performed electronically) and the way it is actually used and (ii) explaining the inconsistency of the results. Therefore, it is essential not to settle for the results in terms of impact but to look at them considering the socio-technical context in which the system being implemented. As far as we know, no study has been published that identifies these hidden explanatory variables. The paper at hand aims to identify the hidden variables that may explain the impact of technology on the DL process. More specifically, it focuses on the distribution of tasks and control during this process and on the impact it may have on satisfaction, performance and quality.

2. Methods

Data collection and analysis were performed by two Human Factors experts in Lille University Hospital (2965 bed). Data collection was performed before, during and after the implementation of the new HIS; the roll-out of the new HIS spread progressively from 2009 to 2014 in the medical units. During this period HF experts evaluated the feasibility of replacing the former HIS with a new one from a HF perspective, focusing on the DL process. They also supported the implementation of the HIS and of related tools supporting the DL process. Numerous medical units with a great variety of work system were investigated (cf. Table 1) in order to ensure results are suitable to the largest possible number of medical units. Data were collected through several methods:

- Observations supported by field notes and screen captures of professionals' interactions with the HIS: they focused on identifying the professionals involved in the creation and transmission of patient DL, their tasks, their work habits, the tools and media they use along with their work organization.
- Semi-oriented interviews: they focused on contextual factors that could influence the DL process and allowed refining data collected.
- Finally, a questionnaire was developed in order to assess the extendability of the results to other medical units.

Interviews and notes were transcribed. The workflow and the role of each professional involved in the DL process were modeled through the Analytic Method of Description (MAD) and the Business Process Model (BPM) formalisms. Finally, based on those results, HF experts identified key socio-technical dimensions that could impact the satisfaction, the performance and the quality of the DL process and content and they drawn hypothesis concerning this potential impact. This identification and the hypotheses drawn were cross-checked by 3 other HF experts.

3. Results

A total of 89 physicians and 86 medical secretaries from 11 medical units participated in the study representing a total 149h of observations/interviews. Questionnaires were filled in by 8 physicians and 12 medical secretaries from 6 medical units (cf. Table 1).

Table 1. Methods applied, number and profile of the participants and medical units investigated

Methods	Number and profile of participants	Medical units
Observations and Interviews	89 physicians 86 medical secretaries	Resuscitation, endocrinology, neurosurgery, cardiology, geriatrics, emergency department, internal medicine, psychiatrics, neurology, pediatrics, traumatology
Questionnaires	8 physicians 12 medical secretaries	Resuscitation, gynecology, urology, nephrology, obesity, oncology

3.1. Characterization of the Discharge Letter Process

The analysis identifies three main steps in the process which may be considered as sub-processes, each of them issuing an outcome, as described in Table 2. Each sub-process runs with different work system. These work systems differ according to:

- The distribution of tasks between the roles and actors and the technical system
- The technical system implemented and its' usage; the technical system includes the functions of the HIS supporting the DL process and the technical devices supporting the dictation task
- The organization of the entire process, which depends heavily on personal preferences of (senior) physicians in a given medical department.

Table 2. The three sub-processes constituting the DL process, characterized in terms of tasks and outcomes.

Sub-processes	Tasks	Outcomes
Sub-process 1: Draft the letter	Collect data / information	Draft letter - electronic document
	Phrase and dictate draft letter	
	Type dictated letter	
Sub-process 2: Validate the letter	Verification/ Correction	Validated / signed letter
	Validation and signature	Electronic doc / printed
Sub-process 3: Send the letter	Send signed letter	Sent and Archived letter
	Archive validated letter	

The three sub-systems are more or less independent from each other, meaning that all combinations of the various work system are possible across the three sub-systems. The following section describes more precisely these work systems per sub-process.

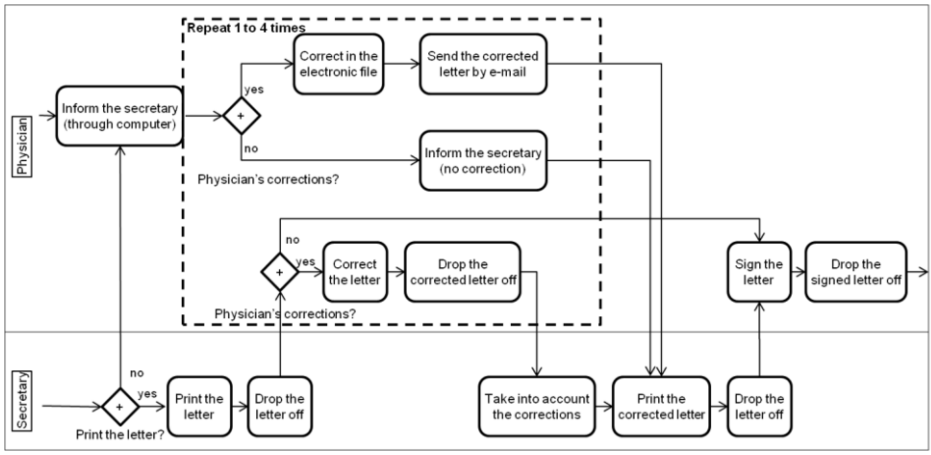

Figure 1. Schematic representation (BPM) of the verification/correction/signing of the letter.

3.2. Description of Sub-process 1 - Draft the Letter

The most usual distribution of tasks across roles and actors observed in this first sub-process remains rather traditional with (1) the physician collecting and selecting relevant information, then (2) phrasing and dictating the letter, before (3) handing the draft letter over to the medical secretary for (4) typing. Several types of devices are used to record the dictated letter (from analog to digital recording devices). Of note, magnetic tapes must be handed by physicians to secretaries. Digital voice recorders present several factors that impact the work system and their integration in the HIS:

- Digital sound files may be transmitted to the secretaries electronically
- Patient ID (and authoring physician identification) may or may not be systematically and properly attached to the file name and draft letter content
- Digital recording may be combined with voice recognition software. This eliminates typing. However, the quality of the document received by the secretary depends on the physician's work habits: some documents are not looked at before being sent to the secretary, while others thoroughly check the document before handing it to secretary.

Finally, HISs may provide functions that completely automate the process and issuing e-DL. In this case, the main role is devoted to the computer which, depending on parameterization, collects, selects and formats the medical data/information and generates the DL. This eliminates secretaries' typing task. At the end of the sub-process, whatever the work system, the outcome is a draft letter in the form of an e-document.

3.3. Description of Sub-process 2 - Validate the Letter

Most frequently, and especially in those situations where the secretary is in charge of typing a dictated letter, a verification-correction-validation process takes place where:

- The secretary transfers the typed letter to the authoring physician
- The authoring physician reviews the letter; notes needed corrections, and hands it back to the secretary for modification
- The secretary corrects the letter and hands it back to the validating physician

- The physician validates the final version of the letter and signs it.

The organization of this second sub-process varies widely across medical units and even within units, depending again on physicians' preferences:

- Some physicians review a paper copy of the letter while others review an electronically formatted document, eliminating the secretary's task of typing
- In some units, interns draft a first version which is then corrected by one or two senior. There may be up to 4 reviewing/signing physicians for a letter.

Table 3. Examples of variables in each sub-system that are likely to impact performance/quality indicators of the DL process. Striped cells point at relevant combinations "Variables X Indicators".

Discharge letter sub-processes	Variables	Indicators		
		Time from discharge day to recipient	Quality of the process	Quality of the letter Satisfaction
Sub-process 1	Technical system			
	Automated generation	■		■
	Voice recognition	■		
	Integration of dictation functions in HIS		■	
Sub-process 2	Local organization			
	Number of reviewing / editing cycles	■		■
	Physician's preference (review and edit paper/electronic doc)	■	■	
Sub-process 3	Technical system			
	Secure e-sending or snail-mail (paper)	■	■	

When functions for automated e-DL are available in the HIS, we observe that their usage depends again heavily on physicians' preferences: some physicians (mostly seniors) insist on checking and eventually correcting the computer selection and structure of information while others (mostly juniors or for simple and radical cases such as deceased patients) would simply trust the system and not even look at the letter automatically generated. In this case, sub-process 2 is skipped.

3.4. Description of Sub-process 3 - Send/Archive Letter

The third sub-process simply consists in sending the signed letter to all intended recipients and at the same time archiving an electronic version of the validated letter in the HIS and a paper copy in the medical record, as paper-based medical records are still a national regulatory obligation. The secretary is ordinarily in charge of this sub-process. The main feature of the technical system impacting this sub-process is the availability (or not) of a secure electronic information exchange system linking the hospital with outside healthcare professionals to allow sending the letter in electronic format. When such a secure system does not exist, paper letters are sent by snail-mail, and/or handed to the patient on the day of discharge (if the letter is ready).

3.5. Identification of Key Variables Potentially Impacting Performance or Quality

A number of variables of the work system described above are likely to impact performance or quality indicators of the DL process. It is not possible here to present the entire list of suspected variables and their hypothesized relation with indicators, but Table 3 provides a few examples of such variables and of the indicators on which they might have an impact.

4. Discussion/Conclusion

There are some limitations to the present study, essentially in terms of generalization, as observations and analyses were performed in only one academic hospital. Therefore, complementary observations and interviews have been carried out in two smaller hospitals (650 bed CH Denain and 578 bed CH Roubaix). Additionally, three other academic hospitals participating in the national evaluation project compared the data collected in Lille University Hospital with their own DL process and technical systems. The analysis of these additional data did not identify new types of work system or new key explanatory variables. Nevertheless, it is still necessary to extend the observations to private hospitals that may operate differently than public hospitals.

The overall goal of the national project is to design a methodology to evaluate the impact of the technical system (including HIT) and of the work system it is embedded in, on the performance and quality of the DL process and content. The next phase of the research consists in designing a method to collect data on the key variables identified in the present study which are likely to impact performance and quality indicators of the DL. Some data may be collected semi-automatically but most of them require qualitative investigation. These data will be collected through a questionnaire.

We expect interesting results regarding co-variations between work systems characteristics and DL indicators. That will allow us to measure realistically the impact of the IS used for the DL process. International collaborations will be required to cross-check these results with the many international studies that have been carried out on the subject. Such collaborations with more advanced countries regarding automation of the DL process (e.g. Australia and Denmark) are under exploration.

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