

Architecture of an Enterprise Allergy Monitoring System

Francis Engbert, Laura Noiro, Richard Reichley, Wm Claiborne Dunagan, MD, Thomas Bailey, MD

BJC HealthCare and Washington University School of Medicine, St. Louis, MO, USA

Abstract

We designed and implemented a real-time system to store an enterprise-wide historical record of patients' drug allergies. Pharmacy orders are checked against known allergies, and newly identified allergies are checked against existing pharmacy orders. When a potential drug-allergy interaction is detected, an alert is created.

Keywords: Medical Informatics, Data Collection, Systems Integration, Information Dissemination

Introduction

Hospital computer systems typically validate drug orders against a list of known allergies. Without a central repository, patients' allergies available to the pharmacy systems are usually limited to those known by the specific pharmacies for the current admissions. Furthermore, each pharmacy system may use different logic to identify drug-allergy interactions. A centralized Allergy Monitor can leverage data collected from multiple facilities to create a longitudinal allergy record, and use that information to consistently and predictably identify drug-allergy interactions.

Methods

Structure

We used VantageRX Database™ (VantageRX) as the knowledge base that would supply drug allergy categorizations and interaction information. We then built Allergy Monitor to use the knowledge supplied by VantageRX to check all incoming allergies and drug orders from Barnes-Jewish Hospital (BJH), a large urban teaching hospital.

We established a real-time feed of BJH patient allergy data from the hospital's *Medication Control System* (MCS) software. MCS uses allergy codes supplied by NDDF™ (First DataBank, San Jose, CA). We created an algorithm to map NDDF allergy codes to an internal master list of allergy codes. This list, the Medical Entities Dictionary (MED), has a direct relationship with the VantageRX codes, while taking into account the different levels of abstraction of the two coding systems. When a new allergy is entered, it is formatted as an HL7 message with the NDDF code translated into a MED allergy code, and routed to Allergy Monitor, which checks all of the patient's active drug orders against the new allergy.

We also established a real-time feed of BJH pharmacy orders. When an order is entered into MCS, patient and drug

identifying information are formatted into an HL7 message and routed to Allergy Monitor, which uses VantageRX to compare the ordered drug to the MED-coded historical list of the patient's known allergies.

Whenever Allergy Monitor finds a potential drug-allergy interaction, it generates an alert. Alerts are sent via fax, email or pager to the appropriate pharmacy satellites. A pharmacist may log into an intranet site to see details of the drug order, the patient's allergies, and a description of the interaction.

Scalability

The system needs to be scalable in two dimensions: First, it must be able to process, in real-time, data from multiple hospitals. Second, it must be flexible enough to accept allergy codes from each of those hospitals' pharmacy software, which may have allergy coding systems that differ from that of MCS.

To meet the first challenge, we optimized Allergy Monitor for speed by developing it as a multithreaded C++ application and giving it separately configurable numbers of threads to process drug orders and allergies. It uses Sybase Adaptive Server Enterprise to store patients' allergies and alert data, but where practical, data structures are stored in RAM, with relatively slow database and disk requests made only when necessary.

We met the second challenge by separating the code mappings from the data processing. When we add a new facility to the system, we obtain a detailed list of their allergy codes and then map those codes to the MED, which allows Allergy Monitor to access codes from all facilities in a consistent way.

Results

We found that a single order-processing thread is sufficient to process all drug orders for BJH. A single allergy-processing thread is sufficient to process all incoming allergies for both BJH and a large community hospital. In 148 days of operation, Allergy Monitor has generated 3,323 alerts while processing 17,094 distinct allergies and 1,431,695 orders. The alerts represent drug orders for which the patient has a known allergy or a potential cross reacting drug class allergy. Validation of these alerts is in process.

Conclusion

Having a centralized Allergy Monitor allows a large health system to leverage data from multiple facilities to create a longitudinal, cross-facility drug allergy safety net, offering an enhanced level of allergy checking to existing pharmacy order entry software.