Development of an educational research software for detection of clinically important drug-drug interactions

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Abstract

Objectives: The aim of this study was to develop a free, simple stand-alone educational research software (ERS) to assist medical and healthcare students or professionals in detecting clinically important drug-drug interactions (CIDDIs).
Materials and methods: The prototypic tool was based on a Microsoft Access 2010® database with Microsoft C# 2010 Express Edition2010 ® as the user interface. It can be distributed on Compaq Disk (CD) and be run on any Personal Computer (PC) on Windows.
Results and discussion: The developed (ERS) -which we have called DDIS v.1.0- currently has data for 106 drugs used in the design. It doesn't require wide knowledge and expertise in computers. When the user logs into the system, a default page appears prompting him/her to select one or more drugs to test for interactions. The interaction is one-to-many; it will be tested on all the drugs already selected. The pair in which we have interactions will be shown in test outcome table.
Conclusions: The free (ERS) could be a useful teaching tool in medical and healthcare education. Future work should focus on further evaluation of its accuracy, its usefulness on the teaching process and its acceptance by the healthcare students or professionals.

Keywords: drug interaction, adverse reaction, medical software, education

I. Introduction

A drug interaction is defined by the Food and Drug Administration as a drug–drug interaction that can lead to a change in systemic exposure, resulting in variations in the response to the coadministered drugs (Gómez Perales et.al., 2013). Clinically important drug-drug interactions (CIDDIs) are a notably significant type of adverse drug events since they are usually predictable based on earlier clinical reports, and an awareness of the underlying biochemical mechanisms. Several adverse drug events have life-threatening effects and could cause the exclusion of common medications from the marketplace (Juurlink et.al., 2003). Such radical measures are plausibly justifiable because clinicians are often unaware of serious CIDDIs (Juurlink et.al., 2003). One of the tools that medical and other healthcare professionals or students rely on to review medication profiles for CIDDIs is the use of software for the detection of CIDDIs. Despite the fact that manual review of clinical pharmacology handbooks can be performed, recognition of CIDDIs without the use of an assistance (e.g., drug interaction reference, software) only detects about 70% of CIDDIs in a 2-drug regimen and the proportion is shortened considerably as the number of medications elevates (Abarca et al., 2006). As a consequence, CIDDI screening has

the potential to improve the recognition of possibly detrimental CIDDIs beyond what can be carried out with manual review alone (Abarca et al., 2006). However, far too little attention has been paid to the development of CIDDIs detection softwares with user-friendly characteristics as tools for educational research purposes. The aim of this study was to develop a free, simple stand alone educational research software (ERS) to assist medical and healthcare students or professionals in detecting (CIDDIs).

II. Materials and methods

System Design

The design of the system was initially done on paper withall the relevant stages and data processing outlined clearly. The mathematical algorithms were detailed in simple English language for easy of programming. At this stage, we evaluated the appropriateness of the available databases and programming languages.

Implementation

The minimum hardware requirements for the (ERS) are a Pentium 4 processor (Intel) or equivalent and 1 GB of random-access memory. The required operating system is Windows XP Service Pack SP 2 or later (Microsoft), and the required software is Access 2003 or later (Microsoft) or its runtime and the Microsoft.Net Runtime Library 4 or later.

Development

Data for CIDDIs (they were collected from internet biomedical databases and supplemented by information from clinical textbooks) were added into the corresponding tables developed using Microsoft Access 2010® which is a relational database management system. Each table had a unique identifier, the key. Depending on the need, tables were linked together through creation of fields that contain same data. This process was done through utilization of Structured Query Language (SQL) commands and queries. The databases architecture created allowed addition, retrieval, and storage. The user interface was created using Microsoft Visual C# 2010 Express Edition ® which was also the programming language. The database and the user interface were linked through a data link utility (Microsoft OLE DB®). The software can be distributed from one Personal Computer (PC) to another using a flash drive, a compact disk, or any portable medium.

III. Results and discussion

The development of the software-which we have called DDIS v.1.0 (Delimaris Drug Interaction Software v.1.0)-was done successfully. It currently has data for 106 drugs used in the design and it doesn't demand special skills and expertise in computers. When the user logs into the system, a default page becomes visible prompting him/her to select one or more drugs to test for interactions (Figure 1).

The interaction is one-to-many. This means that the interaction will be tested on all the drugs already selected. The pair in which we have interactions will be shown in test outcome table. The (ERS) gives information when a drug increases or decreases the action of another drug (Figure 2).

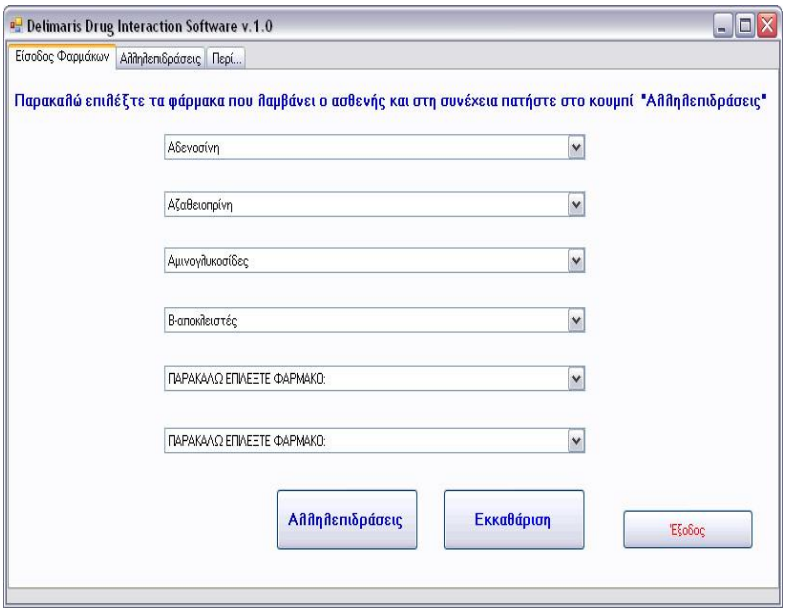

Figure 1 : An illustration of the screen from the ERS that appears during drug selection

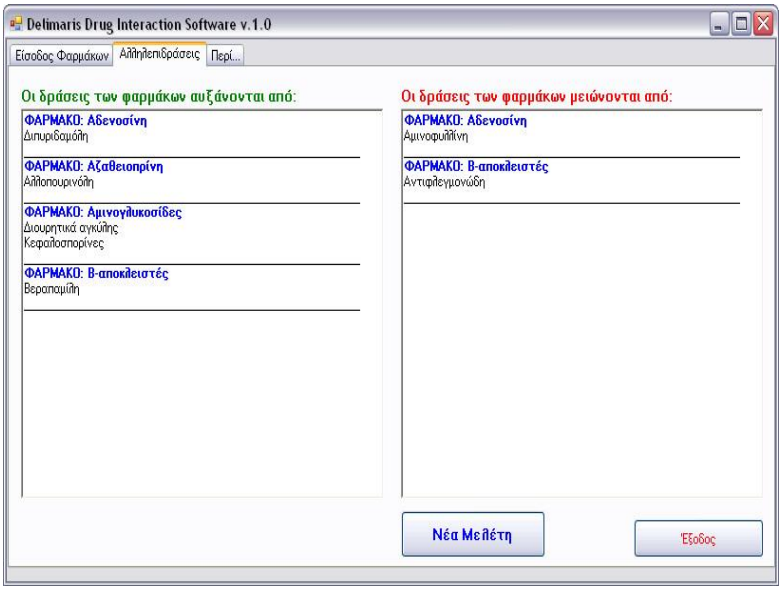

Figure 2 : An illustration of the screen from the ERS that appears when CIDDIs are detected. It provides data with regard to the potential increase or decrease of the pharmacologic action(s).

Computer literacy is valuable to a large extent for healthcare students because it supports cognitive processes needed for effective learning and professional practice. By exposing medical students early in their training to the vast profusion of electronic information resources, medical educators can help produce a generation of health practitioners who have a different orientation toward knowledge and learning (Koschmann et al., 1995). Discrimination learning is the process that teaches the student to differentiate between the different clinical manifestations, and an educational software could help the student to detect the subtle differences (Dev et al., 2006). A similar learning approach could be extremely useful in the training for detecting different drug interactions. Howbeit not all drug interactions are clinically important, it is significant for the medical student to be careful for those that are. It is

not possible to memorize all the drug-drug interactions reported in the literature. Nevertheless, an awareness of the main types of drugs that are more likely to be involved at the clinical level is a realistic educational purpose for the medical and healthcare students.

There are several valuable drug-drug interaction computer programmes in the marketplace which are used by the working personnel in pharmacies or other healthcare settings to improve medical decision making, safety, and quality of care (Malone et al., 2010). However, they might not have usefulness for educational research purposes because they inquire extensive knowledge of database systems, while many of the listed interactions included in these softwares could be rare, minor, or only occur under specific conditions and may not be clinically important. The developed (ERS) was designed to differ from them as it focuses specifically on CIDDIs and it is very easy to be used by the student.

In any case it is important to bear in mind the weaknesses in computerized approaches for the detection CIDDIs. Unexpected harms related to errors in algorithms, screen display, or poor attention to clinical severity issues, have only been recently appreciated (Wong et al., 2010). The drug interaction literature itself is of insufficient quality to mandate against most drug combinations and the methods of presenting computerized decision support, including drug interactions, require further refinement (Wong et al., 2010). Existing and new softwares for CIDDIs detection should be further studied and developed, and their validity and reliability should be examined (Hakkarainen et al., 2012).

IV. Conclusions

In conclusion, the developed (free) ERS has the potential to predict CIDDIs and it could be used as an educational research tool for healthcare studies. Further work is needed so as to find possible ways to improve its ability for accurate and precise detection of CIDDIs and to evaluate its performance/usefulness on educational activities by healthcare students or professionals.

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