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Inconsistencies Between Antiparkinsonian Drugs and ICD-10 Codes in Inpatients: A TOLBIAC Project Case Study

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Abstract. In France, data derived from hospital information systems are adequate to feed the prospective payment system. The consistency between drugs prescribed to patients and their indications could solve difficulties related to the identification of ICD-10 undercoded chronic diseases as the Parkinson Disease. Our goal was to highlight patients' stays mentioning administration of antiparkinsonian drugs and not coded for Parkinson's disease. Our approach was to parameterize tables of associations between ICD-10 codes and drug identifiers in the Web100T® application that collects medical information in our hospital and displays related inconsistencies for patients' stays. Based on acute care patients' stays of the second semester of 2015, we identified 246 patients corresponding to 253 stays, for which 33% of stays were not coded with the ICD-10 G20 code of the Parkinson's disease. The precision of our approach was 29%. Based on these data we predict roughly 84 patient stays without mention of Parkinson Disease. We plan to extend this study to other drugs and other kinds of data available in the health information system, such as biology or medical devices in order to improve the coding of chronic diseases in our hospital.

Keywords: Parkinson Disease, antiparkinsonian drugs, Electronic Health Records, Clinical Coding.

1. Introduction

In several countries, public and private hospitals funding is based on prospective payment system: In France, since 2004, the T2A (*Tarification à l'activité*) is applied to acute care, based on a uniform electronic dataset implemented within a hospital information system, the PMSI [1] (*Programme de médicalisation des systèmes d'information*). According to the national rules, each acute care inpatient or outpatient is described by a Standardized Discharge Summary (SDS) collecting 1) diseases, coded

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using the International Classification of Diseases (ICD-10), and 2) medical procedures coded using a French classification, the "*Classification Commune des Actes Médicaux*"(CCAM). A patient classification system (French Diagnoses Related Groups) is applied on the SDS to determine the revenue relating to the stay.

Many hospitals have an Electronic Health Records (EHR) and clinical data (drugs, biology, and medical imagery) available in the clinical applications of the Hospital Information Systems (HIS). In France, medical information is usually coded by physicians. However, some relevant information may not be encoded in the PMSI resulting in an incomplete stay's account, with a consequent impact on T2A revenues. The TOLBIAC project (Terminologies and Ontologies for Linking Billing Information and Accurate Clinical data) aims to measure the consistency between clinical data available in the EHR and codes entered in the PMSI. Consistency between drugs prescribed and patients' conditions corresponding to their indications could solve difficulties related to the identification of ICD-10 undercoded chronic diseases.

Parkinson's Diseases (PD) is the second most common neurodegenerative disorder, and appears more frequently in older adults over 60 years. Nowadays, no drug can stop its progression, but some drugs are available to treat the associated symptoms. There are three major classes of drugs [2]: "drugs aimed to filling the deficit in dopamine in the brain" such as Levodopa; "drugs for inhibiting the breakdown of dopamine or to correct their side effects" for example COMT inhibitors, and finally "drugs which don't act through dopamine" whose "anticholinergic drugs" should be distinguished from other products. Indeed, anticholinergic drugs can also be used to treat neuroleptics' side effects, where manifestations are similar to Parkinson's disease, but the effects are reversible.

Our goal was to improve coding by highlighting patients' stays mentioning administration of antiparkinsonian drugs and not coded for Parkinson's disease.

2. Method and materials

Hospital datasets from July 1st, 2015 till December 31st, 2015 were extracted from the PMSI database of the University Hospital of Saint-Etienne. The application in charge of the PMSI (Web100T®) allows the collection of diagnoses (ICD-10) and procedures (CCAM) and includes quality controls generating marks attached to patient stays to suggest potential coding improvements. For the TOLBIAC project, an interface was implemented to retrieve information on drugs administration from the computerized medication administration record of the EHR (Cristal-Net®) and to supply this information to the Web100T® application.

Antiparkinsonian drugs available in the drug formulary of the University hospital of Saint Etienne were selected and validated by a pharmacist. We extracted thereafter the list of corresponding CUD (*Common Unit of Dispensation*) codes. Subsequently, we parameterized tables of association between ICD-10 codes and CUD codes of drugs in the Web100T® application. The method involves the extraction of all stays in connection with the antiparkinsonian drugs, as identified by the mark "missing diagnosis in the presence of a CUD trace. The selected data included the UPI (*Unique Patient Identifier*) as well as the analysis date of CUD activity in Web100T®. In order to measure the efficiency of the automated identification of missing codes, we performed a second analysis considering the whole stays in our database. Besides, the stays during the same period including a G20 ICD-10 Code (for Parkinson's disease)

were extracted. We have focused on primary PD coded as G20 in order to make this work more specific of acute care, and not Parkinsonian syndromes induced by drugs (G21), especially neuroleptics that was observed mainly in psychiatric patients, or the rare Parkinsonian syndromes secondary to other diseases (G22) such as Syphilitic Parkinsonism. We did not take into account off-label indications of antiparkinsonian drugs: These drugs may be prescribed for a broad range of rare neurologic diseases coded as G23 (e.g. Richardson Olszewski syndrome). Finally, we crossed dates and UPI from CUD file with SDS files using SAS V9.2 software (SAS Inc., Cary, NC, USA). It allowed us to establish the following three assumptions (Figure 1).

i. All stays in which we have trace of dispensation of CUD that have not been coded using G20 code.
ii. All stays in which we have trace of dispensation of CUD in the presence of the G20 code.
iii. All the SDS in which the G20 code is present, but that have no trace of the dispensation of CUD.

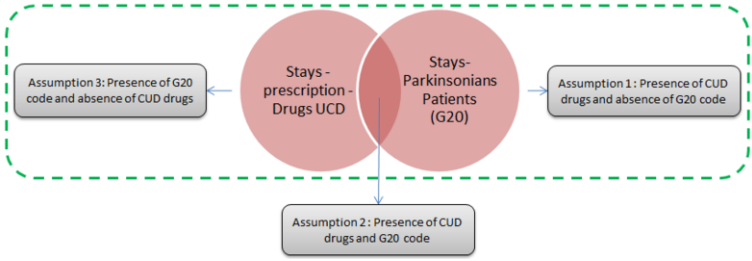

Figure 1. Assumptions

All the stays with CUD dispensation without a G20 code were revalued by a physician.

3. Results

The population, studied in the second half of 2015, included 14,222 CUD units dispensed to 395 patients corresponding to 448 stays. Figure 2 summarizes the results for our three hypotheses. We observed 253 (56%) acute care stays in which we have trace of dispensation of an antiparkinsonian drug and 195 (44%) stays where G20 is present but without trace of dispensation of antiparkinsonian drug.

Table 1. Results and precision

Designation	Parkinson
Patient stays with trace of an administered antiparkinsonian drug	253
Patient stays without mention of PD	84 (33%)
G20 should be coded	24
G20 should not be coded	60
Precision	29%

Table 1 shows the output of figure 1 and the relevance assessment for the estimation of precision. Two evaluators reviewed the 84 non coded stays (including 17 with anticholinergic drugs and 67 with other antiparkinsonian drugs), and recommended that the G20 should be coded in 24 (29%) stays.

Conversely, during the same period, among the 247 stays coded G20, only 52/247 (21%) have a trace of the dispensation of an antiparkinsonian drug.

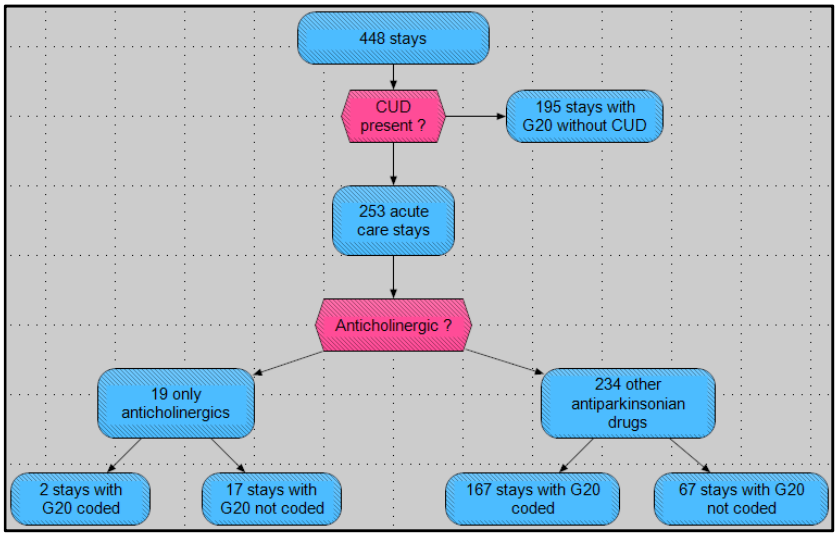

Figure 2. Repartition of stays according to the several criteria (presence of CUD, presence of anticholinergic drug, presence of the G20 code)

4. Discussion

Although increased uses of EHR by physicians enable to collect clinical information in large populations, identification of a particular disease in these records is still far from simple [3, 4]. Two reasons have prompted us to choose Parkinson's disease. Firstly, drugs indicated for PD are relatively specific for this disease. Except anticholinergic drugs, those were a major cause of false positives when identifying undercoded PD with these drugs. Secondly, patients with PD are usually treated with antiparkinsonian drugs (unlike other chronic diseases for which a non-drug treatment may be undertaken). Ragain *et al* put in evidence an economic benefit of using a tool automatically advocating diagnoses through the exploitation of administered drugs [5].

In a recent study [6], Halfon *et al* measured the consistency between the information related to prescription drugs and information related to ICD-10 codes. Their objective was to test the possibility of deducting the existence of some chronic diseases from prescription drugs. Our results show that it is possible to check coding completeness thanks to a measure of coherence between drugs taken by the patients and ICD codes already coded for the stay. However considering PD, results may seem disappointing as we observed large cases of false positives (precision 29%). This may be explained by several issues that have already been addressed in previous work.

Schulz *et al* already proposed an automated method for checking coding completeness based on a knowledge base in which drug names were linked to sets of ICD-10 codes [7]. However information on drug names was obtained by scanning discharge summaries with a text classification system, whereas we introduced an ergonomic improvement by checking completeness directly within the Web100T® application that coders use in our hospital. This rests on the implementation of an

interface for drug dispensation between our EHR and Web100T®, and the parameterization of contingency tables between CUD and ICD codes.

Nevertheless Schulz *et al* were able to detect several non-coded Parkinson but also observed several false positives (precision 14% and recall 70%) [7]. The higher precision observed in our study may be explained by a better retrieval of drug information. We had a poor recall (21%) as no antiparkinsonian drugs were associated with several patient stays coded with G20 in the Web100T application. The format of the interface between the EHR and Web100T® is HPRIM-XML. Some medical units were not benefiting from a computer provided order entry at the time of this study, and we also observed prescriptions of apomorphine and ropinirole that were not in the selected drugs, and that suggests that we should also take into account drugs missing from our drug formulary. Halfon *et al* observed it was possible to improve precision when evaluating coherence between prescriptions of antiparkinsonian drugs and ICD codes for PD, by removing cases where anticholinergic drugs are associated with neuroleptics in an attempt to decrease the effects of drug-induced extrapyramidal syndrome [6].

Schulz *et al* found that less than 2% treatment episodes were undercoded which accounts for a limited potential improvement in coding completeness [7]. This is however significant when considering revenues from the prospective payment system, as Ragain *et al* found a direct gain of 2.13% when checking 200 acute stays thanks to drug treatments [5].

Such work should be generalized to other kinds clinical data available in our HIS as we already implemented interfaces to recover medical devices and laboratory data, and other kinds of clinical data such as weight and body mass index in the Web100T® application.

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