Case-Based Reasoning for Antimicrobial Prescribing Decision Support: A Solution for Critical Care?

Conference Paper · September 2014

DOI: 10.13140/2.1.4530.5280

6 authors, including:

Luke S P Moore
Imperial College London
211 PUBLICATIONS **5,942** CITATIONS
SEE PROFILE

Esmita Charani
Imperial College London
150 PUBLICATIONS **5,566** CITATIONS
SEE PROFILE

Pau Herrero
Imperial College London
147 PUBLICATIONS **1,906** CITATIONS
SEE PROFILE

Bernard Hernandez
Imperial College London
28 PUBLICATIONS **289** CITATIONS
SEE PROFILE

The UK's largest ever gathering of Biomedical Engineers, Bioengineers and Medical Engineers

MECbioeng14

Medical Engineering Centres Annual Meeting and Bioengineering14

at Imperial College London

10-11 September 2014

mecbioeng.org **#MECbioeng14**

wellcome trust

bio eng uk
the bioengineering society

EPSRC
Engineering and Physical Sciences Research Council

Case-Based Reasoning for Antimicrobial Prescribing Decision Support: A Solution for Critical Care?

***Luke SP Moore**, Esmita Charani, Pau Herrero-Vinas, Bernard Hernandez-Perez, Pantelis Georgiou, Alison H Holmes*
Centre for Infection Prevention & Management, Imperial College London, Centre for Bio-Inspired Technology, Imperial College London

Background: Prescribing antimicrobials is complex, often undertaken by non-specialist doctors, and frequently based upon incomplete and disparate information. Existing decision support systems (DSS) to aid prescribing decisions are not fit for purpose, and a solution is urgently needed. We report the development of a novel antimicrobial prescribing DSS by a multidisciplinary team of engineers and healthcare professionals in the context of a teaching hospital network in London. **Objective:** To develop a case-based reasoning (CBR) DSS to aid critical care antimicrobial prescribing through adaptive, heuristic algorithms drawn from archived patient cases. **Method:** Iterative development included: requirements gathering; decision making analysis (with categorisation of clinical, pathology and demographic variables); mapping of existing and required information systems (and subsequent linkage); workflow modelling; and finally, an adaptive software development process. 28 parameters were identified to categorise cases, antimicrobials and outcomes; principal component analysis (PCA) was used to reduce the dimensionality of the data. The final product was ported as an mHealth application (App) for use on mobile tablets. Information governance was assured through use of the App as a thin client, with all communication within secure hospital firewalls. **Results:** Pilot data on 50 clinical cases showed 100% accurate retrieval of patient demographic, clinical and pathology data from disparate NHS information systems. Clinically the App is in case-accrual phase, but concurrently Monte Carlo simulations are being used to optimise case retrieval (i.e. case comparison and database organisation). Workflow modelling suggests a 40% reduction (62 hours per month to 37) in critical care infection-specialist time following App roll-out. **Conclusion:** An unmet need exists around decision support for antimicrobial prescribing, particularly in critical care. Following deployment, the DSS will optimise decision making by facilitating: personalisation of antimicrobial prescribing (adaptation of evidence based medicine by cohort level and patient level clinical and pathology results), continuity (point of care support for inter-professional communication), and education (of non-specialist doctors).

Electronic Acquisition of Vital Signs on General Wards

***Peter Charlton**, Timothy Bonnici, Lionel Tarassenko, Peter Watkinson, Richard Beale*
King's College London, University of Oxford, Oxford Biomedical Research Centre, Guy's and St Thomas' NHS Foundation Trust

INTRODUCTION Vital signs are routinely measured every 6 hours in general hospital wards using a spot-check monitor and typically recorded on paper. Newer monitors can transmit vital signs wirelessly to computerised charting and alerting systems. Research into their effectiveness is usually carried out by capturing vital signs wirelessly in parallel with paper charting. We report our experiences of using paper and wireless acquisition in parallel as part of a research study. **METHODS** The study aimed to acquire a physiological database from patients recovering from cardiac surgery. Patients were asked to wear wireless telemetry monitors throughout their stay on a recovery ward. Ward staff were trained to use Wi-Fi enabled spot-check monitors at the outset. They were asked to record vital signs on paper for clinical use, and electronically for research use, requiring minor workflow additions. Research nurses visited daily to support study patients and assist staff. Vital signs were acquired from 198 patients over 14 months. Two experts transcribed vital signs from paper charts using double data entry. **RESULTS** 372 (6%) out of 6432 vital signs sets were acquired electronically. The proportion acquired electronically decreased over the four quarters of the study duration: 18% (out of 626), 8% (2118), 2% (1867) and 3% (1813). We identified a number of issues contributing to poor monitor usage:1. There was no immediate positive reinforcement for acquiring vital signs electronically since staff did not have access to the electronic charting system.2. Ward staff were mainly encouraged to maintain telemetry monitor usage. They were not encouraged as strongly to maintain high levels of spot-check monitor usage since it was thought this may engender a negative response.3. Staff turnover and use of temporary staff was high. Therefore during the study an increasing number of staff had not received full training on the monitor.4. We did not have a local champion from within the ward staff with adequate time to encourage usage. **CONCLUSION** Engaging clinical staff in research data collection can be difficult. Data collection tasks should be aligned as closely as possible to their existing workflow. Adequate engagement, incentivisation and training are also required. These tasks may require significant resources throughout a study.