

The Development and Evaluation of a New Coding System for Medical Records

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Abstract. *Purpose:* The present study aims to develop a simple, reliable and easy tool enabling clinicians to codify the major part of individualized medical details (patient history and findings of physical examination) quickly and easily in routine medical practice, by entering data to a purpose-built software application, using structure data elements and detailed medical illustrations.

Materials and Methods: We studied medical records of 9,320 patients and we extracted individualized medical details. We recorded the majority of symptoms and the majority of findings of physical examination into the system, which was named IMPACT[®] (Intelligent Medical Patient Record and Coding Tool). Subsequently the system was evaluated by clinicians, based on the examination of 1206 patients.

Results: The evaluation results showed that IMPACT[®] is an efficient tool, easy to use even under time-pressing conditions.

Conclusion: IMPACT[®] seems to be a promising tool for illustration-guided, structured data entry of medical narrative, in electronic patient records.

Keywords. IMPACT, structured data entry, electronic medical record.

Introduction

Clinicians are generally reluctant to deal with routine entry of clinical information in electronic medical records, as they prefer to focus their attention on the patient rather than on any non-medical device [1,7].

The model of structured data entry (i.e. data entry based on predefined medical concepts) was developed to bypass this problem [1,2]. However, systems based on this model have not yet been widely adopted, as they failed to become user-friendly enough to be used under the usual time pressure in clinical practice [3,4].

In 1998 J.Kirby and A.Rector announced the Pen&Pad data entry system with the following main features: Graphical point-and-click selection of clinical topics, automatic generation of data entry forms for each topic, user customization, generation of readable natural language expressions from the data entered and automatic production of codes for central reporting or remuneration [4].

The present paper describes the process of developing IMPACT[®] [5] (Intelligent Medical Patient Record and Coding Tool) and its evaluation in clinical practice. IMPACT[®] is a tool enabling medical doctors and other health professionals to record the majority of individualized medical details quickly and easily using structured data elements and assisted by detailed medical illustrations. Translated codes permit automatic generation of translated reports into various languages.

1. Materials and Methods

We studied medical records of 9,320 patients who had been treated in Hygeia hospital in Athens, from January 1995 to December 2003. We recorded and classified common symptoms reported in these records. We also recorded and classified all findings of physical examination, that can be derived using simple instruments such as stethoscope, ophthalmoscope, colposcope, otoscope.

Because normal findings in a physical examination are, sometimes, as important as the abnormal ones, we incorporated normal findings into 67 codes. For example, "On inspection of the abdomen there is no distention, presence of ectopic pulses, protrusion of intra-abdominal mass, presence of hernia or dilated superficial veins". Selection of this code meant that the doctor had undressed and carefully inspected the particular body area of the patient and had ruled out the presence of all the abnormalities mentioned above. On the contrary, lack of selection of this code meant that either the doctor had not inspected the related body area of the patient during the examination, hence any existing abnormality may have been missed, or he/she had inspected the area and had found an abnormality that had to be described by selecting another code.

We encoded anatomic regions of the surface and physical cavities of the human body. There are codes for large areas (e.g. head), codes for small areas (supra orbital area) and codes for details (e.g. manubrium of malleus). A number of illustrations permit the user to easily select any anatomical area. We added codes for procedures, concerning the presence of a foreign body (e.g. catheter, plaster, stoma).

For the description of a patient's medical history, we used codes that indicate the onset and termination of symptoms and also codes for types of symptom variations.

Translation of the codes into various languages, permit automatic multi-lingual translation for patients who lack proficiency in the language of the records.

Processing of the data created 1,480 codes. The system was named IMPACT[®] (Intelligent Medical Patient Record and Coding Tool). We translated all of them into two languages, English and Greek, with the scope of evaluating automatic translations of the derived text from one language to another. Finally we incorporated ICD-10 codes for the needs of case history recording.

Doctors of our hospital used IMPACT[®] in 1,206 randomly selected (last digit of the year of birth) patients. At the end of each examination the doctor completed an evaluation questionnaire, tailored for this study.

2. Results

Results are shown numerically and in percentages. Differences in the proportions were assessed using χ^2 Goodness of Fit Test. The significance level was set to 5%. All statistical analysis was performed using STATA 11.2 (Stata Corporation, College Station, TX).

In 65% of the cases doctors found that the use of IMPACT[®] was very easy or easy with the difference between Very easy/easy and Moderate/Hard/Very Hard being highly statistically significant (p value < 0.001).

In 85% of the cases, users needed less than 10 minutes to fill-in IMPACT[®] tables while in 39% they needed less than 5 minutes with the median needed time being 7.5 minutes.

In 66% of the cases, doctors managed to codify more than 60% of the information of medical history and, in the 80% of those cases, they managed to codify more than 60% of the clinical findings. In both cases the contrast between <60% and ≥60% was highly statistically significant (p-value < 0.001).

In 91.7% of the cases, doctors evaluated the text derived from the IMPACT® as good or very good, whereas in 93.6% of the cases they found the automatically translated text easy to comprehend (p-value for the comparison between Good/very good vs. very poor/poor/moderate <0.001 in both cases).

Table. User satisfaction from the application of IMPACT® (N=1206)

How easy was the use IMPACT® in this particular case?	Very easy 158 (13.1%)	Easy 634 (52.6%)	Moderate 258 (21.4%)	Hard 148 (12.3%)	Very hard 8 (0.7%)
How long did it take you to fill-in IMPACT® tables?	< 2 min 8 (0.7%)	2-5 min 468 (38.8%)	5-10 min 551 (45.7%)	10-15 min 88 (7.3%)	> 10 min 91 (7.5%)
What percentage of the entire information of medical case history did you manage to codify with IMPACT®?	< 20% 10 (0.8%)	20-40% 182 (15.1%)	40-60% 218 (18.1%)	60-80% 792 (65.7%)	80-100% 4 (0.3%)
Which percentage of the entire information of the physical examination did you manage to codify with IMPACT®?	< 20% 7 (0.6%)	20-40% 11 (0.9%)	40-60% 228 (18.9%)	60-80% 680 (56.4%)	80-100% 280 (23.2%)
How do you evaluate the quality of text derived from IMPACT® tool?	Very poor 3 (0.2%)	Poor 8 (0.7%)	Moderate 89 (7.4%)	Good 543 (45.0%)	Very good 563 (46.7%)
How do you evaluate the quality of automatically translated text?	Very poor 24 (2.0%)	Poor 118 (9.8%)	Moderate 431 (35.7%)	Good 408 (33.8%)	Very good 225 (18.7%)
How comprehensible was the automatic English translation of texts?	Very poor 0 (0%)	Poor 3 (0.2%)	Moderate 74 (6.1%)	Good 532 (44.1%)	Very good 597 (49.5%)

3. Discussion

Considering the inevitable complexity of the 24-page leaflets and the need of filling in tables by hand, the degree of user-friendliness is expected to considerably increase, when the tool is available to be used through a software application in a touch-screen mode.

Advantages of IMPACT® are: 1) It facilitates the formation of very detailed reports in routine clinical practice, even when time-pressing conditions do not permit such detailed writing by hand, typing, or dictating. 2) The entire information recorded is coded. This facilitates research and enables communication of databases with expert-system applications, aiming at assisting diagnosis, supporting decision-making and contributing to reduction of preventable medical errors [6]. 3) Automatic translation of all texts greatly facilitates international distribution of medical information among

authorized health professionals. It also permits real-time medical supervision of trainees, regardless of location of trainers and language barriers. 4) As IMPACT[®] can act as a guide in the process of recording a case history and, particularly, in the process of describing physical examination findings, it may be a useful tool in teaching institutions.

Limitations of IMPACT[®] are: 1) It is currently limited to General Practice and Internal Medicine. Further work needs to be done in order to expand its use to other specialties. 2) Considering the complexity of both, medical history and physical examination it may not be possible to achieve 100% codification of individualized medical details and therefore we believe that there will always be room for plain text. 3) Although automatic translation is comprehensible, it will always have inevitable syntax errors.

The development of such an efficient and user-friendly touch-screen software application, which would be broadly accepted by doctors, as it would save time and effort in routine clinical practice, is undoubtedly a great challenge.

4. Conclusion

This study showed that IMPACT[®] is an easy and quick tool for recording medical case history and findings of a physical examination. Further improvements and re-evaluation in larger scale studies are required, before the implementation of IMPACT[®] in routine clinical practice.

5. References

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