Development of an advanced clinical decision support system on medication safety

Sara Ibáñez-García¹, Ana Herranz-Alonso², Jose Luis de la Rosì³, Carmen Guadalupe Rodríguez-González³, Maria Luisa Martín-Barbero⁴, and María Sanjurjo-Sáez⁵

¹Pharmacy Service, Hospital General Universitario Gregorio Marañón, Spain
²Yerbabuena Software Inc.

Keywords. Clinical Decision Support Systems, Adverse Drug Event

Introduction

At present, the increased efficiency of drug therapy and prevention of adverse drug events (ADE) is one of the most important challenges that must face any National Health System. The purpose of the study is the development of an intelligent tool that integrates medical record, clinical laboratory data and pharmacology treatment, and generates recommendations for a safety and effective prescription.

1. Methods

We carried out a feasibility analysis of the project by the information systems department and information technology company. A multidisciplinary team comprising four pharmacists, four physicians and two informatics was assembled to define the intervention programs (IP) and develop the tool.

2. Results

The project was considered feasible because the hospital has a high degree of computerization and technological level (electronic medical records, computerized prescription order entry and laboratory testing on-line). The level of standardization found in integration interfaces provided by the hospital (mainly HL7) enables data to be queried in real-time.

The intelligent tool was developed with the following features:

- Integration of 5 sources of information: medical record, clinical laboratory data, microbiology data, pharmacology treatment and a bundle of clinical rules (CR). The integration was performed through ETL processes based on HL7 using a Mirth server.

¹ Corresponding Author
- Generation of alerts based on the bundle of CR, previously defined within each IP by the multidisciplinary team:
  1. Antimicrobial therapy optimization (eg. Treatment with caspofungin in sensible Candida sp infections: consider de-escalation to fluconazole)
  2. Detection of biochemical/hematologic toxicities (eg. linezolid and platelets< 50,000/mm³: consider treatment interruption)
  3. Drug dose adjustment in renal impairment (eg. metformin and eGFR<30ml/min: contraindicated)
  4. Drug dose adjustment in hepatic impairment (eg. metotrexate and SGOT<180 UI: reduce recommended dose by 25%)
  5. Individualization of drug therapy according to patient's genetic characteristics (eg. abacavir and HLA-B*5701 allele positive: contraindicated)

It provides a lot of processing and query by implementing a vast knowledge base using NoSQL technologies, logical rules to define CR and an ad-hoc inference engine. This rule processing is based on the MapReduce paradigm.

- Generation of standardized recommendations for pharmacist’s interventions.
- Recording automatically pharmacists’ interventions and the acceptance by the physicians.
- Assessment of the alerts’ positive predictive value, severity of the ADEs they have prevented, and the associated cost savings.

3. Discussion

The development of a technology with these features is presented as an effective strategy for automated and real time pharmacotherapy counseling, which will reduce the incidence of ADEs and its cost associated.