Royal Hobart Hospital
DEPARTMENTS OF ID/MICROBIOLOGY AND PHARMACY

Dr Tara Anderson
ACSQHC
Thursday 7th April 2011
Royal Hobart Hospital (RHH)
Efficient Systems & Processes

Leading the Way in Better use of Antibiotics

The hospital recently launched a new tool to support more appropriate and cost effective antibiotic use.

A simple software program is the hospital's primary component of a multi-faceted approach to antimicrobial stewardship, (in simple terms, appropriate and cost effective antibiotic use).

The new program, Enhance RHH includes a range of factors to oversee antibiotic use including the creation of a team of experts in diagnosing, treating and controlling infection to develop guidelines and educational materials; development of a restriction policy to ensure use of broad spectrum antibiotics are used based on best evidence; utilisation of specialised software to enhance education and restriction; and provision of feedback and statistics to medical staff on antibiotic performance.

Antimicrobial stewardship is defined as a rational, systematic approach to the use of antimicrobial agents in order to achieve optimal outcomes. This means using the right agent, at the correct dose, for the appropriate duration in order to cure or prevent infection, while minimizing toxicity and emergence of resistance.

Specialist pharmacist, Duncan McKenzie was the project coordinator and said that while antibiotics had revolutionised healthcare, there was also problems associated with antibiotic use.

Duncan demonstrates use of software to Director RHH Infection Prevention & Control Unit, Dr Tara Anderson.

“Those problems include cost, side affects, allergy and resistance, which is one of that biggest issues facing modern healthcare and is strongly associated with antimicrobial overuse or misuse.”

Duncan said that international research suggested that up to 50% of all antibiotic use is either unnecessary or inappropriate.

“These issues can then be compounded in a hospital environment due to the high numbers of patients and the volume of antibiotic used. The development of new antibiotics has reduced in recent years and as it may be 10+ years before important new antibiotics find their way to market, maintaining the effectiveness of currently available agents is critically important.”
Governance Structure

*First meeting 4th September 2008; quarterly meetings with 6 monthly reports
Role and Function

The purposes of the RASC committee are to:

- Promote appropriate antimicrobial use that is safe, evidence based and cost effective.
- Guide the development of protocols and clinical guidelines for antimicrobial use. Guidelines produced by the committee will be submitted to the RHH Clinical Guidelines (Policy) Committee and/or the State-wide Therapeutic Drug Committee (STDC) as appropriate.
- Assist in the promotion and rollout of Guidance DS/MS, a computerised tool for the approval, restriction and guidance of antimicrobial use at the ward level.
- Supervise the work performed at ward level by the Royal Hobart Hospital Antimicrobial Stewardship Program (RASP) team; consisting of Infectious Diseases Physicians and the Infectious Diseases Clinical Pharmacist.
- Provide formal response to audit results and outcome measures produced by the antimicrobial stewardship program.
<table>
<thead>
<tr>
<th>Chair:</th>
<th>Infectious Disease Physician</th>
<th>Tara Anderson</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membership:</td>
<td>Executive Sponsor:</td>
<td>Tony Bell</td>
</tr>
<tr>
<td></td>
<td>ID Pharmacist:</td>
<td>Duncan McKenzie</td>
</tr>
<tr>
<td></td>
<td>Department of Respiratory Medicine:</td>
<td>Cameron Hunter</td>
</tr>
<tr>
<td></td>
<td>Haematology-Oncology Physician:</td>
<td>Louise Nott</td>
</tr>
<tr>
<td></td>
<td>Medical Co-director Surgery:</td>
<td>Stuart Walker</td>
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<tr>
<td></td>
<td>Director of ED:</td>
<td>Dean Powell</td>
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<td></td>
<td>Director of DCCM:</td>
<td>Maria Downey</td>
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<tr>
<td></td>
<td>Director of Paediatrics:</td>
<td>Sean Beggs</td>
</tr>
<tr>
<td></td>
<td>Junior Medical Officer Representative:</td>
<td>Jenny O-Hern</td>
</tr>
<tr>
<td></td>
<td>Pharmacist and representative of QUM and STDC committee: No current representative</td>
<td></td>
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<tr>
<td></td>
<td>Safety and Quality Unit representative:</td>
<td>Shirleen Wickham</td>
</tr>
<tr>
<td></td>
<td>ADON Medicine:</td>
<td>Geoffrey Wieczorski</td>
</tr>
<tr>
<td></td>
<td>Anaesthetic representative:</td>
<td>Bruce Newman</td>
</tr>
<tr>
<td></td>
<td>General Medicine representative:</td>
<td>No current representative</td>
</tr>
</tbody>
</table>

| Executive Officer:  | Carol-Anne Eaton: Administrative Assistant – Infection Prevention and Control Unit |
## ANTIMICROBIAL RESTRICTION PROTOCOL

### Appendix 1. Unrestricted, Restricted and Highly Restricted Antimicrobials

<table>
<thead>
<tr>
<th>Class</th>
<th>Unrestricted Class A</th>
<th>Restricted Class B</th>
<th>Highly Restricted Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotics</td>
<td>Amoxicillin/Clavulanate</td>
<td>Azithromycin (oral, IV)</td>
<td>Amikacin</td>
</tr>
<tr>
<td></td>
<td>Amoxicillin</td>
<td>Ceftriaxone</td>
<td>Cefepime</td>
</tr>
<tr>
<td></td>
<td>Benzylpenicillin</td>
<td>Cefotaxime</td>
<td>Colistin (IV)</td>
</tr>
<tr>
<td></td>
<td>Cefadroxil</td>
<td>Cefazidime</td>
<td>Daptomycin</td>
</tr>
<tr>
<td></td>
<td>Cefoxitin</td>
<td>Ciprofloxacin (oral, IV)</td>
<td>Etanopenem</td>
</tr>
<tr>
<td></td>
<td>Cefuroxime</td>
<td>Meropenem</td>
<td>Imipenem</td>
</tr>
<tr>
<td></td>
<td>Cephalexin</td>
<td>Moxifloxacin (oral, IV)</td>
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<tr>
<td></td>
<td>Cephalothin</td>
<td>Norfloxacin</td>
<td>Linezolid</td>
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<tr>
<td></td>
<td>Cephazolin</td>
<td>Piperacillin-tazobactam (Tazocin)</td>
<td>Pristinamycin</td>
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<tr>
<td></td>
<td>Clindamycin</td>
<td>Rifampicin</td>
<td>Tigecycline</td>
</tr>
<tr>
<td></td>
<td>Colistin (inhaled)</td>
<td>Ticarcillin-clavulanate (Timentin)</td>
<td>Quinupristin-dalfopristin</td>
</tr>
<tr>
<td></td>
<td>Dicloxacillin</td>
<td>Tobramycin (inh, IV)</td>
<td>Teicoplanin (IM, IV)</td>
</tr>
<tr>
<td></td>
<td>Doxycycline</td>
<td>Vancomycin (oral, IV)</td>
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<tr>
<td></td>
<td>Erythromycin (oral)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Fluvoxacin</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Fusidic Acid</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Gentamicin</td>
<td></td>
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<td></td>
<td>Lincomycin</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Metronidazole</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nitrofurantion</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phenoxymethylpenicillin (penicillin V)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Sulfadimethoxazole/Trimethoprim (Bactrim)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trimethoprim</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antifungals</td>
<td>Amphotericin (conventional)</td>
<td>Amphotericin (liposomal)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fluconazole (oral, IV)</td>
<td>Caspofungin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Itraconazole</td>
<td>Fluconazole</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Posaconazole</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Voriconazole</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antivirals</td>
<td>Aciclovir (oral, IV)</td>
<td>Famiclovir</td>
<td>Foscarnet (IV)</td>
</tr>
<tr>
<td></td>
<td>Valaciclovir</td>
<td></td>
<td>*Ganciclovir (IV)</td>
</tr>
<tr>
<td></td>
<td>Oseltamivir</td>
<td></td>
<td>*Valganciclovir (oral)</td>
</tr>
<tr>
<td></td>
<td>Zanamivir</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Unless Section 100 (S100) criteria met*
Royal Hobart Hospital

RHH Home Page

News & Announcements
- Whooping Cough Vaccination Program
  15 July 2009
- New Departmental Home Pages
  15 July 2009
  - Admissions Centre
  - Aged Care Services
  - Department of General Medicine
- RHH Staff Clinic - Assessment of Respiratory Illness in Staff
  15 June 2009
  Email Message from RHH CEO
  RHH - Staff Flu & Gastro Watch Form - updated new version 16 July 2009
  (Please fill in this new version, save and forward to rhinfeccontrolunit@dhhs.tas.gov.au)
- CEO's Newsletter
  Issue No. 304 - 2 July 2009
  Archive - 2006 to 2009
- Staff Forum Dates - 2009
  12 December 2008
- Swine Flu Update
- Memos

Useful Links
- Antimicrobial Approvals - Guidance
- Central Contact Point - Tasmanian CARPoint
- Conference Room Bookings - RHH & Clinical School
- Digital Medical Record
- Electronic Incident Monitoring System (EIMS)
- Emergency Procedures
- EP OCH - Clinical Information
- Fire & Emergency E-Learning
- Honeywell - Work Request
- InFocus - the RHH Newsletter
- Informed Consent
- New Royal Project
Ward Approval Process
For Category B Antimicrobials

Prescribe Restricted Category B Antimicrobial

- Electronic approval for standard indication & duration obtained within 24 hours
  - Antimicrobial dispensed
    - Duration expires.
      - Expired approval alert formulated
    - RASP team review
      - Approved
        - Approval granted for RASP determined indication and duration
      - Not Approved
        - Recommendation for alternative antimicrobial or antimicrobial cessation.
      - Pharmacy alert raised

- Direct discussion with ID registrar or consultant regarding appropriate antimicrobial choice
  - Antimicrobial dispensed, enough supplied until the next working day.

- Electronic approval for non-standard indication/duration obtained within 24 hours
  - Antimicrobial dispensed, enough supplied until the next working day.

- No approval obtained within 24 hours
  - Non-standard alert raised
  - RASP team review

Daily antimicrobial stewardship ward round
21/3/10

Abx stewardship wrt
ceftazidime commenced 20/3/10

Ceftazidime non-standard indication:
surgical prophylaxis
more appropriate surgical prophylaxis

discussed with home team
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Program launch

Chart 3: 3rd/4th generation cephalosporins (ceftriaxone and cefotaxime grouped together)
Why use antimicrobial cost?

- Annual antimicrobial cost ~ $2 million (~20% of drug budget)
- Growth at rate of ~ 11% each year

Info used in 2008 business case

Slide from Oct 2008 presentation
Total RHH antibacterial cost: May 2008-April 2009=$990,944 May 2009-April 2010=$745,056 (difference=$245,888)
Table 1 outlines the indication for liposomal amphotericin for individual patients over previous 24 months obtained from Guidance DS approval data.

<table>
<thead>
<tr>
<th>Ward</th>
<th>Indications - individual patients</th>
<th>Vials received</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBS</td>
<td>Invasive fungal infection of GIT; <em>Mucor</em> / other - febrile neutropenic</td>
<td>630</td>
</tr>
<tr>
<td></td>
<td>Yeast in blood culture NHL</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td>Fungal Sinusitis</td>
<td>148</td>
</tr>
<tr>
<td></td>
<td>Alternate day prophylaxis for IFI, azoles contraindicated</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Cavitating lung lesions - aspergillus isolated</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Cavitating fungal lung infection bckgd - promyelocytic leukaemia</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Disseminated aspergillus - bckgd NHL</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Aspergillus sinusitis</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Destructive fungal sinus infection</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Lung and skin lesions - septic, immunosuppressed</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>End stage lung disease - immunosuppressed - abscess/ febrile</td>
<td>3</td>
</tr>
<tr>
<td>DCCM</td>
<td>CNS disease in setting of ALL; <em>fungal CNS infection.</em></td>
<td>116</td>
</tr>
<tr>
<td></td>
<td>Severely unwell - ongoing febrile neutropenia per protocol</td>
<td>106</td>
</tr>
<tr>
<td></td>
<td>Empirical antifungal cover severely unwell febrile neutropenia non small cell cervical cancer</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>Empiric cover, Severe mucositis, febrile neutropenic, B cell lymphoma septic</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Presumed fungal infection - AML - febrile neutropenic</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Brain abscess ? Unknown organism</td>
<td>10</td>
</tr>
<tr>
<td>ACC</td>
<td>Chronic pyelonephritis unresponsive to all other therapies</td>
<td>79</td>
</tr>
<tr>
<td>NSU</td>
<td>Cryptococcal meningitis; renal impairment worsening on conventional amphotericin</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Worsening renal function, Candida Albicans in brain tissue</td>
<td>25</td>
</tr>
<tr>
<td>IBN</td>
<td>Cavitating lung lesions - aspergillus isolated</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>End stage lung disease - immunosuppressed - abscess/ febrile</td>
<td>3</td>
</tr>
<tr>
<td>IBOP</td>
<td>Cavitating fungal lung infection bckgd - promyelocytic leukaemia</td>
<td>50</td>
</tr>
<tr>
<td>NPICU</td>
<td>Candidaemia C. glabrata</td>
<td>24</td>
</tr>
<tr>
<td>2B</td>
<td>Cryptococcal peritonitis - renally impaired</td>
<td>3</td>
</tr>
</tbody>
</table>
Antimicrobial Point Prevalence Survey Conducted Across Five Pilot Sites

T Anderson¹, D McKenzie¹, K Busing², L Upjohn³, N Chaves³, K Thursky³, V Wallroth³, Hui Ling Eu⁴, Min Shan Gan⁴, J Ferguson⁵, P Doherty⁵, K Cairns⁵ and O Cotte⁶
Royal Hobart Hospital¹, Royal Melbourne Hospital², Peter MacCallum Cancer Centre³, School of Pharmacy University of Queensland³, John Hunter Hospital⁵ and St Vincent’s Hospital Melbourne⁶

Introduction
Safe and appropriate antimicrobial use is the goal of an effective antimicrobial stewardship program. Auditing the actual antimicrobial drugs being prescribed and assessing the appropriateness of their use is important to obtain a better understanding of consumption patterns in a given healthcare setting. This then allows provision of appropriate feedback to prescribers and targeting of strategies to improve antimicrobial use.

The European Surveillance of Antimicrobial Consumption (ESAC) web-based point prevalence surveys have been performed in over 27 countries across Europe since 2001. The surveys allow collection of antimicrobial use data and comparison between facilities.

Further information in relation to the ESAC project is available on the ESAC website:
http://apps.esac.org/ps/profile/

5 pilot sites in Australia have collaborated with the ESAC team to set up their own Australian electronic data entry portal and embed existing the ESAC point prevalence survey methodology within their hospitals.

Method
The surveys identified all inpatients who were receiving antimicrobials on the day of the survey or had received antimicrobial surgical prophylaxis during the previous 24 hours.

For all inpatients, a survey form was completed. An example is illustrated below:

Site (Diagnosis Group) Codes:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Antimicrobial prescribed on day of survey (for surgical prophylaxis)</td>
</tr>
<tr>
<td>B</td>
<td>Antimicrobial prescribed three or more in hospital (for surgical prophylaxis)</td>
</tr>
<tr>
<td>C</td>
<td>Antimicrobial prescription (for surgical prophylaxis)</td>
</tr>
<tr>
<td>D</td>
<td>Antimicrobial prescription (for surgical prophylaxis)</td>
</tr>
<tr>
<td>E</td>
<td>Antimicrobial prescription (for surgical prophylaxis)</td>
</tr>
</tbody>
</table>

Indication Codes:

- Each pilot site utilised a “local expert” to assess compliance in the appropriateness of antimicrobial therapy relative to local and national guidelines.

Results
The five sites successfully completed the point prevalence surveys; 4 tertiary referral hospitals and 1 specialist cancer centre. Of the 4 tertiary referral hospitals, the percentage of patients receiving antimicrobial therapy was between 37-44%, with 61% of patients in the specialist cancer centre being prescribed antimicrobials on the day of the survey.

Important issues highlighted included the following:
- Poor clinical documentation relating to the indication and planned duration of antimicrobial therapy
- Excessive duration of surgical antimicrobial prophylaxis with many hospitals reporting use greater than 5 days
- Excessive use of topical antimicrobial therapy with unclear indication
- Inappropriate dosing of certain antimicrobials including matromicin and extended spectrum penicillins
- Local antibiotic practices that may have not been identified (as were not known to the infectious diseases and pharmacy auditors) without the performance of the survey for example: post-operative cephalosporin in plastic surgical and ear, nose and throat units
tinycocillin and third generation cephalosporin for surgical antibiotic prophylaxis in certain surgical units

Estimated resources required:
- The process was labour intensive
- Most sites required 2-7 people to dedicate a full day to data collection with subsequent time to follow-up missing data
- Initial data collection for a 569 bed hospital took approximately 45 hours
- Additional hours were required for data entry and collation
- Local experts were required to review data quality and to assess appropriateness of therapy based on the data collected

Discussion
The methodology used provided valuable information in relation to antimicrobial use in the healthcare facilities surveyed. The prevalence of antimicrobial use is higher than the mean for European sites as reported by ESAC² is 37-44% compared with 30% in Europe.

Advantages:
- Obtained a profile of antimicrobial use across the healthcare facilities which allows for comparison at regular intervals and benchmarking between facilities
- Allows targeting of strategies to improve antimicrobial use within a healthcare facility
- Useful tool for measuring prevalence of healthcare associated infection

Some difficulties encountered are outlined below:

Difficulties:
- Resources required
- Inconsistencies uncovered in relation to interpretation of some of the tool elements e.g. allergy versus pseudo allergy documented
- Measurement of compliance: areas of improvement identified which would improve data quality in relation to non-concordance of therapy
- Extensive data collected: certain elements identified that removed, would simply impact data collection
- Provision of a “snapshot” representation of antimicrobial use

Conclusion
All sites undertaking the point prevalence survey using the ESAC methodology felt it to be valuable. All sites plan to repeat the surveys six monthly. There may be some scope to improve the tools without losing comparability to the ESAC data.

Acknowledgements
ESAC team. All students and staff who contributed to the point prevalence surveys across all pilot sites.

References
¹ Resources obtained from ESAC team
Point Prevalence Survey

- Based on ESAC survey methodology
  - 5 pilot sites in Australia; RMH, PMCC, John Hunter, RHH and St Vincent’s Hospital
- 31st August 2010
- All 360 inpatients surveyed
- Standardised coding;
  - Site (diagnosis group) code eg CNS, EYE, ENT, RESP
  - Indication code eg community associated infection, healthcare associated infection, surgical prophylaxis, medical prophylaxis or unknown
  - Appropriateness of antimicrobial therapy
Flow chart appropriateness of antimicrobial therapy

Antibiotic in use
  yes
  no

Infection
  yes
  no
  Insufficient information

Antibiotic needed
  yes
  no

Prophylaxis
  yes
  no

Antibiotic indicated
  yes
  no

Choice based on formulary
  yes
  no

Correct dosage
  yes
  no

Correct interval
  yes
  no

Correct application (IV/IM/PO)
  yes
  no

Correct duration
  yes
  no

Insufficient information

1a
1b
1c
1d
2a
2b
2c
3
4a
4b
4c
5a
5b
5c
5d
Results....

360 patients; 161 (44%) of patients were taking 252 antimicrobials
22% pneumonia/bronchitis
23% prophylaxis
Oral Antimicrobials

31% pneumonia/bronchitis
22% skin + soft tissue
Indications for antimicrobial use

- 52% community associated infections
- 22% healthcare associated infections
- 15% prophylaxis (medical and surgical)
Community Associated Infections

Community Associated Infections:
Systemic Therapy

- Bacteraemia
- Bone/joint
- CNS
- CVS
- Cys/Pye
- ENT
- EYE
- GI
- GUM
- HIV
- IA
- OBGY
- Bronch/Pneu
- SIRS
- SST
Community Associated Infections: Directed vs Empirical Therapy

- Directed
- Empirical
Community Associated Infections: Appropriateness of antimicrobial therapy

- Appropriate
- Incorrect dose
- Incorrect duration
- No requirement for antibiotics
- Incorrect interval
- Inappropriate antibiotic choice
- Incorrect route
Healthcare Associated Infections: Appropriateness of antimicrobial therapy

- Appropriate
- Inappropriate antibiotic choice
- Incorrect dose
- Incorrect duration
Surgical Antibiotic Prophylaxis

Surgical Antibiotic Prophylaxis:
Duration

- Single dose
- One day
- >1 day
Surgical Antibiotic Prophylaxis: Appropriateness of duration
Figure 8 outlines the antibacterial cost per OBD for the IBS ward. There has been a significant decline in cost over the period illustrated below.
Figure 9 outlines the antifungal cost per OBD for the 1BS ward. As mentioned previously, LAMB forms a major component of the overall cost.
Figure 10 outlines ‘azole antifungal cost per OBD for the 1BS ward. Of note, the changing trends in voriconazole and posaconazole use are reflected in the cost data which is consistent with National Guidelines for antifungal use in the haematology-oncology setting.
Since program launch.....

- Quarterly RASC meetings
- Daily antimicrobial stewardship ward rounds
- Regular ID liaison ward rounds
  - Adult ICU (twice weekly), Haematology-Oncology (weekly) and Neonatal/paediatric ICU (weekly)
- Guideline development with auditing component
  - Vancomycin guideline with upcoming audit planned
  - Aminoglycoside guideline with repeat audit planned
  - Surgical antibiotic prophylaxis guidelines with repeat audits planned
  - SAB guideline with upcoming SAB review planned
  - Respiratory tract infections and antibiotic use
  - Gastroenterology unit antibiotic use
- Reporting/feedback
  - 6 monthly reports
  - Annual point prevalence surveys
Acknowledgements

- Duncan McKenzie
- Sanchia Warren
- Infectious Diseases Team
- RASC Members
- DHHS
- Melbourne Health