A mixed methods study of the barriers and enablers in implementing antimicrobial stewardship programmes in Australian regional and rural hospitals

Rodney James1,2*, Susan Luu2, Minyon Avent3, Caroline Marshall1,2, Karin Thursky1,2 and Kirsty Buising1,2

1Department of Medicine, University of Melbourne, Melbourne, Victoria 3010, Australia; 2NH&MRC National Centre for Antimicrobial Stewardship, Royal Melbourne Hospital at the Peter Doherty Institute for Infection and Immunity, Melbourne, Victoria 3000, Australia; 3The University of Queensland, UQ Centre for Clinical Research, Herston, Queensland 4006, Australia

*Corresponding author. NH&MRC National Centre for Antimicrobial Stewardship, Royal Melbourne Hospital at the Peter Doherty Institute for Infection and Immunity, 792 Elizabeth Street, Melbourne, Victoria 3000, Australia. Tel: +61-3-9345-9414; E-mail: rod.james@mh.org.au

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Objectives: The Australian Commission on Safety and Quality in Health Care released recommendations for antimicrobial stewardship programmes to be established within all Australian healthcare facilities. However, implementation practices are not well defined. The aim of this study was to gain an understanding of factors affecting implementation of antimicrobial stewardship programmes within Australian regional and rural hospitals.

Methods: This study was designed whereby a preliminary quantitative process was used to contribute to a principally qualitative study. Site visits to regional and rural hospitals in Queensland, New South Wales, Victoria and South Australia were planned to assess factors impacting on implementation of antimicrobial stewardship. Subsequently researchers identified issues requiring further exploration with specific key informant interviews and focus group discussions. Data were collected between May and October 2012 and entered into Nvivo10, openly coded and analysed according to mixed methods data analysis principles.

Results: Regional and rural hospitals were not conducting many of the recommended activities and seven major themes emerged. The key barriers were perceived to be lack of access to education, resources and specialist support. The enablers were a flatter governance structure, greater sense of pride, desire for success and good internet and tele-health access.

Conclusions: This study helps us to identify where efforts should be focused to facilitate the establishment of antimicrobial stewardship programmes in regional and rural hospitals, by describing the gaps and limitations of current programmes and the major issues currently being faced, providing recommendations to better guide activities that support regional and rural hospitals.

Introduction

Antimicrobial stewardship (AMS) programmes are being established in hospitals worldwide, improving clinical outcomes for patients, while limiting the emergence and spread of antimicrobial resistance.1–6 In 2011, the Australian Commission on Safety and Quality in Health Care (ACSQHC) recommended AMS programmes to be established in all Australian hospitals5 and in 2013 AMS became an accreditation standard for all hospitals, including regional and rural facilities.5 It is uncertain whether the ACSQHC recommendations, which are modelled on experience at metropolitan hospitals, can be implemented in the 569 facilities (76%) of Australian public hospitals that are classified as regional or rural.7

International studies describing AMS may not directly compare to the Australian context, in terms of population density, geographical spread and limited infrastructure. Previous studies into AMS within Australia demonstrated wide differences in resources and activities performed between hospitals,8–10 principally in policy development, approval systems, prescription review and auditing,9 which is consistent with international studies.11 These hospitals will need to develop strategies for AMS that are innovative and appropriate to their size, available staff and accessible resources.12 This study aimed to gain an in-depth and corroborated understanding of factors that impact on AMS in Australian regional and rural hospitals.

Methods

This study used mixed methods, whereby a preliminary quantitative process contributed to a principally qualitative study,13–15 allowing
researchers to study specific aspects of AMS with exploration of original themes from a range of healthcare professionals and facilities, while triangulating the findings to ensure consistency.

**Sampling and recruitment**

Purposeful sampling was used to recruit hospitals from the most populous states—Queensland, New South Wales, Victoria and South Australia—including public hospitals of varying size, geographic remoteness and resources. Site visits were arranged to assess different factors that might impact implementation of AMS. Subsequent to the site visits, researchers identified additional issues requiring in-depth exploration with specific key informant interviews and focus group discussions. Participants for the key informant interviews were purposefully selected and invitations for the focus group discussions were circulated through an infectious diseases pharmacist email list.

**Data collection**

**Site visits**

A Needs Assessment Survey (NAS) was completed before site visits to collect quantitative information on hospital characteristics, including governance structure, work practices and available resources, and analysed before each visit to guide the selection of participants and the issues to explore. The two South Australian sites did not complete the NAS due to time restraints and the required information was ascertained during the site visit.

Between May and September 2012, researchers consisting of at least one clinical microbiologist and one senior hospital pharmacist (R. J., S. L. and M. A.), conducted the site visits to all participating hospitals, except for one of the South Australian sites where the interviews were conducted by teleconference due to the remoteness of the hospital. Site visits required between 3 and 7 h to complete and consisted of: (i) semi-structured interviews; (ii) focus group discussions; (iii) observational tour; and (iv) document review.

The interviews and focus group discussions were designed to explore the workflow within facilities and examine attitudes, perceived barriers and the acceptability of proposed components of AMS programmes. They were semi-structured with a set of pre-determined key topics to be explored and open-ended questions designed to encourage discussion and the generation of themes. Participants were recruited from three major groupings:

(i) executive group—chief executive officers, chief medical officers, hospital administrators, directors of pharmacy and nurse unit managers;
(ii) clinical champion group—infectious diseases physicians, clinical microbiologists, senior clinicians, AMS pharmacists; and
(iii) grass roots clinician group—junior doctors, ward pharmacists, infection control practitioners (ICPs) and nurses.

For the observational tour, researchers were accompanied by a staff member to areas including the emergency department, ICU, general wards and the pharmacy dispensary. Items including medication charts, imprest stock, restriction lists, in-house guidelines and antimicrobial policies and procedures were viewed to verify information provided in the NAS and offered by participants.

**Key informant interviews and focus group discussions**

Between June and October 2012 a series of additional key informant interviews and pharmacist focus group discussions were performed to purposefully supplement data collected during the site visits. Interviews were conducted by teleconference using semi-structured interview techniques with a set of pre-determined topics similar to those from the site visits.

**Table 1. Demographics and staffing of the hospitals participating in the site visits**

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Bed number</th>
<th>AIHW peer group classification</th>
<th>Distance from infectious diseases/microbiology</th>
<th>General practitioners</th>
<th>Staff specialists</th>
<th>Visiting medical officers</th>
<th>Contracted infectious diseases support</th>
<th>Onsite clinical pharmacy</th>
<th>AMs pharmacist onsite/offsite</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>233</td>
<td>principal referral</td>
<td>20</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>2</td>
<td>79</td>
<td>large regional and remote</td>
<td>&gt;20</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>3</td>
<td>58</td>
<td>major city</td>
<td>10</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>4</td>
<td>169</td>
<td>metropolitan group</td>
<td>60</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>5</td>
<td>25</td>
<td>small regional acute</td>
<td>110</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>6</td>
<td>75</td>
<td>small non-acute</td>
<td>350</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
<td>multipurpose service</td>
<td>290</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>small regional acute</td>
<td>395</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>9</td>
<td>25</td>
<td>principal referral</td>
<td>900</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>10</td>
<td>83</td>
<td>large regional and remote</td>
<td>475</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>11</td>
<td>52</td>
<td>small regional acute</td>
<td>700</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

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Data analysis

All interviews and discussions were audio-recorded while observations and documents reviewed were documented using a checklist and individual field notes. Quantitative and qualitative data from the NAS, site visits and additional key informant interviews and focus group discussions were transcribed and entered into NVivo version 10 (QSR International), openly coded and analysed by two researchers (R. J. and S. L.) according to qualitative data analysis principles. 

Quantitative data from the NAS were analysed descriptively both as aggregate data and integrated with qualitative data using a mixed-methods matrix to develop meta-inferences for the findings. The code structure was developed using both an inductive and a deductive approach. To ensure consistency and reliability, both researchers read the transcripts and field notes and met weekly to peer debrief and discuss any inconsistencies in the codes and agree on the themes generated. The major themes developed were compared with those generated through analysis by the NVivo software.

Ethics

Ethics approval was granted by the Human Research Ethics Committees from Melbourne Health, The University of Wollongong, The Prince Charles Hospital and Country Health South Australia.

Results

Hospitals were recruited until there was a diverse range of size and remoteness classification as per the Australian Institute of Health and Welfare (AIHW) and saturation was achieved on thematic analysis. The additional key informant interviews and focus group discussions recruited participants from every state and territory (except the Australian Capital Territory, which does not have any regional or rural hospitals). Thirteen hospitals were recruited for site visits with a median of 58 beds (range 10–233), with a wide range of distance from a specialist infectious disease or microbiology service, median 215 km, (range: 0–900 km). The demographics and data obtained by the NAS are summarized in Table 1.

Relevant quantitative data and a summary of the perceived barriers to AMS implementation from the NAS are displayed in Table 2. Of those with an approval system for restricted antimicrobials, five out of the six required infectious diseases or microbiology support from an offsite facility. Further barriers to effective AMS implementation included lack of expertise within organizations, difficulty in attracting qualified clinicians to act as champions for AMS and lack of financial support.

The semi-structured interviews and focus group discussions lasted between 30 and 60 min; information on the participants recruited for these are presented in Table S1 (available as Supplementary data at JAC Online). Following this thematic analysis, there was found to be equivalence between the themes generated by the researchers and the NVivo software. Of the seven major themes that emerged from the data, five of these were consistent between the site visits, key informant interviews and focus group discussions. Relevant quotes from participants pertaining to each major theme developed are presented in Table S2.

Key themes identified

AMS perception refers to what the participants understood by the term ‘Antimicrobial Stewardship’ and its importance within their hospital. There was a wide diversity in the understanding of these concepts with staff from larger hospitals, those with impending accreditation and with a clinical pharmacy service having a better understanding.

AMS process refers to the components of an AMS programme, such having endorsed guidelines, a restricted formulary, performing point-of-care intervention with feedback to prescribers and auditing of antimicrobial prescribing practices. There was a wide variation in the processes currently being performed; three of the hospitals performed one out of the five essential AMS components recommended by the ACSQHC and five hospitals reported performing all five components.

Access to advice refers to having an arrangement to access infectious diseases physicians, clinical microbiologists or other expert advisory services. Few hospitals had formalized agreements or network-wide specialist resources. Hospitals often had to contact non-affiliated metropolitan hospitals through junior doctors and perceived advice to be inconsistent and sometimes inadequate.

Workforce capacity refers to having an adequate and stable staffing level to effectively manage an AMS programme. There were chronic understaffing and high turnover in many facilities, most noticeably in pharmacy, with difficulty in attracting senior or experienced clinicians. High turnover also prevented consistency and therefore compliance with programmes and did not allow for succession planning.

Education included teaching the basics of antimicrobial prescribing and use, through to specialized training in the implementation and management of AMS. There was a lack of education available, which was seen as the main barrier to AMS implementation.
Governance structure refers to both the overarching governing style of each state with regard to hospital network structure and funding and the management style of the individual facility.

Proposed models of care represent a variety of potential models for AMS that were suggested by participants and discussed within the focus groups and key informant interviews.

Discussion

From the NAS review, staffing and resource allocation varied widely amongst facilities. There was often a lack of specific onsite personnel, including infectious diseases, clinical microbiology and pharmacy, which are seen as essential key resources for any successful AMS programme. This is a common finding that has been reported in an international survey of AMS programmes.

Table 3. Summary of major barriers and enablers for implementing AMS programmes in regional and rural hospitals

<table>
<thead>
<tr>
<th>Major barriers</th>
<th>Major enablers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to formalized infectious diseases or clinical microbiology support</td>
<td>Flat hierarchical structure of governance within small hospitals</td>
</tr>
<tr>
<td>Lack of access to education and training</td>
<td>Pride in their local healthcare facilities</td>
</tr>
<tr>
<td>Lack of internal expertise within healthcare facilities, namely pharmacists with AMS skills</td>
<td>Access to national antibiotic prescribing guidelines, freely available to all public healthcare facilities throughout Australia</td>
</tr>
<tr>
<td>Difficulty in attracting and retaining qualified clinicians to regional and rural areas</td>
<td>Low use of broad-spectrum antimicrobials</td>
</tr>
<tr>
<td>Differing governance structures amongst the states and territories and individual facilities</td>
<td>Good tele-health and internet access</td>
</tr>
</tbody>
</table>

There were limited processes for post-prescription review or auditing, mainly due to the lack of pharmacy services. ICPs often found themselves responsible for AMS, but did not feel they had adequate time, support or expertise.

Lack of access to education was a major barrier; strategies to address this include developing online modules, credentialing packages or training courses that remain up to date and are tailored to address local issues. Although there has been a recent move to utilize eLearning technology, this has been accepted by nurses and pharmacists better than doctors, and face-to-face and peer-to-peer education was preferred.

The governance structures were highly variable between states and would influence the types of programmes that could be established. Some had clear lines of accountability and support, whereas others reported less clear structures. Programmes would need to be flexible enough to work within these overarching constraints. Flatter governance structures with better ‘buy-in’ from the staff and a sense of pride and community with a desire to see their facility succeed were seen as an important enablers.

The strength of this study was that mixed methods were used to triangulate and verify data, allowing staff from many disciplines to be interviewed, gaining different perspectives and the ability to look for consistency in opinions. The observational tours enabled the researchers to independently verify the findings and provide a greater understanding of how AMS may be implemented. Overall, mixed methods research not only led to corroboration, but also increased the breadth of the findings in this study by allowing exploration of unexpected issues. The major limitations of this study were the skill set of the researchers involved and the time available. As participants were recruited on a voluntary basis, there may have been bias towards those that had an interest in AMS. The fact that sampling was diverse and similar findings were obtained from multiple participants meant that it is likely that generalization of these results to other regional and rural hospitals within Australia and internationally is reasonable.

As AMS is now a national standard for Australian hospitals, there is the potential to provide national assistance to hospitals, especially regional and rural hospitals, in implementation and evaluation of their programmes. This may be as a suite of policies and interventions that can be implemented depending on need,
resources and available specialists, being customizable to fit into the infrastructure of the hospital. \(^1\) There have been few concerted national programmes to assist with AMS implementation; one such model has shown some success in Vietnam. \(^2\)

Strong buy-in from senior leaders and the administration is imperative, as well as having a local champion who can provide stimulus and initiative to the programme. \(^1\)\(^2\)\(^3\) These champions may need to be non-specialist staff and include local clinicians and nurses, especially ICPs. \(^4\) The role of the nurse in AMS is ever expanding and recent publications have discussed the need for their input, especially in less well-resourced hospitals. \(^2\)\(^3\)\(^4\)\(^5\)

Previous studies have shown the benefit of consultation with an infectious diseases service in improving outcome measures. \(^8\) A strongly held view was that metropolitan infectious diseases services should provide outreach and oversight to regional and rural facilities. Although these have been previously accessed in an informal manner, participants wanted the arrangements formalized through contracts, with remuneration to encourage long-term relationship building and accountability. \(^8\) This has been shown to be an effective model in providing services to facilities with no on-site specialists. \(^3\)\(^4\)\(^6\)\(^7\) Microbiology laboratories were also thought to be able to assist with supporting AMS, as these links were much stronger due to historical ties. This has been previously suggested for provision of specialist services. \(^1\)

In conclusion, this study provides insight into the barriers and enablers for AMS in Australian regional and rural hospitals (Table 3) and provides some recommendations that may support them in implementing or improving AMS programmes (Table 4).

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Transparency declarations
None to declare.

Supplementary data
Tables S1 and S2 are available as Supplementary data at JACOnline (http://jac.oxfordjournals.org/).

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