The FreeMedForms project: managing drug-drug interactions, an open source experimentation.
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INTRODUCTION: Drug-drug interactions (DDI) can lead to severe health outcome and are all avoidable. Electronic medical record (EMR) managers can help to improve patient safety, as prescribers and pharmacists' ability to recognize potentially interacting drug pairs is limited. Unfortunately, many DDI software products are not optimal.

THE PROJECT: The FreeMedForms project was started in October 2008 as a free and open source work. The main objective is to provide a full EMR and an open source DDI software for practitioners and pharmacists. The project is coded using C++ and the Qt framework, running under Windows, OS X and Linux. The project is driven by a volunteer community of medical doctors, pharmacists and computer scientists. The code is released under the GPLv3 license.

DATA SOURCES: The drug databases are based on governmental free data, the DDI engine is based on a compilation of data sets mainly extracted from governmental web sites and scientific publications. The internationally recognized ATC classification is used to compute DDI and other patient-drug interactions. The main work consists of translating drugs components to their ATC equivalents. This is done using a specific application called FreeToolBox and has to be checked manually. There is no automated data-mining. Currently, the DDI engine can manage databases for the following countries: France, USA, Canada, South Africa and Belgium.

THE DDI ENGINE: As drugs can contain multiple components, the DDI engine analyzes prescriptions by pairs of components. Each component that can be translated to its ATC equivalent is analyzed. The DDI engine takes the route of administration into account, as some routes do not have any (or a weak) systemic passage. Two kinds of alerts are defined: non-blocking alerts are represented by an icon next to the drug inside the prescription view, and blocking alerts which require acknowledgment before the user moves on. The threshold of each kind of alert can be defined separately to avoid alert fatigue. Alert fatigue is well known and defined as a phenomenon caused by excessive warnings including irrelevant, non-significant, or repetitious alerts. The timing of the alert system is also clearly defined and the engine analyzes prescriptions at three different moments: when user searches for a drug (warn allergies), when a drug is selected and when the posology is defined.

INTEROPERABILITY: FreeDiams, FreeMedForms' prescription module, can be connected to any EMR that wishes to take advantage of its expertise using an interoperability interface. This interface uses simple XML files. The GNUmed and some other EMR projects have already implemented this interface.

CURRENT AND FUTURE DEVELOPMENT: Some development is currently underway to implement more complex interactions (mainly patient-drug interactions) like potentially inappropriate medication, renal failure detection, pregnancy-drug compatibility etc. A scientific validation of the DDI engine is required and should be done by independent scientists (to avoid competing interests or any conflict of interest).

Bibliography
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<table>
<thead>
<tr>
<th>Repartition of interactions according to their level of risk</th>
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<tbody>
<tr>
<td>Contra-indication</td>
</tr>
<tr>
<td>Unadvised</td>
</tr>
<tr>
<td>Glycoprotein P interaction</td>
</tr>
<tr>
<td>P450 cytochrome interaction</td>
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<tr>
<td>Take into account</td>
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<tr>
<td>Precaution for use</td>
</tr>
<tr>
<td>Information</td>
</tr>
<tr>
<td>Undefined</td>
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<tr>
<td>Total DDI per INN</td>
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ABOUT THE AUTHORS: Eric Maeker is a french medical doctor, practicing general medicine and geriatrics (curriculum vitae can be found at http://ericmaeker.fr). Christian A. Reiter is an Austrian medical doctor, currently finishing his general practitioner training.

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