Standard of practice in infectious diseases for pharmacy services

Standard of practice in infectious diseases

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Preface

This Standard references and relies upon the SHPA Standards of Practice for Clinical Pharmacy Services\textsuperscript{1} as the foremost Standard. This Standard may overlap with others and depending on the area of specialty practice it may be advisable to refer to additional Standards of Practice.

The use of the word ‘specialisation’ in this standard is in line with the National Competency Standards Framework for Pharmacists in Australia,\textsuperscript{2} where ‘specialisation’ refers to the scope of practice rather than the level of performance. ‘Specialisation’ of itself does not confer additional expertise.

This Standard is for professional practice and is not prepared or endorsed by Standards Australia. It is not legally binding.

Introduction

In Australia, everyone shares a fundamental right to safe and high-quality healthcare. This is defined in the Australian Charter of Healthcare Rights,\textsuperscript{3} which all healthcare systems must strive to uphold. The Charter summarises the basic rights of patients and consumers when accessing healthcare...
services including access, safety, respect, partnership, information, privacy and the ability to give feedback. The provision of pharmacy services must encompass the Charter to deliver effective, efficient, timely and equitable patient-centred care.

The National Competency Standards Framework for Pharmacists in Australia complements the underpinnings of the Charter across five domains of competency for the pharmacy profession, namely: (1) professionalism and ethics; (2) communication and collaboration; (3) medicines management and patient care; (4) leadership and management, and; (5) education and research.²

Purpose and definitions

The purpose of this Standard is to describe best practice for the provision of clinical pharmacy services for infectious diseases (ID). Throughout this Standard, all pharmacists working in the broad field of infectious diseases will be referred to as an ‘ID pharmacist’. The ID pharmacist may practice in hospitals (including both the inpatient and outpatient setting), and in community and domiciliary settings.

An infectious diseases service consists of a multi-disciplinary team that works to prevent, treat, and manage illness, disability and death caused by a wide range of infectious diseases.

Antimicrobial stewardship (AMS) is a systematic approach by a health service organisation that promotes optimal antimicrobial prescribing to improve patient outcomes and decrease the incidence of antimicrobial resistance.³

The Standard predominantly refers to pharmacists but may be applied to suitably qualified pharmacy technicians where appropriate.¹ The SHPA supports both pharmacists and pharmacy technicians to operate at their full scope of practice to achieve optimal patient and pharmacy outcomes.

The infectious diseases pharmacy service

Infectious presentations and complications occur across all patient populations and antimicrobials are among the most prescribed medicines in the clinical setting. Therefore, ID pharmacy services may operate in a wide variety of settings and subspecialties. This service usually operates as part of an organisation’s infectious diseases service and should be provided by pharmacists whose main area of specialisation is infectious diseases. An extension of the infectious diseases pharmacy service is the AMS pharmacy service, where the ID pharmacist practising in this subspecialty leads and/or is a core member of an organisation’s multidisciplinary AMS service.⁴
The role of the ID pharmacist should include:

- delivery of pharmacy services that add value to healthcare systems and improve patient outcomes
- the development of and input into policies, procedures, guidelines and resources
- advice on medicine formulary decisions with relevance to infectious diseases
- the provision of educational programs and training for healthcare professionals and students
- quality improvement activities and research related to infectious diseases.

Additionally, the role may include involvement in:

- hospital governance teams
- AMS programs
- community based parenteral antimicrobial therapy (CoPAT) programs
- external committees.

The ID pharmacist should be a point of contact for medicines information enquiries related to ID, for other pharmacists, health professionals and the health service.

Evidence of pharmacy impact in Infectious Diseases

ID pharmacists are locally and internationally recognised for their leadership, clinical impact, change management and research in this broad field. There is increasing evidence of ID pharmacists collaborative involvement in the pharmacological management of complex patient populations with infectious diseases, such as those seen in the critical care setting, haematology and oncology settings, peri- and post-transplant recipients, patients with sexually transmitted infections and those with Human Immunodeficiency Virus (HIV). ID pharmacist-driven research in antimicrobial dose optimisation using therapeutic drug monitoring and pharmacokinetic/pharmacodynamic modelling has been pivotal in shaping the international guideline and clinical practice landscape in the critical care setting.

Local evidence for hospital AMS programs led by or including ID pharmacists has shown increased antimicrobial prescribing appropriateness, reduced use of target antimicrobials and provision of cost savings without adversely impacting clinical outcomes such as length of stay and mortality. Pharmacists are continuing to show their expertise in specific subspecialty areas within AMS, including antifungal stewardship, and antimicrobial allergy de-labelling. Published evidence abroad is consistent with the Australian experience and further supports these findings.
Objectives of the service

The objectives of an infectious disease pharmacy service are to optimise the use of antimicrobials, minimise the emergence of resistance to antimicrobials and ensure the safe and effective use of antimicrobial agents to improve patient health outcomes. Inappropriate use of antimicrobials may contribute to an increased risk of antimicrobial-resistant pathogens. Furthermore, patients with antimicrobial-resistant infections require more complex antimicrobial regimens, have longer hospital admissions, require additional investigations and have increased morbidity and mortality, compared to patients infected with non-resistant pathogens.\textsuperscript{32}

ID pharmacists must deliver the service as part of interdisciplinary collaboration and within the framework of evidence-based, patient-centred healthcare, to ensure optimal patient outcomes. The ID pharmacist must contribute to, and collaborate to, address the broader aims of infection prevention and control.

Scope

This Standard applies to all pharmacists working in infectious diseases. In addition, this standard can be used by non-specialised pharmacists with the support of an ID pharmacist. This Standard is intended to be used across hospital pharmacy services in Australia, regardless of the service type (public or private) or location (metropolitan, regional or rural). The service may be delivered across several settings including the inpatient, outpatient and/or ambulatory care setting. Although this Standard is intended for hospital pharmacy services, the principles and aspects of patient management discussed herein can be applied to broader pharmacy services, for example in primary care.

The scope of services provided by ID pharmacists will depend on a variety of factors including the setting, patient population, the services that the hospital or health service provides, funding models, governance structures for infectious diseases services, infectious diseases unit and pharmacy department priorities, organisational priorities and the scope of practice of the individual pharmacist. Although the range of pharmacy services provided in infectious diseases is primarily delivered by pharmacists, it may be supported by pharmacy technicians in clinical and non-clinical roles.
The infectious diseases pharmacy service should provide those services described in the SHPA Standards of Practice for Clinical Pharmacy Services and may include the following key services, and where relevant, special settings services, to support patient care.

**Key service areas**

Depending on the health service organisation and the resources available, the role of the ID pharmacist should include:

- providing clinical leadership in the field of infectious diseases
- leading or supporting AMS programs and initiatives
- performing quality improvement activities and research related to infectious diseases
- delivering pharmacy services that add value to healthcare systems and improve patient outcomes e.g., patient education, counselling and obtaining informed consent
- developing and providing input into policies, procedures, guidelines and resources
- advising on medicine formulary decisions with relevance to infectious diseases
- providing educational programs and training for healthcare professionals and students
- responding to medicines information enquiries related to infectious diseases
- collaborating with other units, particularly Microbiology and Infection Prevention and Control (IPC)
- procurement and supply of antimicrobial therapy, including management of drug shortages.

At the patient level, the role of the ID pharmacist should include (but not be limited to):

- participating in multidisciplinary ward rounds to optimise antimicrobial therapy
- promoting the switch from intravenous to oral antimicrobial therapy where appropriate
- pharmacokinetic and pharmacodynamic optimisation, including therapeutic drug monitoring
- engaging with patients and carers to provide education and encourage shared decision making
- antimicrobial-allergy label assessment including de-labelling and desensitisation.

Additional roles may include involvement in:

- hospital governance teams
- infection prevention and control teams

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Infectious diseases
The ID pharmacist should demonstrate competence (knowledge, skills and attributes) across the many types of infectious diseases commonly encountered across the hospital and extending to other areas. Such infections include (but are not limited to); skin and soft tissue infections, urinary tract infections, bloodstream infections, pneumonia (both community and hospital-acquired) and *Clostridioides difficile* infection. Domains of clinical practice commonly encountered by the ID pharmacist are shown in Box 1.

Not all health service organisations will have a dedicated inpatient infectious diseases service, and patients with infectious presentations or complications may be admitted under other clinical units within the hospital setting. In this situation, the ID pharmacist should provide their knowledge and skills on a consultation basis.

Antimicrobial stewardship
The ID pharmacist has long been recognised as a core member of the multidisciplinary AMS team. The pharmacist should perform key leadership and resource roles, including coordination of the activities of the health service organisation’s AMS program. The ID pharmacist in AMS should demonstrate an in-depth clinical knowledge of infectious diseases, have practiced clinically as an ID pharmacist, possess a strong working knowledge of technology utilisation and have received either formal or informal AMS training. In addition to patient-level roles, the ID pharmacist in AMS has important roles at a systems level, including:

- leading, implementing and evaluating AMS program activities and initiatives
- managing antimicrobial formularies from an AMS perspective and managing approval systems
- monitoring antimicrobial use and evaluating interventions
- liaising with internal and external AMS stakeholders
- involvement in the audit and feedback processes for antimicrobials, to promote safe and appropriate antimicrobial prescribing
- surveillance and feedback of antimicrobial consumption within the healthcare system
delivering staff AMS training and education

- supervising and educating other pharmacists and pharmacy technicians working within the wider AMS team.

More recently the roles of pharmacists, including the ID pharmacist, in a pandemic have been highlighted. This is discussed in Box 2.

The ID pharmacist should have allocated time and resources to carry out these AMS activities.

[Box 2]

Special Settings

In addition to the key areas of practice, the delivery of an infectious diseases pharmacy service may include the following special settings.

Rural and regional health services

Many hospitals and health services in rural and regional areas lack the resources required to implement a comprehensive onsite AMS program. Research has demonstrated that inappropriate prescribing of antimicrobials is higher in rural and regional areas than in major metropolitan hospitals.

In rural and regional areas, significant gaps have been demonstrated such as persistent staff shortages (with high reported rates of locum medical and nursing staff); insufficient training and education; geographical isolation; and competing priorities to AMS, thus novel AMS strategies may be required. Strategies that may be beneficial and can be utilised to supplement healthcare to remote areas include using electronic medical records and electronic medication management systems to enable remote surveillance of AMS programs and telehealth platforms by a central organisation that consists of a multidisciplinary team (ID physician, AMS pharmacist, clinical nurse consultant). Telehealth, for example, has been associated with a reduction in antimicrobial use. Pharmacists in rural areas should be upskilled to ensure they can provide adequate oversight of antimicrobial prescribing. In addition, pharmacists can play a key role in delivering these services by facilitating engagement with local prescribers and the central organisation, as well as upskilling healthcare professionals such as nurses.

Private sector

Private hospitals face challenges including increasing the awareness of the appropriate use of antimicrobials and ensuring engagement of clinical stakeholders with regards to the uptake of ID and
AMS interventions. Approximately two-thirds of Australia’s elective surgeries are undertaken in this sector. Targeted AMS interventions and strategies to ensure the appropriateness of surgical antimicrobial prophylaxis prescriptions have been shown to be successful.

Many prescribing clinicians may be Visiting Medical Officers, which may make engagement challenging, such as limited participation in local peer education activities. Establishing and sustaining an AMS program in private hospitals where resources may be limited may require more innovative approaches, such as those described for rural and regional settings above.

To be successful, AMS programs in the private sector should have formalised, networked arrangements in place to promote reliable and sustainable access to AMS essential services. An approach similar to that advocated for in acute care settings, with a particular focus on obtaining executive support, multidisciplinary input and engagement with all stakeholders involved in the use of antimicrobials, should be adopted.

[Table 1]

Emerging Services

Emerging services relate to services that are innovative, future-focused and are provided in addition to key service areas. The following emerging services are strongly encouraged, as there is growing evidence of improved patient outcomes.

Infectious Diseases in Primary Care

Much of the practice of infectious diseases pharmacy in primary care to date has been in the field of AMS. AMS in general practice, which includes non-medical prescribers such as dentists and community pharmacists, needs to consider the different contexts within which antimicrobial prescribing decisions are made, the nature of patient encounters and presentations and the different supports and infrastructure available in general practice compared to hospitals. The AMS team in general practice is different from that in hospitals. Team members include GPs, pharmacists, practice nurses and practice administrative personnel.

The Antimicrobial Stewardship in Australian Health Care book details the role of general practice in AMS covering factors that influence antimicrobial prescribing, AMS strategies for general practice and clinical governance and leadership. The Royal Australian College of General Practitioners (RACGP) position statement for primary care, supports a collaborative multi-sectorial approach to ensure appropriate antimicrobial use, and efforts to reduce antimicrobial resistance. Proposed activities for AMS have been included in the RACGP’s Standards for General Practice, however, this is only a voluntary accreditation process for GP practices. Pharmacists, in general, are well placed to...
be effective stewards of antimicrobials and are able to play a significant role in collaboration with other healthcare professionals, to optimise the quality use of antimicrobials and help achieve the accreditation standards in primary care. Potential roles for pharmacists can occur at the following levels: patient, clinical and system, with suggested activities listed in Table 2.

[Table 2]

AMS in Aged care facilities

Pharmacists are well-placed to help facilitate AMS activities in aged care facilities as this is an emerging area. Residential aged care facilities (RACFs) provide home-like care to an increasing proportion of Australia’s aging population, with demand continuing to rise. Residents in RACFs are potentially a high-risk population, with a high infection burden. They have a high rate of transfer to acute-care hospitals, often for infection management, and a high burden of exposure to antimicrobials to treat or prevent infection. Both of these factors increase the selection pressure for the acquisition of multidrug-resistant organisms. Critically, there are significant gaps in RACFs with regard to AMS activities. AMS interventions are needed to improve antimicrobial use in RACFs. Interventions require GPs, pharmacists and onsite RACF staff to work together to identify strategies to improve AMS.

The Aged Care Quality Standards, which were implemented in July 2019, require aged care homes to demonstrate practices that promote appropriate antimicrobial prescribing. Pharmacists can play a lead role in several of these AMS initiatives (Table 3). Resources such as the RACGP Aged Care Clinical Guide (Silver Book) can be utilised for guidance with regards to AMS interventions in infection and sepsis care in RACFs.

[Table 3]

Policies, Procedures, and Governance

The ID pharmacist is often a senior member of the pharmacy team and can contribute to the overall governance and strategic planning of clinical services within a hospital, health service or health organisation. The ID pharmacist is a clinical pharmacy leader and may use this position to ensure key priorities are integrated into clinical and corporate governance structures.

ID pharmacists must have knowledge of the following documents that provide a framework within which the pharmacist must practice:

- Australian Charter of Healthcare Rights


- National Safety and Quality Health Service (NSQHS) Standards, including the National Model Clinical Governance Framework;
- NSQHS Preventing and Controlling Healthcare-Associated Infection Standard, including relevant NSQHS Standards Advisories from The Australian Commission on Safety and Quality in Health Care;
- Antimicrobial Stewardship Clinical Care Standard, which is referenced in the NSQHC Standards;
- Recommendations from national antimicrobial prescribing guidelines, i.e., Therapeutic Guidelines: Antibiotic;
- Pharmacy Board of Australia Code of Conduct;
- SHPA Code of Ethics;
- PSA National Competency Standards Framework for Pharmacists in Australia;
- Professional Practice Standards;
- Clinical Governance Principles for Pharmacy Services;
- Responding to the threat of antimicrobial resistance: Australia’s first national antimicrobial resistance strategy 2015-2019;
- Australia’s National Antimicrobial Resistance Strategy – 2020 and Beyond;
- Relevant State and Territory legislation.

Policies for the practice of clinical pharmacy provide a basis upon which infectious diseases-specific policies may be developed and applied.

A number of state and local policies, procedures and guidelines are relevant (depending on health care setting) to the ID pharmacist. These include restricted antimicrobial policies and/or guidelines, antimicrobial therapeutic drug monitoring policies and/or guidelines, Co-PAT policies and/or guidelines and antimicrobial allergy assessment, de-labelling and desensitisation procedures. State and Territory-wide examples are listed in Appendix 3.

Recommended reference texts and disease-specific guidelines for ID pharmacists are listed in Appendices 2 and 3. For resources relating to education and quality improvement, please see Tables 6 and 7.

Recommended Staffing

As per the Clinical Pharmacy Standards, three major factors drive staffing levels for clinical pharmacy services:
(1) range of clinical pharmacy services,

(2) the complexity of care required and

(3) hospital throughput.

Recommended pharmacist staffing levels for infectious diseases pharmacy services are presented in Table 4 and Table 5. These levels should be interpreted with consideration for the health service, activities performed by the ID pharmacist and those that are undertaken by other pharmacists and pharmacy technicians. Intern and early career pharmacists should be supported by a senior ID pharmacist.

The roles of ID pharmacists are varied and dependent on the model of care and size of the health service. Recommended staffing is, therefore, a reflection of these factors. Whereas the traditional model has been that ward-based pharmacists are wholly responsible for an individual patient, pharmacists are increasingly practicing in team-based models and with specialisation, in consultant-type roles. As the models of practice change and roles advance, the provision of advanced pharmacy care for an individual patient may be shared between pharmacists.

[Table 4]

Infectious diseases wards often have patients admitted with complicated medical and medication histories, as well as severe infections accompanied by complicated anti-infective drug regimens with high likelihoods for drug interactions, frequent dose adjustments and application of therapeutic drug monitoring. ID pharmacists are also expected to take a leading role in the provision of education for other staff in the hospital on topics related to their expertise and the development of relevant policies and procedures for optimized use of antimicrobials within specialty areas and at an institutional level.

[Table 5]

Staffing for AMS pharmacy services

ID pharmacists, working in an AMS team, provide a consultation service for complex patients who do not fall under the ID admitting unit. There is currently no consensus on staffing recommendations for AMS pharmacists working in a system as defined above in Australia, or internationally. Previous Australian suggestions for AMS pharmacist resourcing have been 10 hours per week for every 100 acute beds, which equates to approximately 0.3 FTE.\textsuperscript{68} International staffing proposals vary widely, with 0.25 to 1.0 pharmacist FTE per 100 inpatient beds.\textsuperscript{69-73}
Training and Education

It is essential to develop the pharmacy workforce through the training and education of pharmacists and technicians, to enable the delivery of advanced pharmacy care in infectious diseases.

Pharmacists commencing practice in ID should undertake relevant orientation and training.

ID pharmacists should have a scope of practice competency profile with a continuing professional development (CPD) plan that covers the five domains of professional performance as per the National Competency Standards Framework for Pharmacists in Australia 2016. Although the framework itself is not tied to any area of specialisation, for infectious diseases pharmacists, there are qualifications, educational activities, knowledge and skills that are recommended in addition to those of a clinical pharmacist. These have been informed by the SHPA infectious diseases Leadership Committee.

Training and education will predominately be work-based and should follow the principles for teaching adult learners outlined in Chapter 10 of the SHPA Standards of Practice for Clinical Pharmacy Services. Where possible, training should be multi-disciplinary to promote shared knowledge about the role of different healthcare professionals in managing patients with infectious diseases. Participation in research should be considered a core component of training and education and will be discussed further in ‘Research’.

Knowledge, Skills and Experiential Learning

The role of an ID pharmacist, like any clinician with specialised expertise, is based on a high level of skill in general clinical pharmacy rotations with the later addition of specialty-specific experience. Pharmacists working in this area should have high levels of interpersonal skills, including confidence, empathy and effective communication skills, to provide personalised care. Underpinning knowledge related to key areas of pharmacy practice in infectious diseases are the skills and application of clinical pharmacy, which may be advanced by experiential learning.

This Standard does not list the competencies that the individual infectious diseases pharmacist should address, as this will be dependent upon their scope of practice. Where available, frameworks in line with the national competency standards, including Advanced Training Residency or the Advanced Pharmacy Practice Framework (APPF), can be utilised to support development across practice areas. The APPF Infectious Diseases has been adapted for pharmacists advancing their practice in infectious diseases and/or AMS and details the skills and knowledge required by the ID pharmacist for transition through to advanced levels.

The SHPA infectious diseases Leadership Committee considers the ability to undertake preceptorships and/or site visits to health services in either geographically diverse areas or areas of...
diverse practice to be a useful way of expanding knowledge and skills, particularly for those ID pharmacists practicing alone or at smaller sites.

**Credentialing and Qualifications**

Desirable certification, credentialing and qualifications for ID pharmacists may include:

- a postgraduate qualification in clinical pharmacy or an infectious diseases-related area, for example:
  - *Infectious Diseases by Distance Learning* offered by the London School of Hygiene & Tropical Medicine
  - Master of Public Health with specialisation in infectious diseases, infectious diseases control, or communicable diseases control (offered by several Australian universities)
- pharmacists can also obtain credentialing in infectious diseases pharmacy practice by completing the *Board of Pharmacy Specialties Infectious Diseases Pharmacy examination*
- completion of an Advanced Training Residency (or similar program) in the field of infectious diseases
- credentialing as an Advancing or Advanced Practice Pharmacist provided by Pharmacy Development Australia.

There are a variety of domestic and international certificate programs available, including:

- *Antimicrobial stewardship: managing antibiotic resistance* six-week course from the University of Dundee, Scotland and the British Society for Antimicrobial Chemotherapy (BSAC)
- *Antimicrobial stewardship: A competency-based approach* developed by the World Health Organisation
- *Antimicrobial Stewardship: Improving Clinical Outcomes by Optimization of Antibiotic Practices* offered by Stanford University
- *Antimicrobial Stewardship Certificate in Acute care or Long-term care* offered by The Society of Infectious Diseases Pharmacists (SIDP)
- *Human Immunodeficiency Virus (HIV), Hepatitis B and C, and sexually transmitted infections training* offered by the Australasian Society for HIV, Viral Hepatitis and Sexual Health Medicine (ASHM)

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1 This is a limited list offered for general information and does not represent endorsement of any provider; new providers may emerge. Some of the international offerings may need to be considered in the context of the Australian setting.
OPAT: Outpatient Parenteral Antimicrobial Therapy offered by the BSAC.

**Educational Activities**

As per the Pharmacy Board of Australia Guidelines on Continuing Professional Development, it is recommended that ID pharmacists have a significant proportion of their continuing professional development per year tailored to infectious diseases services. Recommended continuing education activities for ID pharmacists include local activities: attendance at hospital department meetings (such as the infectious diseases department), participation in local quality improvement activities, activities organised by statewide AMS programs (e.g. Queensland Statewide AMS Program) and bodies such as the New South Wales Clinical Excellence Commission or undertaking an accredited unit of study in ID pharmacotherapy via a university (e.g. Monash University or the University of Tasmania).

Several national and international organisations and professional societies are available for pharmacists to join. Examples of these are shown in Table 6 alongside examples of educational activities suitable for pharmacists. There is increasing use of social media as a valuable educational tool for healthcare workers, including ID pharmacists. 

[Table 6]

**Quality Improvement**

Quality improvement activities should demonstrate continuous and sustained improvements in patient care by targeting and achieving the best outcomes for all patient groups, including those at greatest risk of medicine misadventure. Quality improvement activities should also assess the impact of the ID pharmacist on patient care, and the overall safety and quality of the ID/AMS services provided.

The outcomes of interventions performed by the ID pharmacist can be difficult to isolate and quantify as many factors may impact patient outcomes. ID pharmacists often work as part of a multidisciplinary team, all working towards a common goal. When evaluating quality improvement measures it is important to consider limitations and variability of measurements (examples are provided in Appendix 4). Quality improvement outcomes should have a clear reporting structure within the hospital, health service or health organisation, which may be driven by the ID pharmacist.

All public and private hospitals, day procedure services and public dental practices are required to be accredited to the National Safety and Quality Health Service (NSQHS) Standards. Examples of quality
improvement activities which may be considered with a plan, do, study, act cycle for quality improvement activities are listed in Table 4. These are most clearly defined for AMS programs through structural, process, clinical outcome and balancing measures for which an ID pharmacist plays a lead role. Further information on quality improvement can be found in Chapter 14 of SHPA Standards of Practice for Clinical Pharmacy Services.

General resources for infectious diseases quality improvement:

- Antimicrobial Stewardship in Australian Health Care, Chapter 6: Measuring performance and evaluating antimicrobial stewardship programs
- NSW TAG National QUM Indicators for Australian Hospitals Set
- The Australian Commission on Safety and Quality in Healthcare Antimicrobial Stewardship Indicators to support Stewardship Programs
- National Quality Use of Medicines Indicators for Australian Hospitals
- World Health Organisation AWaRe (Access, Watch and Reserve)
- The Australian Commission on Safety and Quality in Health Care Access, Curb, Contain classification system for antimicrobial agents
- American College of Surgeons National Surgical Quality Improvement Program (NSQIP).

Research

Research is an essential component of continuing to deliver health care improvements and pharmacists should be lead researchers for advancing pharmacy service provision and optimising patient care. Pharmacist-led research should contribute to the body of knowledge providing evidence of impact of safe use of medicines and advanced pharmacy care for patients with infectious diseases. This may include identifying evidence gaps and implementing evidence-based practice in the optimal practice of infectious diseases. The research question and study design should be of interest to the infectious diseases and collaborating teams and be of benefit to patients. The research should focus on improved quality of life for patients, addressing the ongoing healthcare burden and minimizing deficits.

Examples of pharmacy research in infectious diseases include:

- studies to rationalise and optimise antimicrobial prophylaxis in at-risk patients, including in the peri-operative period
optimised dosing of antimicrobials including the use of therapeutic drug monitoring

- establishing protocols for evidence-based use of antimicrobials in relevant scenarios, including in the area of antimicrobial stewardship activities

- assessing the adherence to and impact of antimicrobial stewardship ward rounds

- multidisciplinary research e.g. prescribing behaviours for antimicrobials

- expanding roles of pharmacists e.g., partnered pharmacist medication charting, clinic participation, pharmacist delivery of immunisations

- expanding roles of pharmacy technicians in infectious disease admissions (e.g. stewardship or infectious disease rounds), quality use of medicines and services

- study of medicine safety e.g. electronic prescribing, digital health records, transitions of care

- cost-effectiveness studies

- health services, including implementation science, studies

- pharmacist-led penicillin allergy de-labelling

- development and/or validation of antimicrobial stewardship tools e.g., prescribing surveys and audits.

Cross-sector, inter-sectoral and interdisciplinary research is advocated to ensure the input of key stakeholders and that research is relevant to the Australian community.

External funding enables larger and possibly multi-centre studies to be conducted. The SHPA funds research grants, practitioner grants and educational grants. Grants may also be available from other organisations including local research foundations and charitable trusts such as the Australian Society of Antimicrobials (ASA), as well as major national funding bodies like the National Health and Medical Research Council (NHMRC) and the Medical Research Future Fund (MRFF) and finally from the pharmaceutical industry for investigator-initiated studies. It is imperative that ID pharmacists present and publish their studies in order to share new knowledge, guide others in the implementation of services related to optimal use of antimicrobials and care of patients with infectious diseases and to illustrate how ID pharmacists are demonstrating improvements in patient care.

The choice of a journal to publish in depends on the consideration of the best audience for the study results. The Journal of Pharmacy Practice and Research (JPPR) presents findings to a primarily...
Australian pharmacy audience but it also has a strong Asia-Pacific presence. Journals specific to infectious diseases are also highly appropriate.

Further research information can be found in Chapter 11 of the SHPA Standards of Practice for Clinical Pharmacy Services.\(^1\)

A health service organisation may also consider developing local partnerships to foster internal collaboration on quality improvement strategies. For example, a quality improvement activity that aims to improve prescribing of antimicrobials in community-acquired pneumonia may be a collaborative effort from the infectious diseases/AMS teams and/or respiratory, geriatric and emergency teams. This collaboration may foster shared ownership of the issue.

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Conflict of interest statement

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97. Australasian Society for HIV. Antiretroviral Guidelines US DHHS with Australian commentary. ASHM. Available at: https://arv.ashm.org.au/.

**Boxes**

**Box 1 Domains of infectious diseases commonly encountered by ID pharmacists in clinical practice**

<table>
<thead>
<tr>
<th>Domains of infectious diseases commonly encountered by ID pharmacists in clinical practice:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• clinical microbiology and antimicrobial resistance mechanisms</td>
</tr>
<tr>
<td>• infection prevention and control</td>
</tr>
<tr>
<td>• primary care</td>
</tr>
<tr>
<td>• aged care</td>
</tr>
</tbody>
</table>

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In the critical care setting, ID pharmacist involvement in antimicrobial dose optimisation using therapeutic drug monitoring and pharmacokinetic and pharmacodynamic modelling has influenced practice and clinical practice guidelines both locally and worldwide.\textsuperscript{21, 33, 34}

\textsuperscript{a}In the critical care setting, ID pharmacist involvement in antimicrobial dose optimisation using therapeutic drug monitoring and pharmacokinetic and pharmacodynamic modelling has influenced practice and clinical practice guidelines both locally and worldwide.\textsuperscript{21, 33, 34}

\textsuperscript{b}Co-PAT refers to ‘the use of both oral and parenteral antimicrobial medicines in a community setting, as an alternative to care in hospital’.\textsuperscript{34} The ID pharmacist plays a pivotal role in the therapeutic efficacy and safety of the medicine, in addition to factors such as the dosage schedule, stability and cost-effectiveness.\textsuperscript{35, 36}

\textbf{Box 2 The infectious diseases pharmacist and pandemic preparedness}

The Infectious Diseases (ID) Pharmacist and Pandemic Preparedness

ID pharmacists play an important role in pandemic preparedness as well as in the day-to-day management of infectious diseases outbreaks. The existing integration of the ID pharmacist within the Infectious Diseases and Infection Prevention Units places them in a leadership role during these uncertain times. This was recently highlighted during the global COVID-19 pandemic. Roles undertaken by ID pharmacists included (but were not limited to), review of rapidly emerging literature, contribution to local and national guidelines development and implementation, education, contact tracing, promotion of vaccination and promoting the appropriate use of antimicrobials in confirmed and suspected COVID-19 patients to mitigate antimicrobial resistance.

\textbf{Tables}

\textit{Table 1 The role of the pharmacist for ID activities in the private sector}\textsuperscript{a}

This article is protected by copyright. All rights reserved
<table>
<thead>
<tr>
<th>Pharmacist roles</th>
<th>ID activities performed by the pharmacist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient-level roles</strong></td>
<td>• promoting patient engagement regarding education about antimicrobials</td>
</tr>
</tbody>
</table>
| **Health Care workers-level roles** | • surgical antimicrobial prescribing  
• education-based initiatives  
• expanding the roles of both the nursing and pharmacy staff |
| **Facility-level roles** | • AMS champions |
| **System-level roles** | • promoting AMS activities at an executive level |

Table 2 The role of the pharmacist for ID activities in general practice

<table>
<thead>
<tr>
<th>Pharmacist roles</th>
<th>ID activities performed by the pharmacist</th>
</tr>
</thead>
</table>
| **Patient-level roles** | • direct patient consultation on antimicrobial matters including being part of the decision-making process utilising resources such as the shared decision-making tools  
• review of long-term antimicrobial prophylaxis  
• clarification of antimicrobial allergies  
• patient education  
• vaccination programs |
| **Health care workers-level roles** | • educating health care workers  
• academic detailing  
• reviewing clinician antimicrobial prescribing and providing direct feedback to the prescriber  
• medicines information requests  
• liaison with community pharmacists |
| **Practice-level roles** | • providing information on the optimal duration of antimicrobial therapy  
• setting default repeat limitations |
| **System-level roles** | • clinical guideline development  
• organisational level strategies (e.g., point of care testing, incentive schemes, delayed prescribing as appropriate for the Australian health care system) |

Table 3: The role of the ID pharmacist in aged care facilities

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<table>
<thead>
<tr>
<th>Pharmacist roles</th>
<th>ID activities performed by the pharmacist</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient-level roles</strong></td>
<td>• facilitating improvements in liaison between the RACF and hospitals</td>
</tr>
<tr>
<td></td>
<td>• review of long-term antimicrobial prophylaxis</td>
</tr>
<tr>
<td></td>
<td>• clarification of antimicrobial allergies</td>
</tr>
<tr>
<td></td>
<td>• patient education</td>
</tr>
<tr>
<td></td>
<td>• vaccination programs</td>
</tr>
<tr>
<td><strong>Health care workers-</strong></td>
<td>• auditing and feedback of appropriate antimicrobial use to prescribers (Aged Care National Antimicrobial Prescribing Survey</td>
</tr>
<tr>
<td><strong>level roles</strong></td>
<td>(AC NAPS))</td>
</tr>
<tr>
<td></td>
<td>• education of healthcare workers</td>
</tr>
<tr>
<td><strong>Facility-level roles</strong></td>
<td>• management of urinary tract infections including asymptomatic bacteriuria</td>
</tr>
<tr>
<td></td>
<td>• management of skin and soft tissue infections</td>
</tr>
<tr>
<td><strong>System-level roles</strong></td>
<td>• implementation of AMS strategies</td>
</tr>
<tr>
<td></td>
<td>• reviewing policies and procedures relating to infection control and/or the management of infectious diseases</td>
</tr>
</tbody>
</table>

Table 4: Recommended pharmacist staffing levels for the provision of clinical pharmacy services based on ‘overnight beds’.

Adapted from Table 9.1 Staffing Levels and Structure for the Provision of Clinical Pharmacy Services.¹

<table>
<thead>
<tr>
<th>Category</th>
<th>Service-related group/bed type</th>
<th>Beds to 1 FTE² pharmacist for clinical pharmacy services 5 days/week³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Infectious Diseases units¹</td>
<td>15</td>
</tr>
<tr>
<td>Specialist units, high dependence on medicines</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

² FTE = full-time equivalent.
³ Service on a weekend (assuming few admissions and discharges and medication chart review only) would require an additional 2 to 2.5 hours per day.
Table 5: Recommended pharmacist staffing levels for the provision of clinical pharmacy services. Adapted from Table 9.2

<table>
<thead>
<tr>
<th>Category</th>
<th>Patient/service type</th>
<th>No. of patients to 1 FTE pharmacist for clinical pharmacy services per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Outpatient clinics</td>
<td>Pharmacists participating in Medical Consultation clinics (including all Tier 2 Non-Admitted Services 20.1-20.51). Pharmacists providing services in Allied Health and/or Clinical Nurse Specialist Interventions clinics (including Tier 2 Non-Admitted Services: 40.01, 40.02, 40.07, 40.13, 40.19, 40.20, 40.21, 40.26)</td>
<td>22</td>
</tr>
</tbody>
</table>

Table 6: Infectious diseases organisations and professional societies, with examples of educational activities suitable for pharmacists

<table>
<thead>
<tr>
<th>Infectious Diseases Organisations and professional societies</th>
<th>Educational activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td></td>
</tr>
<tr>
<td>Australian Society for Antimicrobials</td>
<td>• Annual scientific meeting</td>
</tr>
<tr>
<td>Australasian Society for Infectious Diseases</td>
<td>• Annual scientific meeting</td>
</tr>
<tr>
<td></td>
<td>• Ozbug online networking forum</td>
</tr>
<tr>
<td>Australasian Society for HIV, Viral Hepatitis and Sexual Health Medicine (ASHM)</td>
<td>• Annual meeting</td>
</tr>
<tr>
<td></td>
<td>• Educational webinars</td>
</tr>
<tr>
<td></td>
<td>• Interactive online learning modules</td>
</tr>
<tr>
<td>NPS MedicineWise</td>
<td>• Online antimicrobial prescribing courses and case studies</td>
</tr>
<tr>
<td>National Centre for Antimicrobial Stewardship (NCAS)</td>
<td>• AMS seminars</td>
</tr>
<tr>
<td></td>
<td>• Annual national antimicrobial resistance forum</td>
</tr>
<tr>
<td></td>
<td>• Journal club meetings</td>
</tr>
<tr>
<td>Location</td>
<td>Organization/Program</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----------------------------------------------------------</td>
</tr>
<tr>
<td>The University Of Queensland</td>
<td>Centre of Research Excellence in Redefining Antimicrobial Use to Reduce Resistance (CRE-REDUCE)</td>
</tr>
<tr>
<td>SHPA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>United States of America</td>
<td>The Society of Infectious Diseases Pharmacists (SIDP)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Making a Difference in Infectious Diseases (MAD-ID)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>IDstewardship</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Clinical Care Options</td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>British Society for Antimicrobial Chemotherapy (BSAC)</td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Europe</td>
<td>European Society in Clinical Microbiology and Infectious Diseases</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7: Examples of quality improvement activities and available tools based on the type of measure. \(^{83}\) See appendix 4 for limitations and variability.

<table>
<thead>
<tr>
<th>Brief description of the measure</th>
<th>Examples of quality improvement measures</th>
<th>Examples of available tools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structure measures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessable by processes such as external evaluation and accreditation</td>
<td></td>
<td>The Australian Commission on Safety and Quality in Health Care Antimicrobial Stewardship Indicators to support Stewardship Programs (^{80}) NSQHS Standards Recommendations for clinical governance</td>
</tr>
<tr>
<td><strong>Process measures</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can involve assessment of adherence to established health care practices that are known to be linked to improved outcomes</td>
<td>Continuous antimicrobial usage surveillance • Defined daily doses per 1000 occupied bed days • Defined daily doses per 1000 inhabitants per day • Days of therapy (DOT) per 1000 patient days</td>
<td>National Antimicrobial Utilisation Surveillance Program (NAUSP) (^{84}) The Australian Commission on Safety and Quality in Health Care’s Antimicrobial Use and Resistance in Australia Surveillance System (AURA)</td>
</tr>
<tr>
<td></td>
<td>Concordance to accepted behaviours such as: • Prescribing guidelines e.g., surgical prophylaxis, pneumonia • Prescribing according to relevant microbiological results • Antimicrobial restriction policy • IV to oral switch</td>
<td>National Antimicrobial Prescribing Survey (NAPS), including specific modules for surgical procedures, aged care and quality improvement Global Point Prevalence Survey of Antimicrobial Consumption and Resistance</td>
</tr>
<tr>
<td>Clinical outcomes measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflect whether the changes linked to quality improvement activities are having the intended effect and improving patient care and outcomes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can be difficult to perform as there may be many confounders and time lags with the data.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient outcomes related to optimised treatment of infection:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- infection-related mortality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- hospital length of stay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- treatment response time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- hospital readmission rates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- e.g., surgical site infections, multi-resistant organism colonisation or infection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- hospital-acquired</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Clostridioides difficile</em> rates</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Australian Commission on Safety and Quality in Health Care Hospital-acquired complications list[^85]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surgical NAPS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rates of antimicrobial resistance (e.g., cumulative antibiograms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The Australian Commission on Safety and Quality in Health Care Cumulative-level antibiogram[^86]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost e.g., antimicrobial expenditure, therapeutic drug monitoring</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Balancing measures**

- Appropriate documentation e.g., allergy documentation and indication
- Prescribing patterns stratified by specialties or clinicians compared with an agreed target
- Qualitative evaluation e.g., survey to clinicians regarding their perception of the AMS program
- Rate of acceptance of AMS team recommendations within a given period

[^85]: Australian Commission on Safety and Quality in Health Care Hospital-acquired complications list
[^86]: Australian Commission on Safety and Quality in Health Care Cumulative-level antibiogram
Designed to ensure there are no unintended consequences of interventions

- infection-related mortality
- infection-related readmission within 28 days of discharge
- treatment-related toxicity or adverse events
- allergic reaction incidence

### Appendices

**Appendix 1. Glossary**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Allergy or allergic reaction</td>
<td>An allergy occurs when a person’s immune system reacts to substances in the environment that are harmless for most people. These substances are known as allergens and are found in dust mites, pets, pollen, insects, ticks, moulds, foods and some medicines</td>
</tr>
<tr>
<td>Antibiotic</td>
<td>A substance that kills or inhibits the growth of bacteria</td>
</tr>
<tr>
<td>Antimicrobial</td>
<td>A substance that inhibits or destroys bacteria, parasites, viruses or fungi and can be safely administered to humans or animals. Used when broadly referring to agents used to treat or prevent infections caused by microorganisms, the term embraces antibacterial, antifungal, antiviral and antiparasitic agent</td>
</tr>
<tr>
<td>Antimicrobial resistance</td>
<td>The failure of an antimicrobial to inhibit a microorganism at the antimicrobial concentrations usually achieved over time with standard dosing regimens</td>
</tr>
<tr>
<td>Antimicrobial stewardship (AMS)</td>
<td>An ongoing effort by a health service to optimise antimicrobial use to improve patient outcomes, ensure cost-effective therapy and reduce adverse sequelae of antimicrobial use, including antimicrobial resistance</td>
</tr>
<tr>
<td>Antimicrobial use</td>
<td>How antimicrobials are used, including treatment goal, treatment of populations versus targeted individuals, duration of use, route of administration</td>
</tr>
</tbody>
</table>
| Community-based | Is the use of parenteral antimicrobial medicines in a community setting, as }
<table>
<thead>
<tr>
<th><strong>parenteral antimicrobial therapy (Co-PAT)</strong></th>
<th>an alternative to care in hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Defined daily dose</strong></td>
<td>The average dose per day of medicine to treat the main indication for an average adult patient, as defined by the World Health Organization</td>
</tr>
<tr>
<td><strong>Dose optimisation</strong></td>
<td>The time course of drugs in the body with reference to their absorption, distribution, metabolism and elimination</td>
</tr>
<tr>
<td><strong>Infectious diseases service</strong></td>
<td>Consists of a multi-disciplinary team that works to prevent and treat illness, disability and death caused by a wide range of infectious diseases</td>
</tr>
<tr>
<td><strong>National Antimicrobial Prescribing Survey</strong></td>
<td>A voluntary annual audit of antimicrobial use by health services. It provides a snapshot of medication charts and patient records that have been assessed for appropriateness of antimicrobial prescribing and compliance with guidelines. The results from NAPS can be used as evidence to support the antimicrobial stewardship criterion of the National Safety and Quality Health Service Preventing and Controlling Healthcare-Associated Infection Standard. NAPS is part of the AURA Surveillance System and is run by the National Centre for Antimicrobial Stewardship (NCAS)</td>
</tr>
<tr>
<td><strong>National Antimicrobial Usage Surveillance Program</strong></td>
<td>A national surveillance program focusing on the standardised measurement of antimicrobial usage in Australian adult public and private hospitals. Hospitals contribute to monthly data voluntarily. NAUSP provides a range of reports on usage rates of selected antimicrobials and therapeutic groups. NAUSP is a program partner of the AURA Surveillance System and is run by South Australia Health</td>
</tr>
</tbody>
</table>

### Appendix 2. Resources

**Recommended texts and guidelines**

Specific ID guidelines:
- Hepatitis C
- HIV (including PrEP and antiretroviral guidelines)
- Sexually transmitted infections
- Tuberculosis
- Spleen Australia Recommendations for the prevention of infection
- National Centre for Infections in Cancer
- Centre for Antibiotic Allergy and Research

Appendix 3. State and Territory local Guidelines and Policy/Directives

<table>
<thead>
<tr>
<th>New South Wales</th>
<th>NSW – Medication Handling in NSW Public Health Facilities Policy Directive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW – Infection Prevention and Control Policy</td>
</tr>
<tr>
<td></td>
<td>NSW – High-Risk Medicines Management Policy Directive</td>
</tr>
<tr>
<td></td>
<td>Clinical Excellence Commission – Antimicrobial Stewardship</td>
</tr>
<tr>
<td></td>
<td>NSW – Adult and Paediatric Hospital in the Home Guideline</td>
</tr>
<tr>
<td>Victoria</td>
<td>The Royals Children’s Hospital – Statewide Antimicrobial Guidelines</td>
</tr>
<tr>
<td></td>
<td>Department of Health Hospital in the Home Guidelines</td>
</tr>
<tr>
<td>Queensland°</td>
<td>Children’s Health Queensland Hospital and Health Service</td>
</tr>
<tr>
<td></td>
<td>Antimicrobial Guidelines</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Location</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queensland</td>
<td>Standards of Antimicrobial Stewardship in Children’s Health</td>
</tr>
<tr>
<td>South Australia</td>
<td>SA Health Antimicrobial Stewardship Policy Directive</td>
</tr>
<tr>
<td></td>
<td>SA Health Antimicrobial prescribing clinical guideline</td>
</tr>
<tr>
<td></td>
<td>SA Health Antimicrobial Prescribing Guidelines</td>
</tr>
<tr>
<td></td>
<td>SA Health Medicines Formulary</td>
</tr>
<tr>
<td>Western Australia</td>
<td>WA Health – Antimicrobial Stewardship Guidance Document</td>
</tr>
<tr>
<td></td>
<td>WA Health - State Medicines Formulary Policy (MP0077/18)</td>
</tr>
<tr>
<td>Tasmania</td>
<td>THS Antimicrobial Use Protocol</td>
</tr>
<tr>
<td></td>
<td>THS Statewide Antimicrobial Allergy (Hypersensitivity) Management Protocol for Inpatients</td>
</tr>
<tr>
<td></td>
<td>THS Tasmanian Medicines Formulary</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>NT TEHS Aminoglycoside Dosing and Monitoring Guideline</td>
</tr>
<tr>
<td></td>
<td>NT Restricted Antimicrobials NT Hospitals Policy</td>
</tr>
<tr>
<td></td>
<td>NT Vancomycin – Adults and Children Greater Than or Equal to 12 years NT Hospitals Guideline</td>
</tr>
<tr>
<td></td>
<td>NT Vancomycin - Children Aged Less Than 12 Years NT Hospitals Guideline</td>
</tr>
<tr>
<td></td>
<td>NT Haemodialysis Vancomycin Medication Order NT Guideline</td>
</tr>
<tr>
<td></td>
<td>NT Surgical Antibiotic Prophylaxis TEHS Guideline</td>
</tr>
<tr>
<td></td>
<td>NT Antimicrobial Prescribing and Management (Adult) TEHS Guideline</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>Canberra Hospital and Health Services Clinical Procedure</td>
</tr>
<tr>
<td></td>
<td>Antimicrobial Stewardship</td>
</tr>
</tbody>
</table>

877 Appendix 4. Further considerations for quality improvement measurement

**Limitations and variability for quality improvement measurements**

- Participation in programs such as NAUSP and NAPS is voluntary, therefore, it is important to be cognisant of this when comparing your health service organisations performance to others and for benchmarking. Furthermore, NAUSP and NAPS may not suit the local context or resource availability of a health service organisation.

- The defined daily dose (DDD) per 1000 occupied bed days is based on adult doses and therefore not suitable for paediatric populations. Furthermore, defined daily doses do not
consider patient variability, individual patient exposure or actual dose administered.

- When reviewing overall usage rates of antimicrobials, it is important to consider that high rates of usage may not necessarily be inappropriate. Some health service organisations may have a high rate of usage but an excellent narrow-spectrum to broader-spectrum antimicrobial ratio. Institutions may also have widely disparate patient cohorts.

- The logistics of surveillance measures may also vary between health service organisations depending on whether they have electronic medication management (EMM) and the degree of functionality of the EMM platform. For example, Days of Therapy (DOT) as a metric may not be a feasible metric without EMM.

- There can be several confounders on a particular outcome measure, which must be considered before concluding. For example, the rate of surgical site infections will drive increased use.

- It may not be possible to attribute a change in parameters to one factor or intervention, such as an AMS program. Determining economic outcomes can be challenging due to alterations in procurement contracts and variation in ordering patterns. Furthermore, it can often be the case that narrow-spectrum antimicrobials may be more expensive than broad-spectrum antimicrobials. This will further complicate using costs as a measure as using the most appropriate agents will be more expensive.81

---

1 Referred to as Immunology and Infections in Clin Pharm SoP
2 Additional Queensland Health clinical practice guidelines and AMS resources are available by contacting: statewide.ams@health.qld.gov.au

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Author/s:
Cairns, KA; Avent, M; Buono, E; Cheah, R; Devchand, M; Khumra, S; Rawlins, M; Roberts, JA; Xenos, K; Munro, C

Title:
Standard of practice in infectious diseases for pharmacy services

Date:
2021-06-01

Citation:

Persistent Link:
http://hdl.handle.net/11343/298619