An Integrated Architecture for a Customized CDS Service from Heterogeneous CDSSs

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Abstract and Objective

Most clinical decision support systems (CDSS) are built-in subsystems or plug-in commercial software with low flexibility under many constrains. In this study, we proposed a platform-independent CDS service integrating two heterogeneous drug-drug interaction (DDI) CDSSs for a teaching hospital with established built-in Drug Utilization Review (DUR) system by integrating new rules and process of a general-purpose CDSS named 'U-brain': (1) data/service interface was designed between the CDSS and prescription system, (2) DDI decision making were performed by the inner inference engine of U-brain system and (3) an integrated DDI knowledge base was built in the U-brain system through reconstructions of two rule sets at hospital information system (HIS) site. From 4781 prescriptions of randomly selected 499 patients, the new CDS system reported 224 DDI alerts and showed 100% of sensitivity and specificity.

Keywords:

CDSS, DDI, CDSS Integration

Introduction

There have been two typical types of CDSSs for a HIS. One is a built-in subsystem that depend on the platform of the whole HIS system. And, the other is a form of commercial plug-in software. Whichever, one failed to provide a flexible service under many constraints, and to adopt institution-specific demands. In this study, we proposed a platform-independent CDS service architecture by integrating two heterogeneous DDI CDSSs, which can reduce the range of system modification and achieve a customized service with flexibility.

Methods & Results

Design an architecture of target system and interfaces

This study was for a teaching hospital with an established DDI CDSS of computer-based DUR. We propose a new tailored CDSS, which had a knowledge base and rule engine separated from operating HIS by integrating the two CDSSs: (1) the established built-in DUR system and (2) a new CDSS which was designed for general uses, named 'U-brain' [1]. There are data and service interfaces between the isolated CDSS and the prescription system, and the inner inference engine performs DDI decision making using the acquired data of prescriptions.

Modeling an integrated DDI Knowledge base

The two heterogeneous knowledge sets had difference origin of knowledge, were out-of-sync in rule management. Therefore, there were issues related to updates, management, integration and duplicate removal of rules. We proposed an integrated DDI knowledge base which was built in the U-brain system by daily reconstructions of two rule sets at HIS site.

Evaluate the confidence of DDI decisions for new CDSS

For system performance, we evaluated the accuracy on decision making by the new CDSS based on random samples from the former prescription data. From 4781 prescriptions of randomly selected 499 patients, the new system reported 224 DDI alerts, and showed 100% of sensitivity and specificity compared with the DDI alerts by the former CDSS.

Discussion

In this study, we proposed a platform-independent CDS service by integrating two heterogeneous CDSSs, which was logically separated from the operating prescription system. A HIS platform-independent CDSS can provide a customized service with flexibility, and contribute to the interoperability and portability of CDSS among different hospitals for general uses.

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