A Diagnostic Component for the EPD-Car Project

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Abstract

This paper describes a diagnostic module which is a part of the EPD-CAR (Electronic Patient Dossier for Cardiology) project of the Interuniversity Cordiology Institute of the Netherlands. It consists of 13 coding trees, each containing between 3 and 20 subitems. The scheme evolved from daily practice where standard coding schemes proved insufficient. It consists of one main diagnosis and up to 10 optional sub diagnoses. Back-end integration is achieved through conversion tables to ICD-9 and ICD-10. The current system is in use now for over 1.5 years and contains diagnoses of over 11000 patients. The system is written in Visual Foxpro 6.0 and is an ActiveX-component.

1. Introduction

The ICIN (Interuniversity Cardiology Institute of the Netherlands) forms one of the scientific institutes of the Royal Netherlands Academy of Arts and Sciences. It promotes and coordinates research in cardiology between the Departments of Cardiology of the eight University Hospitals in the Netherlands. Within the ICIN organization the CADANS working group is active in the area between cardiology and information and communication technology, focussing primarily on the implementation of communication standards resulting in facilitation of the exchange of new ideas and solutions.

EPD-CAR (Electronic Patient File for Cardiology) is an ICIN project in which the Departments of Cardiology work together through CADANS in defining and subsequently constructing a modular electronic patient file for cardiology patients, integrating alpha-numerical data, images and signals [1]. As each department has its own (software) infrastructure, a modular approach is chosen in which standardization of data communication has been emphasized. This way one is able to facilitate the incorporation at a certain point in time of the best-suited components without losing already stored information. Some components fulfilling these requirements were already available, like ECG-acquisition and -presentation [2] and medication [3], while others had to be developed or adjusted. One of the latter modules is a diagnostic system suitable for outpatient clinics as well as for wards. The concept of the diagnostic module used in the department of cardiology at the University hospital in Groningen was adopted to serve as the basis of a diagnostic module to be used in EPD-CAR.

2. The diagnostic module

Since 1990 a diagnostic module [4] is operating as subsystem of the departmental information system of the department of cardiology at the University Hospital in Groningen. It contains the diagnoses (from the clinic as well as from the outpatient clinic) of over 25000 patients who paid more than 145000 visits to the department. It consists of 10 coding trees, each containing between 3 and 20 subitems. Furthermore the wish existed to also code interventions and complications using the same mechanism (figures 1 and 2). The scheme has evolved from daily practice where the standard coding schemes like ICD-9 proved on one hand to be too broad while on the other hand they were not enough specific for the cardiology patient population.

The original module allowed for alphanumeric dataentry by means of a terminal. It did not allow for distinction between main- and subdiagnoses. The process was relatively cumbersome resulting in reluctance by the cardiologists to use it in an on-line dataentry fashion. Therefor especially trained administrative clerks had to extract relevant diagnostic information from dictated patient letters, which was subsequently entered into the database. Because Dutch legislature requires labeling

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each patient visit with an ICD-9 code to be used in a nationwide registry for policy purposes, the administrative clerc performed numerous translations, potentially resulting in deviations from the original incentive of the cardiologist. In order to enhance the quality of the data on one hand and the efficiency of the process by eliminating the work done by the administrative clerk on the other, a windows based module was developed in 1999.

1. Coronary Artery disease
2. Heart failure / Cardiomyopathy
3. Arrhythmia's / Conduction defects
4. Valvular heart disease
5. Congenital heart disease
6. Myocardiomyopathy / Cardiomyopathy
7. Pathology of the large veins
8. Carditis
9. Tumors

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10. Interventions
11. Complications
12. Other relevant diagnoses / interventions
13. Miscellaneous

Figure 1. Main diagnostic classes

The module is developed in Visual Foxpro (currently version 6.0) [2]. It is an ActiveX-component with an ODBC-DB connection (SQL-server database).
It allows for one main diagnosis and up to 10 optional sub diagnoses. Because of the relative small amount of codes, the system is used either by direct entering the data by the cardiologist or by indirect input performed by a technician from a paper copy. The paper copy is only used in the outpatient clinic where the coding scheme is printed on the back of the envelope containing all instructions for subsequent procedures required producing the definite diagnoses. As the final diagnosis is based on the data produced by these procedures, coding can best be performed at the moment all data is available: at the completion of all necessary procedures.
The direct data entry mode is preferred not only because of efficiency reasons, but also because of improved consistency of the data, where the cardiologist is automatically confronted with historical information (figure 3).
Back-end integration is achieved through conversion tables between this data dictionary and ICD-9 and ICD-10 coding schemes.

3. Results

The current system is in use now for over two years and contains the diagnoses of over 14000 patients with over 28000 visits of which 22000 visits were paid to the outpatient clinic. Tables 1 and 2 show some aggregated information.

Arrhythmia's / Conduction defects

301. Atrial fibrillation
    302. Chronicaly accepted AF
    303. Paroxysmal AF
    304. Permanent AF
    305. Persistent AF
    306. Atrial flutter
307. Atypical flutter
308. Atrial tachycardia
309. AVN tachycardia
310. WPW / concealed bypass fract.
311. Ventricular Extra Systoles
312. VT (non-sustained)
313. VT (sustained)
314. VF
315. Mobitz II Block
316. AV Block (total)
317. SSS
318. LBBB / RBBB
319. SD survivor
320. ARVD
321. Long QT syndrome
322. Brugada syndrome
323. Syncopy e.c.i.
324. other

Figure 2. subclasses arrhythmia's / conduction defects

Besides the medical information the system has proved to be an important management tool as well.

- An optimal impression can be generated about the patient population. The availability of diagnostic and therapeutic resources can be fine-tuned on a regular basis with the potential, diagnosis related, demands.
- As different cardiologists specialise in different diagnostic and therapeutic fields, optimal coverage of cardiologic attention can be strived at.
- The transition from paper to direct data entry develops steadily as relevant information concerning

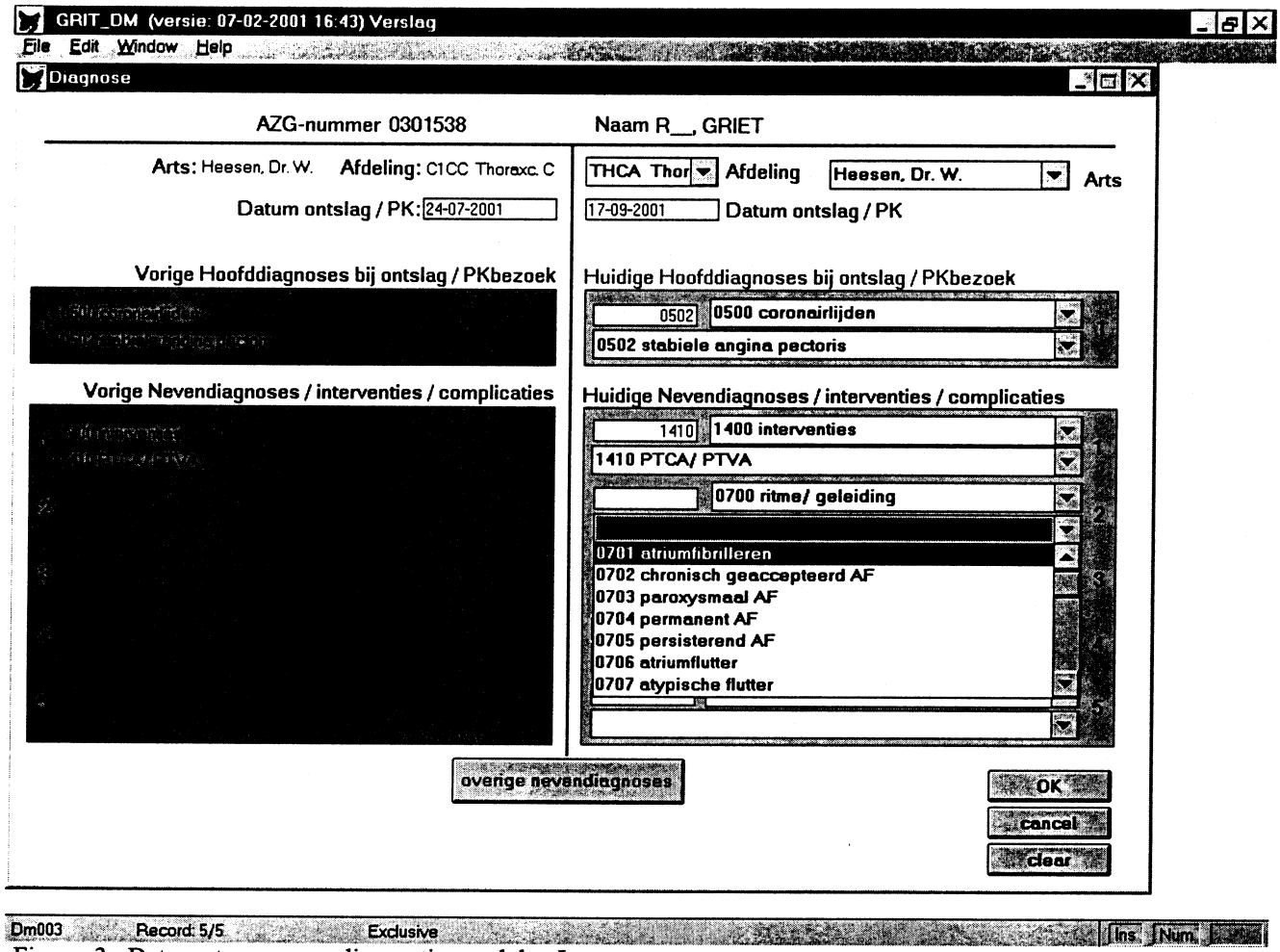

Figure 3. Data entry screen diagnostic module. In dutch; The left panel displays Main (Hoofd) and Sub (Neven) diagnoses of the former visit. The right panel allows for modifying and / or adding data. When a new visit is to be entered, default the data of the last visit is copied.

the patient (like images) can easily be acquired using the electronic patient file.

# patients	11272
# main diagnosis	26670
# 1 sub diagnosis	5838
# 2 sub diagnoses	1206
# 3 sub diagnoses	246
# 4 sub diagnoses	56
# 5 sub diagnoses	7
# 6 sub diagnoses	2

Table 1. Diagnoses stored on 11727 patients from January 1, 2000 till July 1 2001, with the average 2.5 visits per patient. In the vast majority of the visits (> 20000), only a main diagnosis was given.

Diagnostic class	# patients	# visits
1	5100	9706
2	1171	2621
3	2566	5568
4	1016	1609
5	584	931
6	154	231
7	94	131
8	54	75
9	6	6

Table 2. Patients and visits subdivided in the 9 diagnostic classes (see figure 1) for the main diagnosis for the period of 1.5 year starting from January 1 2000. Note the differences in the visit frequency for the different diagnostic classes.

4. Conclusions

After a successful local production period, the module is now incorporated in the EPD-CAR prototype to be used in another participating clinic designated as test site for EPD-CAR. Because of the standard communication tools used, implementation didn't cause any technical problems. As each cardiology department uses its own nomenclature to label the patients; the code-files are designed as simple alphanumeric strings, allowing easy manipulation. Within the project the participants agreed on ICD-10 (including agreed additions) as the common denominator, enabling multicenter comparison of the stored diagnoses.

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