Electronic decision support and antimicrobial stewardship

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“We are drowning in knowledge but starving for information”
(John Naisbett, futurist)
(Antibiotic) Computerised Decision support

“The provision of clinical knowledge, intelligently filtered and presented at appropriate times, to enhance patient care” Purcell BMJ 2005

Why do we need it?

- Knowledge performance gap
- Infections are cognitively difficult to treat
- Pressures to use knowledge
  - Clinical governance, cost, prevention of antibiotic resistance
Barriers to implementation of CDSS

- Poor interoperability between systems/sites/states
- Lack of standards
- IT departments mainly support-based
- Healthsmart (VIC), other state funded initiatives plan to introduce electronic orders, medication order entry (timeline)
- National E-Health Transition Authority (NEHTA)
- Very expensive
- Web-based technology well-suited to current platforms
Synthesis of Research Paper

Ten Commandments for Effective Clinical Decision Support: Making the Practice of Evidence-based Medicine a Reality

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Features of CDSS that are likely to increase clinician uptake

- Speed (primary determinant)
- Usability (ease of use, usefulness)
- Integration into workflow
- Provide alternatives (retain autonomy)
- Simple interventions work best
- Evidence/justification should be provided
- Impact monitored and feedback given to clinicians
- Incentives for use
- Local adaptation of guidelines and local development (Bates 2003, Kawamoto 2005)
Examples of Antibiotic DSS

- Passive: TGA, guidelines, intranet
- Pharmacy-based (back-end)
  - Aminoglycoside monitoring, redundant antibiotic combinations, therapeutic mismatches
- Physician/web-based/PDAs
  - Antimicrobial approvals (Guidance, IDEAS), handheld DSS for AB prescribing in ICU (Westmead), ADVISE (RMH)
- Bedside CDSS with order entry
  - Antibiotic assistant (LDS, Utah), vancomycin guidelines at point of prescribing (Brigham & Womens)

Are CDSS effective?

- CDSS improve adherence to clinical guidelines and reduce medication error (Level I evidence)
  
  *There is insufficient evidence to show that they improve patient outcome*

- Almost all reported antibiotic DSS demonstrate a reduction in amount of or costs associated with antibiotic use, LOS
  
  *Some evidence to demonstrate that they stabilise/prevent the development of antimicrobial resistance (Yong, in process; Pestotnik 1996)*
  
  *Publication bias*

- Impact of commercial CPOE systems??

- Few appropriately designed studies evaluating the impact of CDSS on patient outcomes and antimicrobial resistance
Reduction of broad-spectrum antibiotic use with computerized decision support in an intensive care unit

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Abstract

Objective. To implement and evaluate the effect of a computerized decision support tool on antibiotic use in an intensive care unit (ICU).

Design. Prospective before-and-after cohort study.

Setting. Twenty-four bed tertiary hospital adult medical/surgical ICU.

Participants. All consecutive patients from May 2001 to November 2001 (N = 524) and March 2002 to September 2002 (N = 536).

Intervention. A real-time microbiology browser and computerized decision support system for isolate directed antibiotic prescription.

Main outcome measures. Number of courses of antibiotic prescribed, antibiotic utilization (defined daily doses (DDDs)/100 ICU bed-days), antibiotic susceptibility mismatches, and system uptake.

Results. There was a significant reduction in the proportion of patients prescribed carbapenems [odds ratio (OR) = 0.61, 95% confidence interval (CI) = 0.39–0.97, P = 0.04], third-generation cephalosporins (OR = 0.58, 95% CI = 0.42–0.79, P = 0.001), and vancomycin (OR = 0.67, 95% CI = 0.45–1.00, P = 0.05) after adjustment for risk factors including Apache II score, suspected infection, positive microbiology, intubation, and length of stay. The decision support tool was associated with a 10.5% reduction in both total antibiotic utilization (166–149 DDDs/100 ICU bed days) and the highest volume broad-spectrum antibiotics. There were fewer susceptibility mismatches for initial antibiotic therapy (OR = 0.63, 95% CI = 0.39–0.98, P = 0.02) and increased de-escalation to narrower spectrum antibiotics. Uptake of the program was high with 6028 access episodes during the 6-month evaluation period.

Conclusions. This tool streamlined collation and clinical use of microbiology results and integrated into the daily ICU work.
A web based electronic decision support tool to support better use of medicines and use of clinical guidelines
iApprove

- In use at RMH, Barwon, Petermac, and will go to several sites in Victoria & Tas
- Restricted antimicrobials decided by local DTC
- ‘Standard indications’ as per *Therapeutic Guidelines Antibiotic (current ed)*, with local variations
  - Indications circulated to Heads of Units for comment
  - Initial approval durations nominated (often 3 days)
- ‘Non standard indications’ electronically recorded as 24-hour approval only
- ‘Extensions’ by “superprescribers” electronically recorded
How it works

- Role-based access: doctor, pharmacist, ID service..
- Approvals the responsibility of the parent unit
- Ability to view all existing approvals in real time
- ‘Alert’ indications appear bright yellow
- Pharmacist does not withhold drug
- 24 hours to obtain electronic approval
- Promotes early review by ID service
- All ID recommendations made during consults are recorded electronically
Retrieves patient data from hospital PMI/pathology
Content is developed by clinicians, using national therapeutic guidelines.
All functionality of Internet Explorer browser
Approval Details

Your approval has been created. The details are shown below. Select the 'Printer Friendly' link if you would like to print the details of the approval. Press the 'Done' button to return to the main menu.

Approval Number: XXX-2703-3

Date 27 Mar 2007 15:17
Approval Number: XXX-2703-3
Drug: Ceftriaxone
Patient UR: 123456
Patient Name: Simpson, Homer
Prescriber Name: Black, Jin, F
Authoriser Name: System, System
Duration of Approval: 3 Days
Indications: Pyelonephritis due to gram negative bacilli if narrower spectrum agents unsuitable
Approval Expiry Date: 30 Mar 2007
Extension Scheduled: No

Printer Friendly  Done
Approvals can be tracked by pharmacists and doctors with yellow alerts for important infections.
Detailed audit data can be exported.
Multifaceted Evaluation

- Uptake
- Patterns of antibiotic prescribing over time
- Benchmarking against other hospitals
- Resistance patterns in local bacteria
- Patient outcomes
  - Gram negative bacteraemia 2003-2007
    - Length of stay and mortality

Uptake of iApprove

250-350 approvals generated per month
(80-100% dispensed drugs on med/surg units)
# Changes in antibiotic consumption

DDD data from 2000-2006 using interrupted segmented regression

<table>
<thead>
<tr>
<th>Drug class</th>
<th>Gradient ddds/1000 bed days vs. time (in months) before pilot</th>
<th>Gradient ddds/1000 bed days vs. time (in months) before intervention</th>
<th>Gradient ddds/1000 bed days vs. time (in months) after intervention</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cephalosporin 3rd and 4th gen</td>
<td>+0.52</td>
<td>-0.05</td>
<td>-0.39</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Glycopeptides</td>
<td>N/A</td>
<td>+0.27</td>
<td>-0.53</td>
<td>0.09</td>
</tr>
<tr>
<td>Carbapenems</td>
<td>N/A</td>
<td>+0.12</td>
<td>-0.24</td>
<td>0.21</td>
</tr>
<tr>
<td>Quinolones</td>
<td>N/A</td>
<td>+0.76</td>
<td>+0.11</td>
<td>0.08</td>
</tr>
<tr>
<td>Amino-glycosides</td>
<td>N/A</td>
<td>+0.15</td>
<td>-0.27</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Ext spectrum penicillins</td>
<td>N/A</td>
<td>+0.16</td>
<td>+1.16</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>
Benchmarking against other hospitals
(National Antimicrobial Usage Surveillance Program)

- Conducted by NPS 2004-2007

- In lower half of the group of 23 hospitals for all broad spectrum agents except glycopeptides and ext spectrum penicillins

- Total restricted antibiotic consumption fell 2004 to 2007

- Moved from one of highest consumers to one of lowest consumers of restricted drugs in ICU over time
Antibiotic sensitivity changes in the ICU

M.Yong et al in process
Independent evaluation (Monash Uni): 115 participants: Questionnaires, interviews, focus groups

80% believed that the system
- Increased their knowledge about antibiotic guidelines
- Decreased inappropriate antibiotic prescribing

> 70% believed that the system
- Increased their adherence to evidence based medicine
- Improved the communication between them and pharmacists

About 60% believed that system
- was easy to use with daily workflow
In conclusion

- Success requires overcoming organisational, social and cultural factors that influence doctors prescribing behaviour.

- CDSS can only complement a stewardship program—many other factors need to be in place.

- Hospitals need to prepare and plan for electronic systems—standardized data collection, guidelines, policies, system interoperability.
Guidance Contributors

- Guidance team - Karin Thursky, Jim Black, Marion Robertson, Renu Shanmugasundaram, Jana Graenz, Susan Luu
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- VIDS – Michael Richards, Alan Street, Raina McIntyre
- Medseed Computing – Ryan Warrener, Russell Beattie
- RMH Clinical Pharmacology and Therapeutics department
- Monash Uni Pharmacology – Tabish Zaidi
- RMH Emergency department – Marcus Kennedy
- Medical Admin/ Guideline governance - Steve Golding
- VIDS clinicians, Thao Nguyen, Ann-Marie Sherman
- RMH medical staff – consultants/ registrars / residents