STRUCTURING THE RADIOLOGICAL REPORT

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Abstract: Currently, although all advances in computing, information storage and processing facilities, most radiology reports are still stored in free text. This methodology hinders systemic searches and clinical research for future assistance in the early diagnosis of pathologies. This context points that information obtained through radiological examinations should be stored in a structured way so that they can be retrieved and searched with easy and agility, possibility clinical and scientific research. And enabling a better compression of the report and reducing the margin of mistakes, because the entire report will be transposed in structured fields and all the data will be arranged in a standardized visual form, helping a more accurate and reliable diagnosis.

Keywords: Structured Radiological Report, Diagnosis, Standardization, Radiology.

I. INTRODUCTION

After performing a radiological examination, the medical write the report usually describing the relevant information about the generated image. Several times, the result of this exam is transmitted through report by a doctor who executes it for the requesting doctor [1]. The radiological report contains a lot of information that characterizes the medical condition of the patient and great percentage of this information is in an unstructured form, usually called free text, a methodology that hinders and makes impossible the computational processes of search, analysis and research [2,3]. In Figure 1 a simple model of free-text report composition can be observed, using a direct descriptive method adopted for its preparation. It usually does not provide all the data and information necessary for a concise and reliable diagnosis [1,2,4,5].

Currently, a great advance of the technology can observed through massive use of information technology in health area, making possible to store and process a large amounts of data in a short time with the use of computational tools, turning simple the extraction and solution of complex problems [3].

These advances, in information technology, allow data and radiological information to be store. So that it can be retrieved and studied, helping disease prevention and medical diagnosis, the proposal for structuring the information contained in the report [2,3,6].

This structuring takes place through a pre-defined, standardized and restricted set of terminologies that is used to visualize the report. Always using the same format, helping visualize of information [4,5], through the use of a system structuring of the radiological data of each type of examination.

Figure 1 shows radiological free text report, without ontologic structure. This report illustrates discursive format, used by radiology professionals to describe the highlights of radiological examinations. The personal patient information’s are hidden and only clinical information are show for ethical reasons.

II. MATERIAL AND METHODS

Transforming non-structuring data into computable (structured) information is not a trivial task, according to Barbosa [2]. The solution widely indicated for these questions is the elicitation of the domain’s knowledge through an updated bibliographic survey on the specific radiological examination [7], the interpretation of reports written by specialists in radiology, the applying of norms and legislation for specific area and then moving collected data to an ontological computational structure [2,5].

In the Structured Radiological Report, each information has its unit of measurement and its standardized format, according lexicon information [4,6], facilitating the learning and understanding of terminologies, because it is restricted and standardized [1,2,4,5,6], like in Figure 2. In addition, health area professionals can obtain the information they need, always in the same visual space, since the format of the report keep standardized, and data and information can be retrieved when necessary [2,5,6].

Each radiological examination (Mammography, Magnetic Resonance, Ultrasonography, etc.) has its specificities and needs a specific study and surveys so that data can be structured in an efficient, coherent and
aligned way with daily trends.

Figure 2: Structured data and report information [6].

After preliminary studies made in 2016 at the Laboratory of Health Informatics (LHI) at Gama, University of Brasilia (UnB), in partnership with the Radiology Clinic Janice Lamas, the methodology was proposed for structuring the radiology report of the Breast Ultrasonography, based on studies already performed on the subject [2,5,8]. However, these studies can be extended to other radiological exams.

The first step consists in acquiring the expert's knowledge from lexicons, manuals, norms, studies (articles, books, etc.), researches (theses, dissertations, etc.) and current legislation (laws, resolutions, ordinances, memos, etc.) [4,7]. This documentation is relevant and will guide the structuring of radiological data. Interviews, consultations and questionnaires will be carried out to radiology specialists, in particular to professionals with better examination skills, to specific structure the data in order to abstract their expertise [2,5]. It will be possible to make a sampling analysis of unstructured reports (free text reports) preferably from different institutions to understand the common composition of radiology reports [8].

In the second step, already consolidated an acquisition of specific radiological examination knowledge, expert knowledge will be represented through the ontology [2,5]. The ontology will allow electronic representation of the information and the explicating of the conceptualization of the radiological report, possibilizing the creation of the knowledge base of the specialist turned to computational structures. This will be done through ontological development stages like problem specification, acquisition of knowledge, conceptualization and domain formalization, integrated with other existing ontologies of radiological exams, implemented through an ontological tool and evaluated by specialists in the radiological exams, documentation for traceability, reuse and maintenance for future necessary changes [2,5,8].

In the third stage, using the representation knowledge, a Structured Reporting System will be developed for the specific chosen report [2,5]. It will follow the normal rite of development of a computational system as: requirements survey through formalized ontology, that will support the specification of system and database requirements, helping to elaborate the Structured Report System; Planning, where the systems and business requirements previously established help creating other stages, in order to guarantee higher quality with less cost and time; Implementation of the system, that will achieve the objective of the research, stage in which the structuring takes its intended from based on the planned execution; Tests, using dummy data the information will be tested to verify the effectiveness and stability of the system; Validation the system will be used for experts, who will evaluate if what was previously proposed; Maintenance/update will offer a support so that the system stays stable during its useful life and can be implanted new conceptions in accordance with the current norms of the current regulations. After completing these steps, we will have a computational structuring of a desired radiological report.

The final objective is a system that must comply with the ontology templates and requirements, in order to provide an interface for the collection and visualization of data and information of the radiological report, like as Figure 3.

It is important to observe that the final product would be a proposal for structuring a specific radiological examination, which could eventually, over time, be modified, updated and adapted to daily demands. The structuring is systemic and continuous process that require periodic revisions and updates.

III. RESULTS

With the structuring of the radiological report, it is intended to standardize and provide accurate information in the report, improving the provision and transmission of information obtained in the radiological examinations, storing them in a structured way, so that they are retrieved quickly and reliably, allowing clinical research and scientific studies to improve medical diagnostic through the application of computational decision support tools.
such as the use of artificial intelligence for the discovery of pathological patterns, as described in Figure 4.

Figure 4: Design of a Radiological Report.

These structures are created to allow complex queries to the database quickly and accurately, making it possible to find relationships or correlations in the information contained in the structures, to assist in the early diagnosis of pathologies such as cancer, for example.

Figure 5: Example of Structured Report [4].

Figure 5 shows a scope example of a Structured Report against unstructured report of Figure 1. Figure 5 show better clarity and visibility of the information contained in the examination, significantly efficiency and accuracy in the medical diagnosis.

IV. DISCUSSION

Several studies and researches are developed around the world about this subject. It is important to observe the relevance of the structuring of data obtained from radiological exams. Many benefits already pointed in several studies on the subject like: more complete reports [4], clarity in interpretation of the report [4], possibility of clinical studies and scientific research [3], improvement in the communication of the relevant findings in the exams [1,4,9], efficiency in information transitions [1,4] and many others.

Although the benefits and the importance of structuring radiological data, there is still great resistance on the part of radiology and medical professionals to adopt this methodology [1,5,7]. This resistance comes from a prejudice on the topic or from the limitation that the structured report brings about the way the radiologist makes the report, since the structured reports does not allow professionals write the reports in your own way [1,7].

A way to reduce this aversion in the adoption of structured reports in radiological examinations would be to apply this methodological trend in the training of students in the radiological and medical areas, in order to demonstrate the range of possibilities that the structuring could provide, helping the process decision of these futures professionals [4]. To reduce this barrier for many professionals that already are in the field, would be the lectures and demonstration of studies on the benefits that the structuring would bring about the conventional method [4,7].

In 2014, a survey made in Brazil [10] to compare the usability of the two methodologies for the elaboration of reports (structured and free text) and if there was an improvement in the use of structured reports. The results of this study showed great advantages in the use of structured reports in relation to the free text report, as can be observed in Figure 6.

Figure 6: Research of structured reports and free text [10].

V. COMPLIANCE WITH ETHICAL REQUIREMENTS

A. Conflict of Interest

The authors declare that they have no conflict of interest.

B. Ethical Requirements

Was used in this research, data collection tools like questionnaires, radiology experts consultations, reports of radiological examinations. Any information that can identify the patients was previously suppressed from reports. For legal reasons, is required submit preliminary the research or study to the Brazilian Comitê de Ética em pesquisa (CEP) / Comissão Nacional de Ética em Pesquisa (CONEP) for evaluation and protocol, in
accordance with Resolution 466/2012 of the Conselho Nacional de Saúde (CNS) [12], this in Brazil, since each country has its own legislation and regulations.

VI. CONCLUSION

The structuring of radiological data is a new essential trend to elaborating reports of the radiological exams, but has not yet been well accepted by the professionals of this area [6]. Several studies [1,3,4,8,10] already indicated many benefits and the importance of applying the structured methodology in the form of radiological reports. Research and studies in this subject have great relevance in the clinical and academic scope, in order to improve the medical diagnosis through the structuring of the radiological reports [8], reducing the problems unobserved by the radiologist and improving the practices of elaboration of the reports and in the diagnosis [6,10].

In this context, considering the large volume of data generated and the value they have in the treatment of patients and for future research, is important to store the information generated to faster, reliable, safe and easy retrieval [3,5]. This study proposes, through the use a computer system in accordance with current norms, to demonstrate a methodology for the structuring of radiological data, benefits and importance that such methodology would bring in patient care and in the diagnostic assistance to medical professionals.

VII. ACKNOWLEDGMENT

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VIII. REFERENCES

2. Barbosa F. Metodologia para estruturação de informações de laudos radiológicos. 468 f. Tese (Doutorado) - Faculdade de Medicina de Ribeirão Preto, USP, Ribeirão Preto, 2013.