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Antimicrobial Stewardship and
Outpatient Parenteral Antimicrobial
Therapy (OPAT) in Hospital in the Home
(HITH) and other settings

**Antimicrobial Stewardship
in Australian Health Care
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Chapter contents

Acronyms and Abbreviations	454
Key Points	455
20.1 Introduction	456
20.1.1 OPAT and HITH	456
20.2 Outpatient parenteral antimicrobial therapy	457
20.2.1 Governance for OPAT service delivery	457
20.2.2 Integration of antimicrobial stewardship into OPAT services	457
20.3 Antimicrobial stewardship and OPAT services	458
20.3.1 The OPAT multidisciplinary team	458
20.3.2 Clinical leadership.....	458
20.3.3 Patient selection	458
20.3.4 Patient Education	459
20.3.5 Antimicrobial selection	459
20.3.6 Antimicrobial administration.....	460
20.3.7 De-escalation of therapy - intravenous to oral antimicrobial switch (IVOST)	461
20.3.8 Transition of care from OPAT and HITH	461
20.3.9 Telemedicine and HITH.....	461
20.4 Outcomes monitoring and reporting	461
20.4.1 Patient experience at the completion of care	462
20.5 Conclusions	465
Resources	466
References	468

Acronyms and Abbreviations

Acronym / Abbreviation	Definition
AMR	antimicrobial resistance
AMS	antimicrobial stewardship
AURA	Antimicrobial Use and Resistance in Australia
CDAD	<i>Clostridioides difficile</i> -associated diarrhoea
COPAT	community-based outpatient parenteral antimicrobial therapy
HITH	Hospital in the Home - Hospital in the Home (HITH) is a clinical model that provides admitted acute/sub-acute care in the patient's home or the community as a substitute for in-hospital care. Instead of receiving care and hospital accommodation, patients receive hospital level care whilst being accommodated in their own home
ID	infectious diseases
IV	intravenous
NAPS	National Antimicrobial Prescribing Survey
NAUSP	National Antimicrobial Utilisation Surveillance Program
NSQHS	National Safety and Quality Health Service
OPAT	Outpatient Parenteral Antimicrobial Therapy (OPAT) is the delivery of antimicrobials to patients that require longer term durations of antimicrobials administered by any route other than orally. The antimicrobials are usually administered by clinical staff at either the patient's home or an ambulatory care facility
PICC	peripherally inserted central catheter
pOPAT	paediatric Outpatient Parenteral Antimicrobial Therapy
PREM	patient-reported experience measures
PWIDs	people who inject drugs
S-OPAT	self Outpatient Parenteral Antimicrobial Therapy

Key Points

- Antimicrobial resistance (AMR) continues to be one of the greatest threats to human health, and the overuse of antimicrobials is a significant contributor to AMR.
- Outpatient parenteral antimicrobial therapy (OPAT) is increasingly delivered in Australia and internationally.
- In Australia there are two principal OPAT models. Treatments may be delivered either in the patient's home by an infusion nursing service or at an ambulatory care centre by an infusion nursing service.
- The National Safety and Quality Primary and Community Healthcare Standards, and the National Safety and Quality Health Service Standards, include antimicrobial stewardship (AMS) and clinical governance actions relevant to OPAT services.
- AMS programs are evidence-based, multi-component strategies that aim to decrease inappropriate use of antimicrobials to improve patient outcomes and decrease AMR.
- AMS should be integrated with OPAT service structure and governance to reduce inappropriate antimicrobial use and AMR in the community.
- Features of OPAT services that support an integrated approach to AMS include:
 - delivery of OPAT services by a multidisciplinary team supported by infectious diseases and/or clinical microbiology expertise
 - effective clinical governance and leadership
 - patient-specific selection criteria for OPAT eligibility
 - evidence-based antimicrobial dose selection and administration
 - understanding of antimicrobial stability and the environmental conditions in which it is being stored and administered
 - robust program monitoring and reporting of outcomes.
- Monitoring AMS program outcome ensures AMS activities within OPAT services are effective and continue to be updated to address changing requirements.

20.1 Introduction

Australia's National Antimicrobial Resistance Strategy describes priority actions to address the growing public health threat of antimicrobial resistance (AMR). Antimicrobial stewardship (AMS) is a key component of the national strategy and can be defined as 'the safe and appropriate use of antimicrobials to reduce harm while also curtailing the incidence of antimicrobial resistance'.¹

Antimicrobial stewardship actions are included in the Preventing and Controlling Infections Standard in the National Safety and Quality Health Service (NSQHS) Standards and the National Safety and Quality Primary and Community Healthcare Standards (Primary and Community Healthcare Standards).^{2,3} The NSQHS Standard was updated in 2021 to include a requirement for continuous quality improvement in antimicrobial use in response to audit data.⁴

The NSQHS Clinical Governance Standard requires health service organisations to maintain and improve the reliability, safety and quality of health care. It recognises the importance of governance, leadership, culture, patient safety systems, clinical performance and the care environment to deliver high quality care. It provides the overarching framework to help organisations implement other standards, including AMS.

The Antimicrobial Stewardship in Australian Health Care Book (the Antimicrobial Stewardship Book) was revised in 2018 to provide an overarching resource for AMS programs in Australia. The Antimicrobial Stewardship Book is available at:

www.safetyandquality.gov.au/our-work/healthcare-associated-infection/antimicrobial-stewardship/book/

Additional chapters of the Antimicrobial Stewardship Book are developed and published on specific topics to further support and advance AMS in Australia.

Antimicrobial Stewardship and Outpatient Parenteral Antimicrobial Therapy in Hospital in the Home and other settings is the latest addition to the Antimicrobial Stewardship Book.

AMS is an essential component of safe outpatient parenteral antimicrobial therapy (OPAT). Lessons from implementing AMS in other hospital and community healthcare settings can usefully be applied to OPAT. This chapter provides an overview of the current evidence on antimicrobial use in OPAT and outlines a suggested approach to implement an AMS program for OPAT.

20.1.1 OPAT and HITH

Internationally there are three principal OPAT models. Care may be provided at an ambulatory care centre; the patient's home by qualified nursing staff; or the patient's home by the patient or carer, who has received appropriate education, training and support.⁵⁻⁸ In Australia the predominant models are provided by qualified clinical staff either at the patient's home or at an ambulatory care facility affiliated with an acute hospital.⁹

Hospital-level acute medical services are provided outside the hospital by Hospital-in-the-Home (HITH) programs. Services can be delivered in the home, or at work, school, residential aged care facilities, ambulatory care centres, rural general practices and Indigenous health services.⁹

HITH services are safe, effective, psychologically beneficial, cost-effective and may reduce the risk of healthcare-associated infections. HITH allows patients to receive care in an environment known to them. It offers health services a model of care that supports patient flow and helps manage demand.^{9,10}

To be suitable for HITH treatment a patient must have an acute condition that requires multiple days of treatment, can be safely managed outside a hospital ward, in a suitable and safe location with access to refrigerated storage and a reliable telephone or internet connection. The patient, carer or substitute decision-maker must consent to voluntary participation, which is necessary to ensure the success of the treatment. The patient should not require continuous observation or treatment and the patient or carer is competent in managing the condition and knows when to escalate the care. OPAT can be provided by HITH programs.^{9,11}

Recognising that there is a great range in the size and organisation of HITH services, best practice HITH care should include as a minimum:

- clinical review prior to admission or transfer to the responsible HITH clinician, to establish suitability and a clinical baseline
- scheduled medical reviews (at least weekly) based on the patient's condition, acuity and requirements, and which support early discharge
- criteria-led discharge.

In larger HITH services patients can be reviewed at a weekly multidisciplinary team case conference. This conference includes members of the treating team, community nursing and allied health. Issues recommended for discussion include progress, management plan, change in condition or adverse events, the expected discharge date and follow up tests and appointments.⁹

20.2 Outpatient parenteral antimicrobial therapy

Use of OPAT is increasing worldwide.⁵

Increased OPAT service availability is attributed to several factors, including:

- emergence of evidence demonstrating the safety of OPAT
- increased clinician and patient acceptance of OPAT
- opportunity to reduce the risk of healthcare-associated infections
- advances in the availability of antimicrobials that can be administered once daily, weekly or as continuous infusions in outpatient settings
- suited to use in community settings
- growing pressure on health systems to reduce costs and shorten inpatient lengths of stay.¹²⁻¹⁵

OPAT has growing acceptance by patients as it allows care to be provided at home, which leads to less disruption of daily routines, better sleep, access to usual diet, more family visits and allows earlier return to work or school.¹⁵

In Australia, the dominant model is the provision of OPAT in the patient's usual residence by HITH services.¹⁰

20.2.1 Governance for OPAT service delivery

All HITH services require clinical governance that establishes clear interdisciplinary and organisational agreements, has shared decision support tools and clear and consistent communication and mechanisms for partnering with consumers. Service oversight may be provided by specialist medical practitioners or expert nurse practitioners.

In OPAT services, explicit and agreed governance arrangements strengthen safety and quality systems. Formal, organised OPAT programs are associated with increased OPAT initiation, improved patient selection and fewer readmissions.¹⁶⁻¹⁹ Outcomes achieved by well-established OPAT services can include reduced inpatient bed day utilisation and decreased service costs.^{13,20,21}

OPAT services should ideally have structured arrangements for service delivery by a multidisciplinary team, which include:

- documented clinical governance and leadership arrangements

- guidance from a formal AMS program
- integrated AMS systems and team member roles
- clear clinical pathways endorsed by local lead specialists
- infectious disease (ID) specialist review prior to initiation of OPAT
- arrangements for partnering with consumers in the governance of, and design, measurement and evaluation of OPAT services
- established and consistent communication with the patient's general practitioner, the community team and referring clinician
- processes for outcomes monitoring and reporting.^{2,15,20,22}

20.2.2 Integration of antimicrobial stewardship into OPAT services

The efficacy of antimicrobial agents is paramount in the management of infectious diseases. The increasing and inappropriate use of antimicrobials is contributing to growing rates of AMR, which is a threat to the ability to treat and prevent infections, and increases morbidity, mortality and healthcare costs. Inappropriate or suboptimal antimicrobial use contributes to the development of AMR and leads to poor patient outcomes (see [Chapter 1](#)).

AMS is a systematic approach to optimising antimicrobial use. It aims to minimise the unnecessary use of antimicrobials and promotes appropriate antimicrobial prescribing. AMS is essential in delivering OPAT services.^{9,23}

Studies of AMS programs are largely based in hospital settings. Although many hospital AMS principles apply to community settings, there are some important differences.

A primary aim of AMS is choosing the most effective, safe and narrow-spectrum agent for a specific indication, and for it to be used for the shortest appropriate period of time.¹⁵

However, in OPAT, there is a potential conflict between the choice of the most effective and/or narrow-spectrum agent and the need for convenience in dosing and administration. OPAT services must balance these priorities and may use agents with a broader antimicrobial spectrum than is normally therapeutically indicated.^{12,24}

20.3 Antimicrobial stewardship and OPAT services

The goals of AMS in OPAT include:

- reducing unnecessary prescribing of antimicrobials
- reducing inappropriate dosing and duration administration.²⁴

There are few trials reported in the literature that assess the effectiveness of AMS strategies in OPAT. Strategies with some evidence for effectiveness that are described in this Chapter include:

- delivery of OPAT services by a multidisciplinary team supported by clinical microbiology expertise or an ID physician
- patient-specific selection criteria for OPAT eligibility
- evidence-based antimicrobial selection and prescribing guidelines (e.g. Australian Therapeutic Guidelines)
- good practice in antimicrobial administration by ensuring the right patient, drug, route, time, dose, duration and documentation
- ongoing review of prescribed antimicrobials to ensure treatment is guided by microbiology results, clinical improvement and a switch to oral antibiotics occurs when clinically indicated
- resolution and escalation pathways to achieve consensus about the treatment plan between the admitting HITH clinician and the referring clinician
- robust outcomes monitoring and reporting.²⁴

20.3.1 The OPAT multidisciplinary team

The OPAT team should be multidisciplinary and include, as a minimum:

- an ID physician or clinical microbiologist, or a medical practitioner with knowledge of infectious diseases who has access to advice from an ID physician or clinical microbiologist¹⁴
- a nurse specialist with knowledge and experience in the assessment of patient suitability, provision of patient education and consent, medication preparation and administration, including the use of vascular access devices¹⁵
- a clinical pharmacist to assess potential drug–drug and drug–host interactions, drug dosing, antimicrobial compliance, potential adverse events, therapeutic drug monitoring requirements, and how these are best addressed in an out-of-hospital setting.²⁵

Where an ID specialist is not locally available, remote clinical oversight is a viable and effective method of providing antimicrobial advice and AMS to OPAT programs.²⁶

Input from an ID specialist and clinical pharmacist has been shown to decrease inappropriate antimicrobial prescribing; improve selection of antimicrobial agents and their route of administration, dosage, and treatment duration; improve early intravenous (IV) to oral switching of the antimicrobial agent; and to decrease hospital readmissions, emergency department attendances and overall costs.^{27–34}

OPAT services that deliver care to paediatric patients should include a general paediatrician as a team member. Involvement of paediatricians on the OPAT team can increase the breadth, number of patients and effectiveness of the service.¹¹

The OPAT team should be responsible for maintaining protocols and clinical pathways that support standardised approaches to:

- patient selection, monitoring and follow-up
- antimicrobial agent selection, preparation, and administration, including dosage and duration of therapy, vascular access device protocols and IV to oral switching criteria.³⁵

20.3.2 Clinical leadership

Organisational leadership and executive endorsement are essential for the successful development of OPAT services, and include:

- consideration of resourcing requirements
- appropriately qualified personnel including nursing, ID physician involvement and clinical pharmacist
- effective information technology and administrative support.³⁶

20.3.3 Patient selection

Patient suitability for OPAT is improved with documented patient-specific selection criteria. Criteria are tailored to the goals of the service, type of patients, clinical conditions and available resources. The patient must be clinically and haemodynamically stable. The patient, carer or substitute decision-maker must understand and consent to OPAT and can comply with treatment requirements. There must be appropriate home circumstances, sufficient OPAT resources and the safety of visiting OPAT staff must be assured.^{5,22,35,37,38}

The infection should be diagnosed, the patient should be clinically stable and improving, with no deterioration in any monitored biochemical or

microbiological parameters prior to admission. There should be a documented antimicrobial treatment plan that includes dose, frequency, expected duration and a plan for an oral switch or any further investigations that might be needed prior to antimicrobial cessation or an oral switch.^{12,15,35}

Paediatric patients

There is good evidence to support the management of children by paediatric OPAT (pOPAT) services, which have been demonstrated to be safe, effective, and associated with high levels of patient/parent satisfaction, and incidence of complications and readmission similar to hospital-based and home-based treatments.^{16,22,39-41}

There is evidence supporting the use of pOPAT for fever in the young infant, infective endocarditis, meningitis, lymphadenitis, pyomyositis, pneumonia, osteoarticular infections, bacteraemia, central line infections, brain abscesses, cellulitis, pyelonephritis and mastoiditis.³⁹

Research supports admission of appropriately screened paediatric patients with low risk-febrile neutropenia.⁴² Outcomes include a significant reduction in in-hospital median length of stay, a small proportion of readmissions and no adverse outcomes.⁴³ Major hospital pOPAT services may be tailored to manage children with complex care needs, including children with complicated infections requiring prolonged courses of parenteral antimicrobials, often through a central vascular access device.⁴⁴

Multidisciplinary team members may need to be broadened to manage paediatric patients with complex care needs. These may include a paediatric ID specialist, clinical microbiologist with relevant paediatric expertise, specialist paediatric nurses and paediatric clinical pharmacist expertise.¹¹ Effective clinical governance and leadership in pOPAT services are essential and results in lower rates of medication mismatches, drug-dosing errors, readmissions, and more rigorous laboratory monitoring of drug side effects.^{15,27,45}

Neonatal patients

Neonatal (<28 days old) patients can be managed safely and effectively in a well-resourced, tertiary hospital affiliated pOPAT.³⁷ Specific risks of at-home OPAT management of neonates include difficulty in achieving stable vascular access, lack of safety data for some antimicrobials and the need for specialised clinical assessment skills in a population that has a risk of rapid deterioration.³⁷

OPAT in hard-to-reach groups

OPAT is an option for otherwise hard-to-reach groups, including those with serious mental health diagnoses,

people who inject drugs (PWIDs) and people experiencing homelessness. These programs require:

- good communication with the patient
- clear selection criteria.^{12,46,47}

PWID patients need to consent to admission, have good engagement with the OPAT team and ideally a stable home environment. PWID patients should be assessed by their usual drug and alcohol service and have continued care from them. Care may initially be provided at an ambulatory care centre until the suitability for home visits can be clearly established.⁴⁸

20.3.4 Patient Education

Patients and caregivers require education about symptom and fever management, PICC line care, the side effects of antimicrobials, the first actions they must take when side effects happen (e.g. tinnitus, rash, gastrointestinal symptoms), and who to contact in case of an emergency.⁴⁹⁻⁵¹

Patient information leaflets, standardised teaching with teach-back and cognitive aids support effective patient education.^{5,52,53} Patient information should be given in a manner that is culturally safe. Interpreters should be used if English is not the patient's first language.

20.3.5 Antimicrobial selection

AMS requires that each patient has the most effective, safest, and narrowest spectrum agent for a specific indication with the least capacity for developing resistance.⁹

Antimicrobial selection is complex and requires expert knowledge. Factors to be taken into account include:

- site of infection
- microbiology
- underlying patient factors (e.g. immunosuppression)
- vascular access (dual vs single lumen PICC or portacath or peripheral IV)
- antimicrobial stability at room temperature and duration of infusion
- whether antimicrobials can be administered together and at the required intervals (if patient is prescribed more than one antimicrobial)
- progress of infection and any changes on HITH
- where patient lives and whether adequate monitoring and delivery of antimicrobial plan is possible.^{9,24}

Antimicrobial selection should:

- comply with Australian Therapeutic Guidelines
- follow any affiliated hospital guidelines (e.g. for febrile neutropenia)
- comply with affiliated hospital antimicrobial approval systems
- consider future IV to oral switching.

Effective AMS also requires:

- regular review of microbiology results to ensure indicated changes to antimicrobial therapy are made (e.g. to a narrower spectrum agent)
- collection of further microbiological specimens if there is clinical deterioration
- peripheral blood cultures if there is a suspected IV line infection
- consideration of the potential role of OPAT in the development of *Clostridioides difficile* infection.⁵⁴

Allergy de-labelling

Almost 10 per cent of Australians report an antimicrobial allergy, but studies have shown that 85 per cent of these allergy 'labels' are false. False antimicrobial allergy labels can result in patients receiving inappropriate or less effective antimicrobial therapies. Patients with low-risk penicillin allergy assessment can be offered test doses under supervision to clarify the allergy label. De-labelling false antimicrobial allergies ensures patients can be treated with the most effective and appropriate antimicrobial therapies.⁵⁵

20.3.6 Antimicrobial administration

OPAT IV antimicrobials may be administered by health professionals or by the patient or caregiver (self [S]-OPAT). Where administered by the patient or caregiver, the OPAT team need to train patients and caregivers in antimicrobial agent preparation, sterile infusion techniques, IV line care, and patient monitoring for adverse outcomes or deterioration.^{5,35,54,56} Educating patients and caregivers about storing, preparing and administering antimicrobial agents is important to maintain the integrity and efficacy of the medications and to reduce the risk of iatrogenic infection.^{57,58}

All administered doses of IV antimicrobials must be documented on a medication chart.⁹ The chart should include the antimicrobial agent dose, administration frequency and therapy duration.¹⁵

Community-based OPAT service providers may use OPAT kits that are made up by pharmacists and tailored to each patient and the type of vascular access device; and contain all medications, diluents and consumables required for antimicrobial administration.^{59,60}

Appropriate selection of vascular access is key to the success of OPAT and will depend on the characteristics of the drug infusion, number of daily doses, expected duration of treatment and patient characteristics.⁵⁶ Appropriate insertion and care of the intravascular access device is important to reduce risk of iatrogenic infection and should comply with published standards, and infection prevention and control guidance.^{12,22,52}

IV antimicrobials can be administered via infusion or as a bolus dose. The choice of the infusion device and mode of delivery depends on local resources, training, familiarity, availability of compounding services, and the compatibility and stability of antimicrobial agents.^{5,15}

Clinical pharmacists can advise on the use of different infusion devices for antimicrobial administration, as they have expertise about antimicrobial stability factors, storage conditions (room and refrigerator temperature), infusion time, treatment costs and required pH and osmolality of solutions.^{25,61}

Allergic reactions and anaphylaxis

Clinicians working in HITH and OPAT services must be able to recognise and appropriately treat the clinical symptoms of mild to severe allergy and anaphylaxis. All services require a policy on the appropriate management of anaphylaxis in the community and standing orders for its treatment. The policy should detail the drugs carried by staff to manage anaphylaxis. Paediatric HITH and pOPAT services require specific doses, protocols and kits for children of differing ages and weights.⁹

The first dose of an antimicrobial that the patient has never previously received should be given in a setting where staffing and equipment allow appropriate monitoring and therapy for potential anaphylaxis.⁹

Where an allergic reaction occurs during OPAT care it is essential that this information is included in the patient's medical record and the patient's general practitioner is informed.

Patient monitoring

Monitoring requirements vary according to infection type and severity, patient characteristics, and antimicrobial characteristics and toxicity. OPAT protocols for patient monitoring should include frequency of clinical review and assessment of clinical response to therapy, monitoring of antimicrobial medication compliance, and required pathology investigations and their frequency.^{15,18}

20.3.7 De-escalation of therapy - intravenous to oral antimicrobial switch (IVOST)

Optimal AMS includes timely switching from IV to oral antimicrobials, which should be considered both at the point of referral to OPAT and during treatment. Failure to switch when effective oral alternatives are available increases IV antimicrobial exposure, the risk of adverse events e.g. cannula infection and leads to higher healthcare costs without therapeutic benefit.

General principles that should be considered when deciding whether the switch to oral antimicrobials is appropriate including compliance with Australian Therapeutic Guidelines, evidence of effectiveness of high oral bioavailability agents for the clinical condition, ability to administer and absorb oral antimicrobials, and availability of an appropriate oral choice.^{16,50,62} For children, dosing frequency and taste of oral suspensions should also be considered.⁹ Patient education should be provided when antimicrobials are switched to another IV agent and stepped down to oral therapy. Clinical pharmacists have an important role in this phase of care which requires services to actively develop and support this role.¹⁶

Criteria that may be included in protocols for IV to oral switching include:

- clinical improvement has been observed
- no condition-specific contraindication to oral therapy
- oral fluids are tolerated
- body temperature has been within normal limits for at least 24 hours
- no ongoing or potential problems with oral absorption
- a suitable oral antimicrobial is available that will penetrate to the site of the infection.²⁴

Unused IV antimicrobials should but returned to the hospital for safe disposal.

20.3.8 Transition of care from OPAT and HITH

The decision to cease HITH treatment is made by the clinical team when the patient no longer requires admitted care. At the point of discharge the patient's ongoing care should be documented in a shared care plan and care transferred to the patient's general practitioner. Referrals to community services should occur as soon as it is clinically appropriate.

On discharge patients and carers should be provided with:

- plain language discharge referral information
- a medication management plan and follow up appointments for specialists, general practitioner and other agencies
- community support contact information with referrals made where appropriate
- discharge medications.⁹

A discharge summary should be provided at discharge to the patient's GP and be uploaded to the patient's My Health Record.

A discharge summary should include:

- a medication management plan including any medications that have been changed or stopped, and any changes to allergy status
- follow up appointments for specialists, GPs and other healthcare providers
- community support contact information with referrals made where appropriate
- Discharge medications that have been provided to the patient.

20.3.9 Telemedicine and HITH

Telemedicine can be deployed in several ways to support OPAT services, staff and patients, by providing a scheduled check-in for patients and clinical advice to nurses to:

- help early identification of complications and reduce hospital readmissions
- support more frequent laboratory testing and follow-up
- reduce errors in prescribing
- support nurses in discharging patient from OPAT
- support patients in the delivery of care.^{60,63}

20.4 Outcomes monitoring and reporting

Data entered into the patient's clinical record during OPAT, laboratory data and pharmaceutical dispensing information can inform the OPAT team's understanding of patient and service outcomes.^{12,15} Structured data collection can enable service outcomes monitoring. For example, Mahoney et al. (2021) proposes metrics for OPAT AMS stewardship (see Table 1).⁶⁴

In practice, AMS related audits in HITH should reflect local priorities, for example:

- adherence to dosing protocols

- adherence to guidelines for IV duration for the specified condition
- antimicrobial wastage
- documentation of antimicrobial treatment plans.

Monitoring can also take the form of a service checklist, which compares the service with a list of program features that support AMS. For example, Gilchrist (2015) proposed an OPAT AMS checklist to provide guidance and monitor and assess service performance at the local level (see Table 2).²⁴

Standardised and validated tools that can be used to measure antimicrobial usage and audit prescribing are available through the Hospital National Antimicrobial Prescribing Survey (NAPS) and the National Antimicrobial Utilisation Surveillance Program (NAUSP) (see Resource Section). Contributors to the NAUSP program can submit HITH data if the data are able to be extracted separately from the pharmacy

dispensing program. HITH usage is not reported by the NAUSP, however the submission of HITH data is possible for hospitals that wish to extract their own monthly usage reports for this setting. Hospitals can track usage over time by antimicrobial class, specific agents or formulations of concern.

20.4.1 Patient experience at the completion of care

Patient experience is an important outcome measure for OPAT services.⁶⁵ Ongoing monitoring of patient experience can be achieved through patient satisfaction surveys, monitoring and trending of patient complaints, and general feedback.^{64,66}

Regular surveys of patient experience (Patient-Reported Experience Measures [PREMs]) can be undertaken in key patient groups to inform service improvements.^{64,66,67}

Table 1: Examples of OPAT AMS initiatives and program metrics (adapted from Mahoney 2021 ⁶⁴)

Outcome domain	Rationale	Metric
Oral instead of IV antimicrobial regime selected	<p>Avoids need for PICC line</p> <p>Reduces specialist service use</p> <p>Decreases laboratory monitoring requirements</p> <p>Favourable impact on patient quality of life</p> <p>Potential cost savings</p>	<p>Line days avoided</p> <p>Direct cost savings</p> <p>Patient satisfaction surveys</p>
Duration of therapy	<p>Decrease antimicrobial exposure / resistance</p> <p>Decrease in adverse drug events, including line-related</p>	<p>Days of therapy versus clinical failures</p> <p>Rate of de-escalation in the outpatient setting (appropriate timing of review and step down)</p>
Use of long-acting agents	<p>Administered infrequently (often every 7–14 days)</p> <p>Only require peripheral line (do not require a peripherally inserted central catheter or midline catheter)</p>	<p>Line days saved / or OPAT days saved</p> <p>Patient satisfaction</p>
Use of continuous infusion antimicrobials	<p>Decrease admission to nurse clinics for the administration of IV antimicrobials</p> <p>Decrease in regimen changes for ease of administration</p> <p>Decrease in nephrotoxicity for vancomycin therapy</p> <p>Facilitates Area Under Curve: Minimum Inhibitory Concentration monitoring with vancomycin therapy</p>	<p>Rate of antimicrobial regimen changes</p> <p>Once daily antimicrobial utilisation</p> <p>Time to reach target therapeutic concentration for vancomycin</p> <p>Rate of acute kidney injury</p>
Outpatient clinical microbiology reporting	<p>Allows for real-time tailoring of antimicrobial prescribing</p> <p>Facilitates timely additional susceptibility testing when needed</p>	<p>Time to appropriate therapy</p> <p>Oral susceptibility reports available for each organism</p>
Patient outcomes	<p>Annual tracking and benchmarking</p> <p>Annual goal setting</p>	<p>Time to outpatient follow up OPAT completion rates</p> <p>Adverse effects</p> <p><i>Clostridioides difficile</i> rates</p> <p>Hospital readmissions within 30 days</p>

Table 2. Sample domains from OPAT antimicrobial stewardship checklists (Gilchrist 2015 ²⁴)

Domain	Checklist item
Individual patient management	<p>The following are reviewed for each patient at each clinical encounter:</p> <ul style="list-style-type: none"> • the patient’s clinical and social picture • previous and current microbiology, including antibiograms • radiological imaging as appropriate • need for surgical intervention/source control as appropriate • laboratory markers and antimicrobial therapeutic monitoring • tolerability and effectiveness of the patient’s antimicrobial regimen • opportunities for intravenous to oral switch considered.
OPAT service antimicrobial management	<ul style="list-style-type: none"> • All antimicrobials currently in use are authorised by the organisation OPAT AMS governance • Each antimicrobial prescribed consistent with local antimicrobial prescribing standards • All antimicrobials administered are in accordance with locally agreed protocol • All antimicrobials are monitored where appropriate for toxicity or sub-therapeutic concentrations • There is an active intravenous to oral switch program • All antimicrobial adverse events are reported as per locally agreed protocols • Antimicrobial resistance data are reviewed and considered
OPAT staffing management	<ul style="list-style-type: none"> • There is a multidisciplinary OPAT team • Where the service does not have an ID physician or clinical microbiologist, the OPAT team has access to these clinicians • Each member of the OPAT team is up to date with organisational protocols for antimicrobial use, AMS, infection prevention and control and vascular access
OPAT service / organisational management	<ul style="list-style-type: none"> • An OPAT operational and governance policy exists that is approved by an appropriate healthcare committee • A self-administration policy exists where appropriate • There is frequent multidisciplinary review of OPAT patients • A more detailed review is undertaken for any patient who suffers a failed OPAT outcome • A healthcare-associated infection during OPAT is reported through local governance procedures • An annual OPAT report is published and reviewed to monitor continual improvement in clinical and managerial service delivery • The service compares outcomes with other local OPAT services and contributes to data sharing to facilitate learning from peers

20.5 Conclusions

Outpatient parenteral antimicrobial administration is a growing area of health service delivery in Australia and worldwide.

This chapter provides an overview of the current evidence on antimicrobial prescribing in OPAT and the ways in which AMS is integrated with OPAT team roles.

Lessons learnt from implementation of AMS in other healthcare settings can inform AMS for OPAT services.

Suggested AMS strategies of relevance to OPAT services are described. Core components of AMS for OPAT service delivery include:

- delivery of OPAT services by a multidisciplinary team
- effective clinical governance and leadership
- selection criteria for OPAT eligibility
- evidence-based antimicrobial selection
- appropriate route of antimicrobial administration
- outcomes monitoring and reporting.

AMS for OPAT should form part of the governance structure for the HITH/OPAT service.

Resources

- Australian Commission on Safety and Quality in Health Care.
 - a. AMS Clinical Care Standard. <https://www.safetyandquality.gov.au/our-work/clinical-care-standards/antimicrobial-stewardship-clinical-care-standard>
 - b. AMS Clinical Care Standard – Indicator Monitoring Tool. <https://www.safetyandquality.gov.au/our-work/clinical-care-standards/antimicrobial-stewardship-clinical-care-standard/indicator-monitoring-tool>
 - c. AURA Surveillance System - reports and resources. <https://www.safetyandquality.gov.au/publications-and-resources/aura-surveillance-system-reports-and-resources>
 - d. AURA 2021 - Consumer trifold: Do I really need antibiotics? <https://www.safetyandquality.gov.au/publications-and-resources/resource-library/aura-2021-consumer-trifold-do-i-really-need-antibiotics>
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