8 The role of the infectious diseases service

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8.1 Key points

• Infectious diseases physicians give legitimacy to antimicrobial stewardship programs and play an important role by collaborating with local specialists to ensure that the team’s goals are understood and met.

• The infectious diseases service makes an important contribution to formulary decision making, antimicrobial restriction policies, and the establishment and operation of antimicrobial approval systems.

• The infectious diseases service has a critical role in improving overall antimicrobial use through providing expert advice on the appropriate use of antimicrobials, education of prescribers, and developing and implementing evidence-based guidelines for antimicrobial treatment and prophylaxis as part of the antimicrobial stewardship team.
8.2 Recommendations

8.2.1 The antimicrobial stewardship team includes an infectious diseases physician or clinical microbiologist (if available).

8.2.2 Hospitals have access to an infectious diseases service that provides expert advice, educates prescribers, and plays a major role in the development and implementation of antimicrobial policy and prescribing guidelines.

8.2.3 Hospitals without an on-site clinical microbiologist or infectious diseases physician negotiate external support for antimicrobial stewardship activities.

8.3 Infectious diseases services and antimicrobial stewardship

Antimicrobial stewardship (AMS) includes limiting the use of inappropriate agents, and encouraging the appropriate selection, dosing and duration of antimicrobial therapy. Infectious diseases (ID) specialists have played a major role in antimicrobial management for many years. There is good evidence that their involvement improves antimicrobial use and clinical outcomes as well as reduces costs of antimicrobial therapy. ID services are considered essential to the success of AMS programs. The success of many of the strategies to improve antimicrobial prescribing discussed in Part 1 are dependent on the involvement of the ID service. ID physicians lend legitimacy to AMS programs and can collaborate with local specialists to ensure that the AMS team’s goals are understood and met. Prescribing physicians need to have confidence in the person determining the appropriateness of antimicrobial requests. Clinicians caring for critically ill patients are considered more likely to be willing to follow an antimicrobial policy supported by their ID colleagues.

The contribution of ID services to organisational AMS activities may include:

- leading the AMS program
- providing expert advice
- participating in
  - drug and therapeutics committees, and contributing to decision making for inclusion of all antimicrobials in their institution’s formulary
  - prescribing review, intervention and feedback activities
  - the development, review and audit of clinical pathways and guidelines
  - the evaluation and reporting of hospital antimicrobial use
establishing and maintaining antimicrobial approval systems in conjunction with the pharmacy department
liaising with clinical departments and committees
conducting antimicrobial education for medical staff, pharmacists and other clinical staff.

8.4 Leading the antimicrobial stewardship program

The presence of at least one ID physician with time to work on the development, implementation and function of the AMS program is considered essential to the success of the program. International guidelines recommend that an ID physician is a core member of the multidisciplinary AMS team and the institution’s AMS program should be led by an ID physician.

Gaining physician acceptance of antimicrobial interventions by ensuring there is no perceived loss of autonomy in clinical decision making is an important barrier that an ID physician can help overcome.

Responsibilities for the lead ID physician in implementing an AMS program have been identified as:

- establishing the AMS team
- integrating the functions of the AMS team with the drug and therapeutics, and infection prevention and control committees
- coordinating analysis and reporting of antimicrobial use
- ensuring availability of a process of feedback on antimicrobial prescribing to the prescribers and the AMS team
- identifying responsibility for
  - developing and instituting prescribing policies (including antimicrobial formulary and restrictions), guidelines and clinical pathways
  - reporting antimicrobial use
  - resourcing the above activities
- reporting to the hospital executive.

Obtaining the support of hospital administrators for the AMS program is essential to the effectiveness of the program. The lead ID physician, along with the director of pharmacy, should be given the authority and resources, including dedicated ID physician time, required to implement and maintain the AMS program and to monitor the outcomes of the program.

Teaching hospitals should have at least one ID physician (or clinical microbiologist) on-site to participate in AMS activities. Smaller metropolitan hospitals, and rural and regional hospitals should consider employing part-time ID specialists or obtaining consultancy services from a hospital with an established ID service.
Smaller hospitals employing a part-time ID specialist can show improved antimicrobial use and significant antimicrobial cost savings. LaRocco reported an antimicrobial team led by an ID physician (8–12 hours per week) and a clinical pharmacist performing review and feedback in a 120-bed, nonteaching community hospital three days a week effected a 19% reduction in antimicrobial costs.

8.5 Consultation with infectious diseases services

Inadequate antimicrobial therapy and delays in treatment are associated with increased morbidity and mortality. Inadequate antimicrobial therapy is an independent risk factor for death among critically ill patients with severe infection. Studies have demonstrated an approximate 10% decrease in the mortality rate in patients with severe sepsis receiving adequate antimicrobial treatment when compared with those receiving inadequate therapy.

Kollef cites consultation with an ID specialist as one of six clinical strategies to reduce inadequate antimicrobial treatment in the hospital setting. There are numerous studies that demonstrate improved patient outcomes when ID physicians are consulted. Petrak et al. cite six studies where consultation by an ID physician for patients with bacteraemia reduced morbidity and mortality as well as the cost of care. Byl et al. evaluated 428 episodes of bacteraemia in a teaching hospital. Empirical treatment was appropriate for 78% of the episodes of bacteraemia treated by ID physicians compared with 54% when treated by other physicians ($P < 0.001$). Inappropriate empirical therapy was associated with a higher mortality rate. Similarly, in a retrospective review of management of Staphylococcus aureus bacteraemia, Filice and Abraham demonstrated improvement in several areas when ID physicians were involved:

- Concordance with accepted standards for treatment was improved in cases where ID physicians were involved (97% versus 53%; $P = 0.0003$, Fisher exact test).
- Relapse was more likely in patients without ID physician involvement (29% versus 8%; $P = 0.02$, Chi-square).
- Infection cure and patient survival were higher when ID physicians were involved (85% versus 59%).

The study concluded that outcomes will be substantially better if ID physician involvement is provided for all cases of S. aureus bacteraemia. Including an ID physician to evaluate patients’ antimicrobial treatment as part of an enhanced infection control strategy has also been shown to contribute to significantly reducing the occurrence of vancomycin-resistant enterococcal infections.
Early involvement of the ID service can improve the antimicrobial management of patients, ensuring appropriate dosage, duration and assessment of response. This can be achieved by including a range of infections within the hospital antimicrobial policy where early consultation with the ID service is advised. An example list from Hunter New England Health (Dr John Ferguson, Director of Infection Prevention and Control, Hunter New England Health, pers comm, October 2009) includes:

- infective spinal discitis or osteomyelitis
- infected joint replacements (early or late)
- bacterial meningitis (suspected or proven)
- bacterial or culture-negative endocarditis
- *S. aureus* bloodstream infection
- fever of unknown origin or where response to antimicrobial treatment is poor.

### 8.6 Antimicrobial formularies and approval systems

As discussed in Chapter 2, formulary restriction and prior approval is considered an essential component of any hospital antimicrobial management program. On average, these restrictive interventions have more than a three-fold effect on influencing proper prescribing when compared to persuasive interventions, such as education. Fishman cites prior approval as probably the single most effective intervention to improve antimicrobial use. The ID service has an important role to play in managing the approval process and developing a restricted formulary.

#### 8.6.1 Formularies

ID staff should participate in the development and maintenance of the antimicrobial section of the hospital formulary, and the list of restricted antimicrobials. It is important that formulary decisions are informed by local microbiological information. The ID service should participate in the hospital’s drug and therapeutics committee procedures involving antimicrobials, including:

- evaluating requests for new antimicrobials
- extending indications for existing products
- recommending products that should be restricted
- defining the criteria for prescribing restricted products.

This can be achieved through direct membership of the drug and therapeutics committee, or liaison between the committee and the ID service or AMS team. The ID service should also participate in a regular review of the antimicrobial formulary using facility-specific antimicrobial susceptibility data to guide decisions.
8.6.2 Approval systems

To be effective, antimicrobial approval systems require close collaboration between the ID (or clinical microbiology) and pharmacy services.

In 2004, ID physicians were surveyed in the United States, and most agreed that ID consultants should be directly involved in the approval process. However, significant barriers have been identified, including the time involved in the authorisation process. To overcome this barrier, electronic approval systems may be used, or the approval process may be delegated to ID fellows or clinical pharmacists (with referral to an ID physician for expert advice). Mechanisms for administering approval systems are discussed in Chapter 2.

Requests for antimicrobials provides an opportunity to educate prescribers. If a conversation with the requesting doctor and an ID physician is required, opportunities are created to provide management advice as well as guidance on antimicrobial use. Medical staff in an Australian teaching hospital reported finding the advice provided by an approval system managed by the ID unit to be useful and educational. Sunenshine et al. reported similar findings in their survey of ID physicians in the United States. Most prescribers in the Australian study believed the advice improved patient outcomes. There have been concerns that a web-based antimicrobial approval program would reduce personal communication and education opportunities, but these systems actually facilitate communication and education while saving ID physician time.

8.7 Review and feedback strategies

The evidence for the use of antimicrobial review with intervention and feedback is discussed in detail in Chapter 3. Effective programs involve a member of the AMS team (an ID fellow or physician, or a clinical pharmacist) who reviews:

- orders for target drugs such as broad-spectrum antimicrobials
- potentially inappropriate antimicrobial therapy
- antimicrobial agents not concordant with hospital guidelines

An ID physician may be consulted if a conflict arises.

Review and feedback strategies are considered particularly important in streamlining antimicrobial use and the ID service delivers the point-of-care interventions described in Chapter 4.

8.7.1 Antimicrobial stewardship team rounds

Antimicrobial stewardship team rounds provide the opportunity for ID physicians to discuss therapeutic options at the bedside with the treating clinician.

Intensive care units (ICUs), dialysis units, and oncology and bone marrow transplant wards are some of the primary areas associated with inadequate antimicrobial treatment and could be the focus for AMS team rounds. At a minimum, ICU
patients should have their therapy reviewed by the AMS team. Patients can also be referred for review by the team by clinical pharmacists.

Inadequate treatment of bloodstream infections and nosocomial pneumonia, particularly in ICUs, are recognised as potential causes of increased patient morbidity. All ICUs should have ID or clinical microbiology input. At rural hospitals, intensive care rounds can take place via teleconference with the on-duty intensivist in attendance. A pharmacist can assist in these rounds by assembling a list of the antimicrobials, dose and start dates for each patient prior to the round. The Healthcare Infection Control Special Interest Group provides guidelines for recommended ICU round processes.

8.8 Antimicrobial policies, guidelines and clinical pathways

The ID service has an important role in the development, implementation, review and audit of antimicrobial policies, prescribing guidelines, clinical pathways and bundles of care. This supervision is considered necessary to ensure that prescribing guidelines, restriction policies and other activities are based on best evidence and that patients are not placed at risk.

Several studies have demonstrated that clinical pathways and guidelines can be effective in improving patient outcomes and cost-effectiveness of treatment. Implementation of a multidisciplinary practice guideline in a surgical ICU led to a 77% reduction in antimicrobial use and cost, a 30% reduction in overall cost of care, decreased mortality and a trend to shorter hospital stay. Martinez et al. found that the implementation of guidelines on patients with pneumonia was accompanied by an increase in the percentage receiving the process of care and a lower inpatient hospital mortality rate during the first 48 hours of care and after 30 days. Clinical stability is also reached earlier in patients hospitalised for community acquired pneumonia when the antimicrobial treatment is begun early and complies with the recommendations.

The long-term effect of guidelines on antimicrobial resistance remains to be determined. However, several studies on hospital acquired pneumonia and ventilator-associated pneumonia indicate that improving antimicrobial prescribing through use of guidelines may decrease emergence of resistant pathogens.

8.8.1 Guideline and clinical pathway development

It is recommended that hospitals develop antimicrobial guidelines for treatment and prophylaxis for common infections relevant to the:

- patient population
- local antimicrobial resistance profile
- surgical procedures performed in the institution.

a www.asid.net.au/hicsigwiki
The Therapeutic Guidelines: Antibiotic are recognised as a national standard for antimicrobial prescribing in Australia. Institutional clinical guidelines developed for local use should accord with these guidelines. They should incorporate local microbiology and resistance patterns and specify recommended agents(s), dose, route and duration of antimicrobial treatment for major categories of infection.

The ID services should establish whether there are local reasons for varying from the national guidelines. The AMS team should be responsible for developing and regularly updating institutional antimicrobial prescribing guidelines in consultation with key clinicians or clinical opinion leaders. Recommendations should refer to infections that occur with particular frequency in hospitals. The United Kingdom Specialist Advisory Committee on Antimicrobial Resistance has published a list of common clinical syndromes appropriate for local antimicrobial treatment guidelines. (See Section 1.11.1.)

Suggestions for prescribing guidelines that should be easily accessible to staff members are provided in Section 1.11.1. Some examples of guidelines are provided in Appendix 2, Section A.2.1.

### 8.8.2 Surgical prophylaxis

Surgical site infection is one of the most common healthcare associated infections. Prophylactic antimicrobial use has an important part to play in the prevention of postoperative wound and deep-site infections. As much as one-third to one-half of antimicrobial use in hospitals is for surgical prophylaxis. Studies report levels of inappropriate use ranging from 30% to 90%, especially with respect to timing and duration.

It is recommended that every surgical department should develop a guide for surgical prophylaxis appropriate for the type of surgery performed by staff in the department (see the example in Appendix 2, Section A.2.1). The development and implementation of these guidelines should involve key players in surgical disciplines as well as the ID services. They should incorporate local microbiology and resistance patterns, and the selection pressure of antimicrobial use. Third-generation cephalosporins (e.g. cefotaxime and ceftriaxone) should be avoided.

Surgical prophylaxis guidelines should include:

- the indication for prophylaxis (type of surgery)
- recommended antimicrobial, dose and route
• the preferred option being a single dose\(^a\)
• instances where a second dose may be required (e.g. when procedures are delayed or prolonged (> 4 hours), or major intraoperative blood loss)
• an alternative agent where a beta-lactam antimicrobial is recommended as first line (for patients with a history of allergy to penicillins and cephalosporins)
• optimal time for administration (up to 60 minutes before induction).

8.8.3 Guideline implementation

Numerous studies have shown poor uptake of guideline recommendations.\(^{107}\) Guidelines need implementation plans that are well developed, executed, sustained and embedded in comprehensive programs for change.\(^{107}\) In a survey of New South Wales hospitals, 79% of respondents reported using the *Therapeutic Guidelines: Antibiotic*\(^19\) as a basis of antimicrobial prescribing recommendations.\(^{76}\) However, interventions to implement the guidelines were varied and inconsistent, and evaluation of the effectiveness of the interventions was not common practice.\(^{76}\) The literature defines several barriers to proper guideline use by prescribers, including:

- feelings of lack of ownership
- loss of flexibility and professional autonomy
- beliefs that following guidelines can be burdensome and irrelevant to patient care
- lack of knowledge of existing physician practices.

These barriers need to be recognised and addressed as part of the local implementation plan for introducing prescribing guidelines.\(^{76}\) Another significant barrier is that strategies for implementation at the local level are often not a part of national guidelines.\(^1\)

ID staff should take an active role in implementing and evaluating antimicrobial policy and guidelines. Successful guideline implementation requires the support of motivated individuals to facilitate change\(^{131}\) and research has shown that clinicians are more likely to follow a policy that is supported by their ID colleagues.\(^{29, 127}\)

There is good evidence that guideline implementation can be facilitated through education and feedback on antimicrobial use and patient outcomes.\(^1\) Compliance is also improved by promoting the ownership of guidelines through the development of local guidelines, or adapting the national guidelines to suit the local circumstances.\(^{12}\) A study in the Netherlands reported increased compliance (from 67% to 86%) after revised guidelines were introduced, when physicians were widely consulted in the revision of guidelines for antimicrobial therapy, followed by active dissemination.\(^{132}\)

In teaching hospitals, where senior medical clinicians influence trainees’ prescribing, it is particularly important that senior staff engage in the implementation process.

\(^a\) There is consistent evidence that a single dose of an antimicrobial agent with a half-life long enough to achieve activity throughout the operation is adequate for many types of commonly performed surgery.\(^{130}\)
through involvement in local guideline development. Aiming education at authoritative senior department staff has been shown to have a significant impact in changing surgical antimicrobial prophylaxis practices.\(^\text{12}\)

One barrier to appropriate prescribing is that senior clinicians and registrars are not aware of local and national resources that are available to support decision making.\(^\text{9}\) The ID service and AMS team can promote the existence of antimicrobial prescribing guidelines, educate staff and liaise with hospital management to ensure the guidelines are readily available at the point of care. This can be achieved by making the guidelines available through several sources, including pocket-sized printed editions, the institution’s intranet and other technology such as personal digital assistants.\(^\text{3}\) Embedding guidelines into clinical decision support for electronic prescribing systems will provide further opportunity to guide prescribing at the point of care.

### 8.8.4 Maintenance of guidelines and clinical pathways

Guidelines and clinical pathways need to be regularly reviewed by the AMS team — a minimum of annually has been recommended.\(^\text{17}\) They need to consider the latest version of the *Therapeutic Guidelines: Antibiotic*,\(^\text{19}\) and local microbiology and resistance patterns, which require the input of ID staff.

An important part of this process is ensuring that only the latest versions of clinical guidelines and pathways are available for use.

### 8.8.5 Evaluating interventions and monitoring antimicrobial use

Evaluation of the use of prescribing guidelines and providing feedback to prescribers is an important step in the quality-improvement cycle, as well as a useful strategy to promote the use of guidelines and clinical pathways, and influence prescribing (see Chapter 3).\(^\text{1, 17-18}\) Auditing an organisations’ antimicrobial use also identifies whether implementation strategies are effective and whether different approaches are needed. Monitoring the use of guidelines and their outcomes, including the use of quality use of medicines indicators for antimicrobial therapy, is discussed in more detail in Chapter 5.

Continuous surveillance of antimicrobial use is considered an essential component of AMS programs. ID services should contribute to establishing and evaluating an antimicrobial surveillance system in their organisation. The data produced can be used to assess the need for programs to reduce antimicrobial use, and to scope programs and evaluate whether they are effective. Measuring the rate of antimicrobial use in adult patients by using a ratio of defined daily dose per occupied bed-days is recommended. (See Appendix 1.)

ID staff should also coordinate participation of the hospital in state or national antimicrobial surveillance systems, and advise on the local use of the data (refer to Appendix 1 for details on the National Antimicrobial Utilisation Surveillance Program and reporting measures).
ID staff should:

• advise the AMS team on areas to target for review or on antimicrobial usage evaluation studies

• assist in results analysis

• help to produce reports and recommendations for the committees of
  » drug and therapeutics
  » infection control and prevention
  » health service safety and quality.

See Chapter 5 for detailed discussion on monitoring antimicrobial use.

### 8.9 Liaising with other clinical departments and committees

Effective AMS programs require collaboration between the ID services and other departments and committees, including:

• clinical departments — with the development and implementation of policies and guidelines, and providing education and feedback on results of audits and drug usage evaluation studies

• pharmacy staff — with restricted formulary and approval system management, and the provision of expert advice and support for other AMS interventions described in Part 1; this may include consultation when a conflict arises

• infection prevention and control staff — it is recommended that an ID physician takes a leadership role in the management of the hospital's infection control and prevention program. This provides the ideal opportunity for infection control practices to be enhanced by AMS activities in the control of outbreaks of resistant organisms.

#### 8.9.1 Infection control professionals

Infection control professionals (ICPs) can play an important role in AMS activities and should be included in the hospital's AMS team. Integrating the AMS program with the hospital's infection prevention and control program provides opportunities to synergistically reduce antimicrobial resistance and improve patient outcomes. Data collected by ICPs on nosocomial infections may be useful to evaluate the outcomes of AMS activities. ICPs can include information on AMS in their infection control education programs for healthcare workers — including nursing staff responsible for administering antimicrobials and collecting microbiology specimens. Integrating principles of AMS into infection control education can contribute to the hospital's efforts in preventing emergence of antimicrobial
resistance and subsequent transmission. This education can also cover the correct collection, handling and transport of specimens to avoid degradation or contamination of specimens. ICPs aware of their organisation’s antibiogram can be alert to trends in local resistance patterns and the need to instigate increased infection prevention measures in patients colonised or infected with multiresistant organisms.

8.10 Education of staff

One of the primary roles of the ID specialist is that of a teacher.\textsuperscript{120} Education can be provided as part of a multidisciplinary program,\textsuperscript{17} with presentations at grand rounds or as part of an intervention (e.g. during the approval process or feedback following review of antimicrobial prescribing). Petrak et al. describe ‘… an ID consultation that is written, verbally discussed, supported by literature, and refocused as the case evolves’ as the perfect model for educating healthcare staff.\textsuperscript{120}

Using education as a strategy to influence prescribing behaviour is discussed in detail in Chapter 6.

8.11 Interactions with pharmaceutical companies and their representatives

The influence of the pharmaceutical industry on the prescribing of medicines is discussed in detail in Chapter 6. Studies of interactions between medical professionals and the pharmaceutical industry\textsuperscript{110-112} confirm that these interactions can increase formulary-addition requests (even when there was no therapeutic advantage over existing formulary drugs) and affect prescribing practices. These findings highlight the importance of educating prescribers about the influence of pharmaceutical industry relationships and sponsorship on prescribing behaviour.

The ID service should not only be involved in the provision of this education at undergraduate and postgraduate levels, but the ID physicians themselves need to exercise caution in their interactions with pharmaceutical companies and their representatives. They should actively support the development and implementation of hospital policies that restrict staff access to pharmaceutical representatives, and support the adoption of conflict of interest guidelines developed by professional societies or colleges (see Appendix 2, Section A2.2 for a list of available Australian guidelines and policies). These guidelines should be incorporated into hospital policy and training programs. This topic is further discussed in Chapter 6.